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Sowings of spring wheat (varieties ~~T~~ezium 0111, Gordeiforme 010, and, admissible, Lyutestsens 062) can and ought to be expanded, on new lands and replacing oats (Pobeda variety). Winter rye is still very important. Of secondary crops, the sunflower (very quickly-ripening varieties) ought to be greatly expanded in area, as well as flax for linseed oil, potatoes, and peas. Present sowings of buckwheat and millet could be eliminated.

Fodder crops here are less important than in the preceding districts because of the general emphasis on grains. The most important of them are: hybrid and yellow lucerne, ~~stalkless~~ beardless brome grass; for green fodder also rye and corn; for silage -- sunflower, corn, sweet clover; root plants -- carrots, potatoes, beets.

X(4) Arid steppe on southern chernozems of the former Zilair Canton, with a much more arid climate (120-135 millimeters of precipitation for May-July, with relative humidity of 47-50 percent for June), higher summer temperature (21-22 degrees for July), and a very long frostless period (145-160 days).

Typical spring wheat - sunflower district. Spring wheat gives on the average lower harvests than in the preceding districts, less reliable, but with grain of better quality; recommended varieties: ~~T~~ezium 0111, Lyutestsens 062 admissible -- (better yielding but subject to crumbling), and Melanopus 069 admissible. Durum wheat on old ploughed lands yields 15-20 percent less than Triticum vulgare wheat.

Spring wheat can be expanded, on present wastelands and replacing oats and millet.

The group of crops sown in rows ought to be widespread here, especially the sunflower (the variety Saratovskiy 169 and other

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more quickly-ripening), melons-cucumbers-squash, and corn: Bezenchukskaya and Burli Kaunta.

Crops sown in rows -- i.e., for ploughing -- ought to play a large role, not only for plant oils and fodders for pigs, in addition to grain waste products, but also as the best precursor of spring wheat.

Corn, because of the possibilities of cultivating early-ripening low varieties here, is devoted to feeding (with standing corn primarily) pigs.

Fodder crops are the same as in X(3a).

X(5) District of the northern forest-and-steppe of the western Siberian type, on podsolic and saliferous soils of the Trans-Ural part of Bashkiriya (the former Argayash Canton).

Precipitation around 350-400 millimeters yearly (May-July, 160 millimeters) with a July temperature of 18 degrees Centigrade. A district analogous in natural conditions to the northern forest-and-steppe of the Trans-Urals, with spring wheat the most important crop. Varieties -- Tsezium 0111, Gordeiforme 010, and, admissible, Mil'turum 0321 and Lyutestsens 062, with Gordeiforme 010 and Mil'turum 0321 only for the southern part of the district, due to their late ripening.

The sowing area of oats ("Pobeda" variety) ought to be maintained, because of its good harvests and the demands of the mining industry.

Potato cultivation, at present of secondary importance, ought to be expanded.

Fodder crops ought to be very important because of the general grain-milk emphasis of the economy; of perennial grasses here, these frost-resistant types are more reliable: American couch grass, Grimm



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hybrid lucerne and other hybrid lucernes, brome grass, sweet clover; for green fodder -- winter rye, vetch-oats mixtures; for silage -- sunflower, vetch-oats, and sweet clover; of root-tuberous plants -- potato, turnips (Brassica campestris rapifera and Brassica napus rapifera).

X(6) Mountain-forest (mixed and coniferous forests) district of little agriculture, a mountain range section of the Ural highlands, the former Tam'yan-Katay Canton, northern sections of the former Zilair Canton, and part of the Mesyagutov Canton.

Poor soils of a podsolic character, often gravelly and very often cannot be utilized for farming after their forests have been cut down. Slopes and valleys with chernozem-like soils and degraded chernozems are more suitable for farming.

Because of the great elevation (reaching as much a 1,500 meters in the north and 700 meters in the south) climate is humid (the total yearly precipitation is 500 millimeters and more, of which 200-225 millimeters falls in the period May-July; the average relative humidity for June is over 55 percent), but cold (the average July temperature, 15-18 degrees), with a short frostless period (100-125 days).

In view of its metallurgical characteristics, this little farmed area in the future must develop its plant cultivation in the direction of vegetables and fodder crops and potatoes, from grains, from oats and winter rye to spring wheat with the superior soils of the southern section.

With a significant number of natural meadows and pastures, development of the dairy economy requires additional sowing of clover, sowing of mixed vetch and oats for green fodder, sunflower for silage, and also fodder beets, carrots and potatoes.

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Oats must keep its great significance for transportation in mining, where a considerable number of horses move ore, coal and timber. The varieties of bread grains must be quick ripening, in view of the short duration of the frost-free period. With poor soil, it is necessary to build it up with manure and mineral fertilizer.

## XI. THE URALS AREA

Just as in the Bashkir ASSR, the Urals area has a wide variety of natural conditions in its various parts. In its overall field economy, it is primarily a grain area which must be differentiated by regions: emphasizing clover-potato (vegetable)-oat-rye crops in mining areas, oats-rye-clover in the northern wooded pre-Urals, rye-clover-oats-flax in the southern wooded pre-Urals, in the alluvial pasture areas rye-oats-barley, partly clover-flax in the taiga part of the pre-Urals, with rye-wheat-oats-clover-flax in the "datura" zone and various types of spring wheat in the tremendous area of forest steppes and beyond-the-Ural steppes and in the pre-Urals forest steppes. In the future, and applicable for the entire territory /kray/, a significant expansion must be planned in sowing on new lands, with a great increase in the areas under spring wheat, fodder crops, flax and potato, while lowering the sowings of oats.

The demands upon the agriculture of the region basically are for an increasing and very fast growing mining industry, and for an exceptionally rapid growing industrial population of numerous large factory centers. Supplying dairy products and fresh meat requires the organization of large fodder supplies, also vegetables and potatoes: a vegetable economy. The existence of extensive new construction

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projects, of large wood-working activities and of a number of still poorly mechanized mines which make use of a large number of horses, requires that these be supplied with hay and oats. The development of Urals industry, in turn, soon must be reflected in the industrialization of agriculture in the area, bolstering up its power capacity and mechanization. Further away from the mining belt, parts of the area in some instances can widely develop industrial flax production, and in other cases, grain growing can be developed as independent branches.

In regard to natural conditions, which in turn influence the composition of crops cultivated, the area is divided sharply into three zones, according to climate, geography and soil: western pre-mountainous, middle mountainous, and the eastern beyond-the-Urals plains. Each one of these zones, moreover, has a different climate and soil in terms of latitude. This breakdown is well defined by the borders between those areas where particular types of plants prevail.

XI(1) Northern forest pre-Urals. Big Upper-Kama Okrug and the middle and northern part of Komi-Perm excluding the mountainous parts. Swampy southern coniferous forests of Siberian corolite (largely spruce-fir taiga). Pine forests in sand. The ground cover in the woods is largely moss.

The growing period is short: the time without frost is 100-110 days, while the total warmth of the growing period is only 1,400-1,600 degrees. The mean temperature for July is about 17 degrees, and in January from minus 16.5 degrees in the southwest to minus 17.5 degrees in the northeast. Summer precipitation is abundant, and winter brings a heavy snowfall (the average maximum depth of snow cover, taking a period of many years, in Cherdyn was

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over 90 centimeters). The topsoil is definitely podsol, sometimes with gravel, clay and sand, predominantly on what is the product of exposure of Perm red colored strata. Along the Kama and Vishera Rivers large quantities of sandy and alluvial soils are washed into the valley. There is a great prevalence, particularly in the northern parts of the region of mossy and less often grassy swamps.

The mining area has particularly great possibilities for working potassium deposits. The area is heavily wooded and sparsely tilled. The northern section is particularly without roads.

The basic distribution, because of economic conditions and severe farming conditions here, should be crops which supplement the relatively poor natural fodder available, guaranteeing the development of dairy farming, supplying fresh milk and vegetables to the industrial population and fodder for use in working the forests and mines.

In the group of feed crops, aside from the assortment of perennial cereal grasses, in order to improve natural meadow lands and pastures, sowings of clover for single reaping, mixed with timothy, must be extended to get more hay from land tilled long ago and from lands again brought under cultivation. There must be more extensive use of vetch-oats mixtures, of oats, of pea-vetch-oats mixtures, of barley, rape and turnips with their tops, garden waste and of tilled silage crops. So also, additional use must be made of root-tubers such as potatoes, rape and turnips, and of succulent green fodder of a pea-vetch-oats mixture and of single-crop clover. The wide demand for and extensive uses of potatoes place it here in the category of additional crops.

Of those crops which here must supply grain and concentrated fodder in far off parts of the region without roads, winter rye and



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barley (in the north the Pioneer variety, and in the south Kol'khikum 10/30 is permissible), are the most reliable crops. Here oat grain is needed for the horses but in view of the short growing period, it can be counted on only in the southern half of the region, and accordingly, all in all this crop can have here in the group of grains, only auxiliary importance. But in the south it is basic (in the south a permissible variety is Golden Rain). When necessary, in the southern part of the region, in terms of the location of the place, spring wheat may be cultivated as a secondary crop, making use of its earliest varieties (the varieties are not established, but it is possible to use either Novinki or Garnet). Cultivation of early pea varieties also must have its definite place in the field cultivation of the area.

In the south of the region, there can be an extensive expansion and development of flax sowings based upon the forestry sovkhozes, with a mechanization of reaping and cultivation processes. Climatic and soil conditions here are favorable for good fiber, but development of this crop is impeded by the absence of labor and mechanical equipment.

XI(2) Central forest pre-Urals. The southern part of the Komi-Perm Okrug and of the former Perm Okrug without its mountainous and southwestern parts. There is a predominance of spruce-fir forests, though with a sufficiently great prevalence of linden, also with individual birch and aspen trees mixed in. There are pine woods in the sands along the Kama River. There is alluvial washing of the vegetation along the Kama and Chusova. The region is tilled extensively.



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The frost-free period is 110-125 days; the total warmth of the growing period 1,600-1,800 degrees; the mean temperature for July approximately 17.5-18.3 degrees; and during January it is minus 15.5 to minus 16.5 degrees. The amount of precipitation during the summer and winter months is abundant.

Strongly podsol clayey soils, developed largely on the products of exposed red-colored Perm strata, toward the south change into faintly podsol, and in places, grey forest clayey soils. Along the Kama, there are masses of sandy, and in the west, of claylike soils. Alluvial soils are along the river valleys. There are the mining regions in the east and there is the lumbering industry region, with a number of large urban and industrial populated points. The overall tasks in agriculture are the same as in the former region, though with great relative emphasis on flax and grain crops to supply the short supplied northern and mountainous regions.

In spite of more favorable natural conditions and the somewhat different type of natural pasture and meadows due to the high degree of cultivation of the area, natural fodder is limited and the development of dairy farming must be accentuated, bringing less valuable land into cultivation and making use of crop area for more intensive fodder production. Vegetable raising must be developed with greater emphasis. The area used to supply industry with raw material, in this region must produce flax and potatoes, which although they remain among the auxiliary crops in terms of size of area used, yet their development here must be strengthened to correspond with the development of power equipment and mechanization in agriculture.



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In grain crops, because of their highly dependable crop yield, it is entirely possible not only to meet local needs for grain, cereals, and concentrated fodder, materials for brewing beer, etc., but it is possible also to arrange to supply the mountainous and more northerly regions to a greater degree than before. The little farmed roadless regions of the mountainous zone and the northern part of the area are largely dependent upon the local production of grain, particularly of oats which are in great demand here in the mining and lumbering plants and in transportation.

The mild degree and even distribution of heat and abundant precipitation facilitate the growth here of an excellent barley for beer, particularly in the clay and clayey soils of the south-west portions of the region with its prolonged growing period. These raw materials from here not only can be supplied successfully to breweries in the Urals, but also to get good quality beers, this crop can be developed on a larger scale. Following our western regions in importance for raising barley for beer, this Kamsk barley growing area which includes a part of the Nizhegorodsk territory, is one of the basic areas in the USSR for raising barley for beer. Bearing in mind that barley yield here is not less than that of rye, it makes sense to develop this crop here also for more extensive use as concentrated fodder in fattening animals.

A rainy summer and a winter with a lot of snow assures here a successful development of clover sowing. Perm clover with sowings of timothy is the basis for the hay crop in the area. The southeastern part of the region must extensively develop the sowing of clover for seed. Ensilage can be based upon the use of sunflower, an oat-vetch

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mixture, the waste from vegetables, and making use of the land under single crop. In the group of root-tubers there are potatoes, turnips and rape. For succulent green fodder, use should be made of single-reaping clover mixed with timothy, vetch and pea-oats mixture. Oat mixtures must be used extensively to supplement hay supplies.

The basic crops among the grain group for the reason indicated above must be: oats (Golden Rain variety in the north and Moskovskiy A-0315 in the south) and winter rye (Vyatka). Barley for brewing beer and for fodder must occupy a place of no less importance on the whole than that of an auxiliary crop, and in the southwestern section of the region, it must be basic.(variety: Professor Viner, permissable Kol'khikum 10/30). Wintering conditions here in individual locations permit the presence of less moist clay type soils, for a successful tilling of winter wheat (Moskovskaya 02411 and Moskovskaya 02460) and in the regions of less podsol soils in the south: spring wheat (variety: temporarily permissible Lyutestsens 062).

Although they are only of secondary importance, the grain beans: peas, beans (quick ripening, of the Perm experimental station), can be developed here quite successfully, and they are an altogether valuable crop both for food and for fodder, particularly the horse-beans (konskiye) which have high albumin content and are used for feeding young cattle. Lupin should be used widely for green fodder.

XI(3) Southern forest pre-Urals. Big Sarapulsk, southwest section of the Perm and northwest Kungursk Okrug. Mixed forests with a large proportion of wide-leaf varieties and broad grasses are in the



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forest cover. Vegetation of the alluvial meadows along the Kama. The region is very heavily tilled.

In spite of the southern location, the frost-free period is for only about 130 days, and the amount of warmth during the growing period is 1,800-2,000 degrees centigrade. The mean temperature for July is 19 degrees, and for January it is about minus 15.5 degrees. The amount of summer precipitation is already significant (160-180 millimeters for May-July). In winter, typically, there is deep snow.

The topsoil cover is predominantly turf podsol clayey soil, with less prevalent sandy soils (subarea XI(3a)). In the south and west, there are faintly podsol type soils and grey forest clayey soils (subarea XI(3b)). But in general, because of the complexity of geographic relief, topsoils are of a sufficiently large and variegated number of different types, aside from the dominant ones indicated, including podsols and sands.

There are a number of large metal working and other industrial centers in the area. Transportation services within the area are relatively poor. For the future, however, this region lies along the route of the Siberian super trunk-line, which in the future without doubt must be reflected in the tasks and trends of the agriculture of the area, and primarily in grain crops.

Industrialization and the power supply for farming in the area must in the first instance make itself felt in the extension of laborious industrial crops. Of these, long-staple flax here has entirely favorable natural conditions for development, and it must be one of the leading crops, although due to a somewhat superfluity of continental climate, long-staple flax here does not develop to be



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of very high quality. An auxiliary crop, which can be expanded, must include potatoes for industrial uses. An industrial crop of secondary importance here is hemp which also has a fiber of relatively inferior quality. Experimentation with the oil-bearing poppy, which tentatively gives good results, must be extended.

Industrial places must be amply supplied with a source for vegetables and fresh dairy products.

The development of field grass sowing rotation, essential for the development of the flax crop, calls for the development of dairy farming animal husbandry. With conditions favorable for grain crops, and also with the possibility of using the waste of dairy farming and expanded vegetable farming, the problem of hog raising becomes both general and urgent.

The assortment of feed crops is more extensive here than in the former region: for hay, Perm clover with timothy, vetch-oats mixture, and in places bearded brome grass; for silage, sunflower, corn, vetch-oats mixture, buckwheat, waste from vegetable raising and tilled land; root-tubers, potatoes, rape, turnips; succulent green fodders, vetch-oats mixture and red clover.

As far as grain crops are concerned, here the basic ones are rye (Vyatka) and oats (Moscow A-0315, Victory as permissible, and temporarily for use of the economy Belyak). But the reliability of harvests and the use of oats here is somewhat less than in the previous region, partly because of the less developed lumbering and partly because of great distances from mountain regions. Of no less significance than that of a supplementary crop, spring wheat should be here. It is found in the regions with extensive slightly podsol and grey forest clayey soils, which is completely



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suited to the conditions (a provisionally suitable type is Lyutestsens 062). As far as winter wheat is concerned, it is necessary through extensive testing to determine clearly the possibility and suitability of moving it here. Preliminary actual experience and analysis of climatic and soil conditions indicates that there is good hope for such places in the region, and already at the present moment this crop can be planned among the secondary crops (permissible varieties are Moscow 02411 and Moscow 02460).

Here, analogous to the preceding region, in the clayey soils of the northwest pre-Kama part of the region, located in the zone where coniferous forests predominate and where the Swedish fly is less prevalent, there are favorable conditions for getting large crops of high quality barley. Here is where the East-Kama land area of barley for beer brewing, indicated above, comes to an end. In this part of the region barley must occupy a significant position among grains sown as one of the basic crops grown for fodder, meal and beer, while farther south and farther east, the significance of barley lessens, on the one hand, because of a number of competing other valuable spring crops, in particular beans, and on the other hand, because of the increasing effect of harmful insects. Varieties of barley: the higher yielding and valuable Professor Viner variety of grain is permitted, and where necessary the earlier sort Kol'khikum 10/30, though it is less valuable as grain.

The conditions of the region, particularly its southern part, are altogether favorable for developing peas and fodder lentils. Here there are sufficiently suitable conditions for vetch and grain crops. All these crops must be developed here not only to supply



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local needs, but also for shipping to other regions. In the latter regard, supplying other regions, growing clover seed here is of particularly great importance.

XI(4) Azonal forest-steppe mass of the Kungursk Plateau. Big Kungursk Okrug without the northwest and mountainous portion. The island of forest steppe plant life of the "kolkov" type, surrounded by coniferous and mixed forests.

With respect to climate, the region is similar to the former region XI(3), though fruitfulness, the complexity of terrain and proximity to the mountain range, is reflected in a somewhat shorter growing period (without freezes, an average of about 115 days), great variation in the sum of warmth (over the growing period 1,600-2,000 degrees, centigrade), and somewhat lower temperatures even in comparison with the central area. In the pre-Urals, there is a large amount of precipitation during the summer months (the July average is about 18.5 degrees; and the total precipitation of May-July is over 180 millimeters).

The varied geographic relief gives quite a variation in soils. With a general predominance of average black soils and dark grey and clayey soils, there are some grey forest soils and even podsols under the islands of spruce-fir forests, podsol-like conglomerate sandy soils on the watersheds. Sandy deposits along the rivers, etc. Open spaces predominate. The region is highly tilled.

This region is less industrial than the former one, but its proximity to the mining belt of the area and its good contact with it through means of communication, places upon it the task of serving the mining industry in part with dairy products, fodder (hay and oats), potatoes and vegetable crops.



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The climate and soils of the region at the same time favor the development of feed and grain crops, which together with dairy products can make it possible to develop hog raising. The assortment of feed crops for this region is the same as for the previous one.

In the group of grain crops, of primary significance are spring wheat and oats, which have both the economic and the natural prerequisites for development. Then there is winter rye (oats: Moscow A-0315, with Victory a permissible variety, and rye: Vyatka). The soil and climatic conditions of the region favor the extension of spring wheat sowings, which here should be increased by a lessening of areas sown to spring grey grains, with a change-over to the dominant crops (the variety permitted provisionally is Lyutestsens 062). The secondary grains should include winter wheat (Moscow 02411 and Moscow 02460, the permissible varieties most hardy under wintering conditions), barley (Professor Viner and a less valuable though quicker ripening grain: Kol'khikum 10/30), and buckwheat. Beans: fodder peas and lentils must be developed to an extent which permits them to be shipped into neighboring regions. The conditions for them here are completely favorable.

Potatoes and hemp, to the extent of auxiliary crops, have entirely favorable conditions here guaranteeing high yields. They do not compete for space with other basic crops; and they must be widely developed here to an extent permitting an adequately large use of them as industrial material. Flax may be considered as a secondary crop, among industrial crops.

XI(5) The mountainous zone of the Urals. The complex terrain of worn down mountain chains is covered by coniferous forest co~~v~~ering,



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in the west - Siberian taiga (spruce, fir, cedar; in the north a big admixture of larch; and in the south, pine and narrow-leafed trees such as birch and aspen). There is a heavy concentration of mining industry within the region.

Together with a tremendous longitudinal expanse, complexity of terrain and variation of natural conditions, differences in the distribution of mineral resources and the concentrated location of mining activities all shows great variation in the region. The region can be divided in general longitudinally, in regard to the possibilities for field crops, into four subdivisions, in terms largely of the duration of the period of warmth in the lower layer. For each of these smaller areas, the basic task is the possibly complete supplying of produce and fodder which is difficult to ship and transport to the population and beasts of burden occupied in mining and forestry. With large areas without roads and with heavily broken terrain, this task is particularly important. With rare exceptions, the possibilities for field cultivation of a mountainous region are so poor, that in carrying out this task, the possibilities are exhausted, and do not develop into some other independent branches /of food production/. A supply of fresh milk and sour milk products, less often butter and cheese, supplying potatoes and vegetables, and finally, local fresh pork, (obtained from using the wastes from milk, vegetables, grains, animal slaughtering and other scrap) and along with this the grain obtained from farming, all this requires the organization of feed supplies and the development of a vegetable growing economy.

The role of grain crops in general is secondary, and they and the proper components of the sowing rotation must be grown in small areas or in leftover unoccupied spaces, to meet local demand



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in particularly isolated roadless places. Potatoes are among the food crops which are common for all parts of the region. As the crop which has the most widely divergent uses, here it must give way in extent of cultivation only to fodders taken together, and accordingly it must be an auxiliary crop of field variety in each subdivision of the region.

The assortment of fodder crops of this region, (rugged in terms of climate and soil conditions) with the exception of the mountain pastures of the northern pre-polar area (XI(5a)), generally is the same for all the subdivisions of the region. In using improved additional sowings of perennial cereal grasses of natural pastures and meadowlands, these sowings are for hay -- single-reaped clover with timothy and vetch-oats mixtures; for silos -- oat or barley-vetch mixtures, vetch-pea-oat mixed, making use of vegetable wastes and the waste from tilled land and wild vegetation; and the root tubers -- potatoes, turnips and rape.

The expanding dairy products animal husbandry, on the basis of the existing division of land, cannot get enough fodder. Accordingly, here it is necessary to raise the question of changing over a part of the natural meadows and pastures into plowland, and the question of having crop meadows used more intensively in the direction of fodder.

The assortment of fodder crops indicated above, of course, must vary in accordance with the various conditions, distinguishing the primary significance of one crop over others, not only by regions, but inside the regions in accordance with the economic and natural peculiarities of the particular type of economy.

A significant differentiation in the composition of crops may be indicated in the grain group. Their distribution largely

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according to the duration of the vegetation period and warmth available, can be indicated as follows for individual subdivisions of the region:

(a) Northern bare-mountain, swamp-taiga (northeast part of former Verkhne-Kamsk Okrug). The basic more reliable grain crop here is only barley. Sowings of oats and winter rye as secondary crops, can be grown only in the more favorable locations.

(b) Middle mountain-taiga (southeastern part of former Verkhne-Kamsk, northeast part of Perm and western Tagil Okrugs). The basic grain crops are oats and winter rye. In addition there is barley. The crop which is secondary in area, should be peas.

(c) Middle coniferous-leafy forests (western section of former Sverdlovsk, southeast Tagil and east Kungar Okrugs). The basic grain crops are oats and winter rye. Barley and peas are secondary.

(d) Southern mixed forests of the southwest sections of the former Sverdlovsk and Zlatoust Okrugs. The basic grain crops are oats and winter rye. Spring wheat, barley and peas are secondary crops.

Natural and field cultivation zones and subzones between the Urals and the Altay mountains lie along belts which go from west to east. In most instances, moreover, each of them occupies part of not only one kray, but also parts of neighboring krays. Therefore, the sections of the Urals Oblast which are east of the Urals have characteristics in common with the regions of the West-Siberian Kray and parts of Kazakhstan. Most of the regions in North Kazakhstan go into the respective zones which go across also the West-Siberian Kray.



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Accordingly, trying to avoid repetition, we endeavor to give a detailed description of the natural conditions and the desired direction of field culture with an outline only of the first region listed in each zone and only one of the krays. In similar regions of other krays, where possible, we touch on only those details by which differences are shown between analogous areas of the same zone, though located in different krays in the table (see table No. 1).

Pre-polar north. The polar and pre-polar part of the oblast. The tundra, forest-tundra and northern coniferous forests (swamp cedar), of the west Siberian taiga.

This region of vast expanse has extremely limited possibilities for any extensive development of field crops. It has an extremely wide variety of natural conditions largely contingent upon the geographic situation and the nature of the terrain in the particular places.

Table 1

| Natural Regions | Field Crop Zones | Nos. of Rayons East of the Urals | Western Siberia | Kazakhstan |
|---|---|---|---|---|
| Southern belt of the western and central Siberian taiga. | Rye-oats-barley: alluvial pastures . . . . . | $XI_6$ | $XII_1$ | -- |
| Western Siberian mixed (in the north) | Rye-oats-wheat; pastures (with | | | |



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Table 1 (Continued)

| Natural Regions | Field Crop Zones | Nos. of Rayons East of the Urals | Western Siberia | Kazakhstan |
|---|---|---|---|---|
| and deciduous (in the south) | flax and clover in the south) . . | $XI_7$ | $XII_2$ | -- |
| Western Siberian open and mountainous taiga | Spring wheat-flax-rye-oats, potato-root tubers with grasses . . . . . | -- | XII-7b<br>XII-9a<br>XII-10<br>XII-11b | -- |
| Meadow of salty forest steppe | Spring wheat grasses, oats, flax . . . . | -- | $XII_3$ | -- |
| Northern West Siberian forest steppe of irregular moisture | Spring wheat, oats, grasses, and in the northern sections, flax . . . . . | XI-8<br>XI-9a | XII-4<br>XII-7a<br>XII-11a | -- |
| Pre-mountain forest steppe of the Altai Mountains | Spring wheat, oats, sunflower, hemp . | -- | XII-7c | XIII-9 |
| Semi-dried southern forest steppe | Spring wheat, oats, and in the southern section sunflower | XI-9b | XII-5<br>XII-12a | XIII-1 |



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Table 1 (Continued)

| Natural Regions | Field Crop Zones | Nos. of Rayons East of the Urals | Western Siberia | Kazakhstan |
|---|---|---|---|---|
| Dried variegated grass-cereal black earth steppe | Spring wheat, sunflower, oily flax, millet . . . . . | XI-10 | XII-6<br>XII-12c | XIII-2 |
| Very dried southern-feather grass steppe with chestnut soil | Spring wheat, millet . . . . . | -- | XII-8a<br>XII-12b | XIII-3 |
| Extremely dried southern feather grass and cereal-mugwort semidesert | Oasis agriculture (millet, wheat). . | -- | XII-8b | XIII-3a<br>XIII-3b<br>XIII-4a |

With a generally large amplitude of variation, these conditions everywhere within the region are distinguished for their extreme ruggedness in regard to the possibilities of developing agriculture. The major limitation in this respect is the very short duration of the period of warmth and the small quantity of summer warmth.

In the southern section of the region the period free from freezing weather is up to 100 days, but in the extreme north, throughout the year there are hardly any days above freezing. It is the same story in regard to the amount of warmth during the growing period (the period with average daily temperature above 10 degrees centigrade) from zero degrees centigrade along the northern shore to 1,200-1,300



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degrees in the south. The average temperature in July, from 16 degrees in the south, falls to 2-3 degrees in the north of Ya-Mal peninsula. The average temperature in January is from minus 21 degrees in the southeast to minus 27 degrees in the Ob Gulf. The depth of the snow cover is not great and it drops off greatly toward the north. In general, the climatic conditions are very rugged, though in comparison with the overall continental climate, the region is close to the neighboring northern regions bordering on the Urals in the European part of the Soviet Union, and in regard to greater favorable development of agriculture, it is considerably above that of the neighboring Yenesey Region to the east.

In the soil cover, there are soils of the swamp tundra, swampy and poor podsol type soils of forest-tundra and northern taiga, chiefly light sandy soils. Meadow, swamp and alluvial soils are in the very wide alluvial areas of the Ob' and other rivers. The large northern part of the region is located in the zone of permafrost (north from the latitude of Berezov). There is an exceedingly vast expanse of swampland. The land can be used with the expenditure of a large amount of labor and funds even in the southern part of the region, which is more suited to agriculture. Land cultivation, therefore, hugs the slopes and is in other than swampy and wooded valleys, which have a natural seepage of ground and surface waters, in contrast to water run-off areas which in terms of agriculture are desert. Even river valleys, since they follow a longitudinal direction and are exposed to the cold north winds, in this regard also have strict limitations.

The extensive fertile wash of the Ob' River represents great wealth for the region. Although the action of the river is irregular



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(floods at the wrong time) and this lessens its worth, nevertheless, studying such action and arranging for mechanized haying in order to develop livestock raising, is a matter of great interest.

The region has a future for reindeer raising, lumbering, fishing and hunting-animal breeding, with the development of factory-mill industries from the products of animal husbandry, reindeer raising, fishing, animal slaughtering and hunting. In the south-west, there is a future for the lumber industry and the exploitation of the as yet poorly explored natural mineral resources. Connecting the Ob and the Irtysh with the south of Siberia and the development of the north sea route, and envisaged indicated railroad from the Kama-Pechora system, improving the old Berezov-Obdorsk and building new lines, on the one hand, will give the population a number of products and industrial goods brought in, and on the other hand, it will make possible a more extensive use of the wealth of the kray and it will strengthen its industry and enterprises: industrial-reindeer raising, forestry, fishing, canning, preparing suede leather and fur items, pine nuts and berries, the excavation of ivory from mammoth bone deposits (of which there are large accumulations), developing polar fox raising, sable and beaver raising, and other such activity.

This development makes sense only along with raising the national cultural level of the backward peoples who inhabit this kray (Samoyeds, Ostyaks, Voguls, Ostyako-Zyryns). For the entire north of Siberia, there is a particularly significant situation, advanced by Comrade Stalin: "Only with the development of national cultures can the backward nationalities be really joined together in action for the socialistic economy". Without this cultural-economic mastery, the far north will be retarded for a very long time. This applies



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particularly to the development of agricultural enterprise.

As it was observed above from the description of soil and climatic conditions, the circumstances for developing field cultivation here are extremely rugged. The principal branch of agriculture here should be animal husbandry, principally tundra and forest reindeer raising, making use, on the one hand, of the vast lichen covered swampy and brush pastures, and on the other hand, the more settled type of expansive alluvial wash of the Ob and other rivers. In the south, there should be dairy products, animal husbandry and hog raising.

In farming, because of the economic and natural conditions, first of all potato and vegetable growing must be widely developed in order to meet the needs of the forestry, fish industry and other enterprises, and of the entire population.

The possibilities for developing grain production at the present time are extremely limited. In the south in protected places in valleys, there are "islands" where barley is the only crop which can be relied upon. Here special attention must be given to this crop, using it not only for food, but also for feed for productive livestock and beasts of burden. Of less reliability, yet in the south with an adequate selection of quick ripening varieties, there should be more emphasis on oats, spring wheat, and also peas and winter rye. There is very great need of oats for areas served by draft animals, for forestry enterprise in the Sosva Basin, and even for the entire left bank of the Ob River.

The assortment of feed crops here, in terms of similarity of conditions, can be taken as the same as for the comparable neighboring western regions bordering the Urals: tundra region $I_1$, and the regions of oasis farming $I_2$ and $I_4$.



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It is necessary to bear in mind only that the islands relatively favorable to the development of farming here are very rare even in the river valleys because of the somewhat more continental climate. Along the Ob' River, sowings of vegetable crops (potatoes, turnips, vegetables and greens) at the present time already reach to the polar circle (Obdorsk). If methods of speeding up growth were applied, however, and if protection were afforded against the effect of low temperatures, with the introduction of fast ripening types of vegetables, it would be possible to move things further north and establish there a fully reliable system of vegetable growing.

Among industrial crops, aside from potatoes, hemp may be grown for fiber in addition to that produced in the neighboring southern Tobolsk Region. In places in the southern part of the region, already flax can also be grown (for fiber). Hemp is needed here particularly for developing net and rope production needed for the large enterprises handling valuable types of fish.

XI(6) East of the Urals coniferous woods-swamp. In the extreme northern part of the region, farming is developed to a more or less significant extent, a location in the zone of swampy west Siberian taiga with swampy and podsol clayey soils. The northern sections of the former Tagil and Irbit Okrugs and the southern part (excluding the extreme south) of the former Tobol'sk Okrug.

This zone of coniferous woods as yet has only slightly developed farming, barely meeting the needs of the local sparse population. The forest enterprises, hunting and fishing are the principal occupations of the population. The vast regions of this zone are difficult to conquer because of the absence of convenient ways of communication and because of the swampy characteristics of the



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area. The prospects for this kray include an extensive development of lumbering both for export and to meet the needs of our south, the mining industry of the Urals, and the organization of cellulose-paper production and lumber-chemical industrial combinations.

Until activity in the kray is stimulated with new railroad lines, the development of farming here must proceed along the lines of producing the most essential foods and fodder substances to meet the needs of the local population and of the regions with industrial and other activities.

In connection with the moisture of the climate (160-175 millimeters precipitation from May through July, with the relative humidity of the air 50-65 degrees at 13 hours during the month of June) and the short duration of time free from frost (an average of 100-115 days), the following can be of primary importance in farming: oats, winter rye, followed in importance by potatoes, barley, and in places, in the south the fastest ripening types of spring wheat for local consumption. Sowings of oats here should be expanded in every way possible, in view of the need for them by work horses in lumbering and particularly in winter transportation. Peas should be developed as a secondary crop. Of the fodder crops, in addition to the available natural pastures and hayfields, clover and timothy crops should be developed, also sowings of turnips and rape, plus a greater use of potatoes for fodder.

In the southern part of the region which has a longer period of time free from freezing weather, it is possible to develop flax growing. For the entire region, and in particular in places closest to factories (Nadezhdinsk), there should be added emphasis on animal husbandry for dairy farming and on hog raising. The significance of fodder crops, in comparison with other ones, in such places is being particularly increased.



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XI(7) Located further to the south, the zone of mixed coniferous-deciduous and deciduous forests covers the southern section of the former Tagil Okrug, the central part of Irbit, the extreme southern part of Tobol'sk, and the northern parts of Tyumen' and Ishim Okrugs of the area east of the Urals.

This region bordering on the taiga (next to the coniferous woods), in many respects is similar to the former (also with respect to a predominance of the lumber industry). As a result of somewhat superior climatic conditions, however, and a greater density of population, with some parts of the area close to large industrial centers (Tagil, Alapayevsk), it has much better possibilities for agricultural development.

So also, the soils are poor, very podsolistic, often of a swamp type which requires fertilizer. The duration of the season free from freezing weather, however, is long (115-130 days), with a sufficiently warm summer (17.5 degrees to 19 degrees centigrade in July). This together with a considerable amount of precipitation (165-175 millimeters from May through July) makes it possible to raise crops of clover and flax for fiber, in addition to the natural meadows and pastures; and it makes it possible to reap an adequate amount of quick ripening varieties of spring wheat in addition to the oats, rye and barley.

The eastern part of this region ($XI_{7b}$), between Yalutorovsk, Ishim and Tobol'sk (between the Ishim and Tobol' Rivers) in places has a relief with swampy often salty meadows with complex-salty-swamp-podsol soils. The natural conditions of this part of the region favor the cultivation of flax for fiber and particularly hemp.

The Chernikovsk Administrative Region located here has a reputation for the quality of its hemp, and together with the southern



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part of the former Irbit Okrug, it must be the center of hemp raising for the Urals area. In this part of the region rather than in other parts of area just east of the Urals, thanks to the relatively deep snow cover, the conditions exist for furthering winter-resistant varieties of winter wheat (to the north from the Tyumen-Ishim Railroad). This requires, however, checking with extensive tests and under actual conditions.

In general, the potentialities of this zone for expanding lumbering enterprises, and making use of new lands from the forests -- this must be considered in terms of the development of fodder crops (dairying), flax raising and hemp raising, and also grains: particularly an expansion of the area sown to oats, maintaining the winter rye crop, and of the food spring grain crops: expansion of the area and volume of sowings to quick ripening spring wheats and peas, at the expense of barley, which here is still used for food.

In connection with the need to strengthen dairying with fodder and natural pastures and hayfields, attention must be given to developing the clover crop and sowings of mixed vetch and oats. Clover sowing will be coordinated with the further development of flax and the advancement of animal husbandry will improve the possibilities for improving the poor podsol type soils of this zone.

In those regions of this zone where the largest mining and industrial centers are located (Alapayevsk), there should be built up vegetable and dairy agricultural combinations, as close as possible to these centers. The farming of such combinations should be for the purpose of working out the fodder problem for dairy cattle, also to supply potatoes to the working population, and at the same time, to produce grain crops (wheat, industrial and feed crop barley and oats).



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The fodder crops which should be grown are hay from sowings of clover with timothy; and for green fodder there should be winter rye, clover, and an oats-vetch mixture. For fall and winter succulent feed, moreover, there should be fodder potatoes, turnips, rape and silage from an oats-vetch mixture, potatoes with stalks and leaves and some sunflower.

Let us proceed to a consideration of the zone of spring wheat growing with its various combinations (from the mixed dairy farming with heavy participation from spring wheat in the north, to the typical wheat in the south), located in the south of the territory of the Union, relating to the Urals-Kuznetsk problem. In this connection, it is necessary to consider the relative importance of its various regions in terms of yield, reliability of crops and the quality of wheat grain.

In order to illuminate this problem, we present certain material based on statistical data, showing the average harvests over a twenty year prewar period in the various sections of the area just east of the Urals(Zaural'), Western Siberia and Kazakhstan, in comparison with Middle and Lower Volga, giving the results of the quality analysis of wheat from the various regions, according to the data of the Institute of Plant Cultivation:

1. The foothills (Urals and Kuznetsk) and the northern forest steppes of beyond the Urals and West Siberia (also the Kungur-Mesyatovsk Region of the Ural foothills) because of a climate of adequate moisture, represents a zone of high average yield (a 7-9 centner average over 20 years). This zone has had good reliable yields for years (no years with crop failure) though with grain of only average quality (with average characteristics, average and substandard glassiness and protein content, and with average suitability



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for baking).

2. The southern forest steppe of the beyond the Urals area (Zaural'), Western Siberia, and Kazakhstan, and also the forest steppe of the Bashkir Republic, and Middle Volga, with a somewhat drier climate, yields sufficiently good crops (average of 6-7 centners over 20 years of the prewar period), though the yield is less reliable (over these twenty years, there were one or two bad crop failures). The grain is of good quality. This means it has good characteristics, is very glassy, makes good flour, but it also is of only average suitability to bread baking.

3. The black soil steppe of beyond the Urals, of Western Siberia, and Kazakhstan which is subject to drought, and also of the Bashkir Republic and Middle Volga, gives mediocre yields (5-6 centners), and sometimes there are years without yield (2-3 years out of 20). This steppe area, however, gives a very good quality of grain (tall and large in size, very glassy, with albumin content, giving a high yield of flour, and well suited to bread baking).

4. Finally, there are the chestnut steppes of Kazakhstan and Western Siberia which are very susceptible to drought. These yield usually very little (5 centners, and to the south, 4 centners or less); and the harvests are very unreliable (3-4 crop failures over 20 years), but this grain in all respects is of excellent quality.

In working out the problem of the direction of use of the wheat production of the various regions of the beyond-the-Urals area, of the Bashkir Republic, of Western Siberia and Kazakhstan, it is essential to take into consideration the above-indicated peculiarities of producing wheat in the various parts of the territory. These



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should be related to the Urals-Kuznetsk problem and to the following circumstances as well:

On the West European market in recent times particular attention is being given to the natural characteristics and the glassiness of grain, as most important qualities upon which a good output of flour, from any particular quantity of grain, depends. The best bread baking characteristics relate also to these same specifications. Grain with a high degree of glassiness (percentage of protein), and also of natural characteristics, is usually much more highly prized on the international market which is of particular importance to us now that we compete with Canada on the grain market. At the same time, our spring wheat grain from the dry black soil and particularly the chestnut steppes of Western Siberia and Kazakhstan, turns out to be better than the Canadian, which is not true of the grain from the more moist regions of forest steppe, but is true also of the parts of the Ukraine and North Caucasus which have a climate of comparable humidity.

In planning for the regions of the trans-Urals to ship out grain, it is important to pay particular attention to this situation, at least during the coming years, making use of the wheat of the forest steppes for domestic consumption on the spot, and inside the Soviet Union, in general. This is particularly important with regard to grain from the most northern regions of the USSR, where grain is distinguished ordinarily for its large amount of moisture, where it sometimes is subject to frost before it fully ripens, and accordingly does not stand up so well under distant shipment.

In view of the particularly high quality of grain produced in the southern regions of western Siberia, this grain together with that grown in the trans-Volga area, because of the high prices that



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it will bring, must first of all, be directed toward export.

The cheapening of long-distance transportation, with the introduction of the Siberian super-trunkline, the possibilities for making use of the North Sea route, and the construction of new lines of communication which makes easier the shipment of grain from the southern Siberian regions, makes it much easier to get large amounts of foreign currency by setting aside for export the first-class southern Siberian and Kazakhstan grain.

XI(8) The northern forest steppe (turf-meadow), with a preponderance of birch groves on dark grey podsol type soils, with open steppes at times on the podsol type soils of saline and higher lying black soils, occupies a tremendous zone of the trans-Urals and Western Siberia, extending from the Western Siberia lowlands, from Nevyansk, Kamyshlov, and Chelyabinsk in the west to Novosibirsk in the east.

Within the bounds of the Urals region there is included: the former Shadrinsk and the southern part of the Tyumensk and Irbitsk Okrugs, and the big southern part of Ishimsk and northern Kurgansk Okrugs.

The northern forest steppe is located far from industrial centers, but it is fairly well served by the railroads which run along its length.

The climate favors agriculture, with already adequate moisture. The annual precipitation is from 325 millimeters to 400 millimeters, with a sufficiently satisfactory monthly precipitation (May-July: 145-165 millimeters), which with moderate warmth during the summer (18.5-20 degrees centigrade mean temperature during July), which is reflected in the relatively moist air which is rather favorable during the critical grain vegetation period (the relative humidity at 1:00 p.m. during June averages 46-52 percent).



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The conditions of this zone, accordingly, insure, on the average, a good and relatively reliable crop yield of spring wheat, which must become the principal crop of this region, along with oats (which yields sufficiently well here) for fodder crops, and in the north there should be flax. Moreover, the yield of hard wheat is not less than that of soft (even with sowings on old tilled areas) with sowings on fallows, which often is done here, just as also in the following regions of trans-Urals and Western Siberia. In the northern part of the zone, however, hard wheat often does not fully ripen when there are early autumn freezes. At any rate, in spite of its good and reliable yield, this wheat grain generally is not distinguished for particularly good quality, and it should not be used for export.

Up to the present time, fully satisfactory types of spring wheat for this region have not been found, in terms of suitability for mechanized harvesting over large areas. The hard non-crumbling Gordeiform 010 wheat can be recommended only for the southern section of the region. Of the soft varieties, the Lyutestsens 0479 stands out for its high yield, but it is very crumbly and is not of high quality. The less crumbly Mil'turum 0321, because it ripens late, can be permitted only in the southern section. For the northern more moist section of the zone, great interest has been evoked by the American Kitchener variety which is resistant to crumbling and lyeing down. The variety of oats is Victory.

Winter rye as an auxiliary crop can be somewhat curtailed. Particular attention should be given to the potato crop, and flax for fiber in the northern and eastern parts of the region. As auxiliary crops, it is desirable to expand sowings of vetch and peas, and lentils as well.



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The existence of a sufficiently large amount of unused and meadow areas and the adequate moisture of the climate, has created favorable conditions for meat and dairy animal husbandry (including hog raising), which in the future, along with the wheat-grain economy, must become the foundation of agricultural specialization in the northern forest steppes...in the part of the region near rivers and lakes, as for instance, in the southern part of the former Shadrinsk Okrug. Here there must be a particularly strong development of animal husbandry.

At the present time, the northern forest steppe offers even greater possibilities for expanding the production of wheat, by opening up the unused lands in the eastern half, and in particular, in raising its yield by making use of the best agrotechnical methods. On account of this zone and the two following ones (the southern forest steppes and the black soil steppes of the Urals Oblast, Western Siberia and Kazakhstan), principally, the movement of spring wheat must take place, eastward from the Ukraine and the North Caucasus.

Already, in regard to dairying, the need is felt to increase fodder production, which with bringing in new land to wheat, will require concentrated attention to setting up here artificially a source for fodder. Among the grasses for hay, yellow and hybrid alfalfa should be recommended, particularly in mixture together with American quack grass. In the northwest more humid part of the trans-Urals there should be also red clover and vetch mixed. Of the root vegetables, there should be potatoes, beets, and carrots. Here it is necessary to pay particular attention to the development of silo fodder, using for that: sunflower, a vetch-oats mixture and sweet clover. Sowings of sweet clover must be made also as extensively



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as possible for pasture, including it, following Canada's example, for quick turnover of sowings.

In this connection, to a considerable extent it is possible to cut down on the practice here of using clean fallows under spring wheat for grasses, silo crops and root vegetable crops (and partly, peas), leaving them alone, however, in cases which often occur here, of ground with many weeds. It is recommended that for green fodder, winter rye should be used, rye-pea and vetch mixtures.

XI(9a) In the eastern foothills of the Urals, the former region, narrowing to the south, goes over into the foothill Siberian forest steppe, where the forest (birch groves, mixed with pine woods closer to the mountains) alternates with the steppe. In the foothill Siberian forest steppe ("abrasion platform" -- steep slopes), the influence of the mountains is to make the climate somewhat milder. Here already, the climate is not too drying (145-165 millimeters precipitation from May through July, with a relative humidity at 1:00 p.m. during June, of 46-52 percent). The duration of the period without freezes is the same as in the preceding area considered. The soil is lixiviated often saline black soil.

This region occupies the eastern part of the former Sverdlovsk Okrug, the western section of the former Shadrinsk and Cheliabinsk Okrugs, and the northern part of Troitsk Okrug.

The soil-climatic and economic conditions (the presence of large industrial centers: Magnitogorsk, Chelyabinsk, etc., the developed transportation network, and the relatively dense population) dictates the necessity of developing here in the coming years a direction of economic development including the production of spring wheat, dairying, animal husbandry and hog raising, as well as vegetable



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raising. The significance of spring wheat and oats will be somewhat more dependent than in other regions.

In place of the currently practiced system of letting land lie idle, and retaining clean fallows in the more weedy land (with sowings of fallows with spring wheat), there must be a more intensive grass field system of farming, expanding the sowings of those crops which are dominant here: spring wheat, of which with plowing there are possibilities of bringing more land into use in the southern section of the region. The yield of this wheat can be raised with sowings of furrows in grass. Here, wheat is good and has sufficiently reliable yields, but with grain of only average quality.

Sowings of wheat must not be cut down. The area under rye should be decreased, if difficulties are not encountered in cutting down on winter single-year crop because of the desirability of prolonging the period of grain harvesting. As a result of the somewhat milder climate and the depth of the snow cover which is deeper than in neighboring regions, it would be desirable to try sowing winter wheat. The varieties of wheat for the northern colder part of the region which are permissible are Kitchener and Lyutestsens 0479, and for the area south of Chelyabinsk, Mil'turum 0321, Tsezium 0111, and Gordeiform 010. The varieties of oats suggested are Victory and Golden Rain. It is desirable to extend the sowings of peas and lentils.

Sowings of flax must be extended, here being used partly for fiber and for oil. The best perennial grasses for this region, as well as for other regions in the Siberian forest steppe, according to the findings of the West Siberian and other experiment stations, are those which are resistant to freezing: the American quack grass, hybrid and yellow alfalfa, and in particular, a mixture of these



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grasses. These give not only high yields of good hay, but they free the fields of weeds and increase the yield of the following planting of spring wheat.

A no less important role in this region must be played by a vetch mixture, and sweet clover in particular, and with sowings of this in the pasture and for ensilage with a quick sowing rotation. The desirability of introducing sweet clover on a wide scale is confirmed by its tremendous success in cultivating it under comparable natural conditions in parts of Canada, in developing the dairy and grain direction of agriculture. Here, careful attention must be given to silage, so that together with a vetch mixture and sweet clover, there should be introduced into the sowing rotation particularly sunflower and partly corn (not being cut here for grain). Of the fodder root tubers, place must be given to potatoes, beets and carrots.

XI(2b) Lying to the south of the northern forest steppe, the zone of the southern forest steppe of trans-Urals, Western Siberia and Kazakhstan, represents a transition to the steppes, with a predominance of open steppe-type spaces, with occurrences of pine woods much less frequent than in the northern forest steppe. The soils are black soil, partly saline and lixiviated (under the cleavages).

In this zone, extending from Chelyabinsk-Troitsk in the west to Barnaul-Biysk in the east, within the bounds of the Urals region there is a large part of the former Chelyabinsk Okrug, and the southern part of Kurgansk Okrug (south of the Chelyabinsk-Kurgan railroad line).

The climate is more drying than in the former regions. The precipitation for the year is 325-375 millimeters, of which there



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is 125-145 millimeters for the May-June period. The July temperature is 19-20 degrees centigrade. During January, it is from minus 18 to minus 19.5 degrees. The relative humidity of the air is at its lowest at 1:00 p.m. during June: on the average 45-50 percent.

It also is a zone of spring wheat, dairying, and to some extent meat raising, though with more emphasis in the direction of wheat growing, as a result of great dryness and continentality of the climate with less available natural fodder. Wheat here yields an average not fully reliable crop (over a 20 year period, during the prewar period, there were 1-2 severe crop failures). The quality of the grain, however, is good. After wheat, oats occupies here a sufficiently large percentage of the sowing area, which to some extent can be reduced. In the southern part of the region there is still a considerable expanse of wasteland, which can be used to expand the production of wheat. To the north, along the railroad, for these densely populated areas, an intensification of production can be only on the basis of raising productivity with the introduction of the correct sowing rotation, and by making use of the best agro-technical methods.

Hard wheats (the best Gordeiform 010) to some extent give way to the soft ones in terms of yield on old plowed lands. This region of high yield and high quality variety ~~Tsezium~~ Cesium 0111, leaves the other varieties far behind here. In case of necessity, use can be made of the beardless varieties (in the kolkhoz system), using Mil'trum 0321 as an additional variety. In the case of oat varieties: Victory and Golden Rain are to be used.

Intensification of the economy must follow along the line of developing the dairy economy and raising the yield of wheat, with an expansion of grass sowings, of row crops and ensilage crops. Of the



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crops for plowing, it is particularly essential for those areas nearest to the railroads to expand potato growing. Chief stress should be laid on introducing quick-ripening varieties of crops, sunflower in part of the southern forest steppe, south of the line going 100 kilometers south of Chelyabinsk, Petropavlovka, Omsk, and further in the direction of Kamen' and Barnaul. To the north, this crop will not be fully reliable until there is an expansion of the quicker-ripening and sufficiently productive varieties ("dwarf" variety of the VIR steppe experiment station, the variety of the Omsk station, and others). This will make it possible to move sunflower to cover the entire region. Hemp and peas should have a place here as secondary crops.

As far as fodder crops are concerned, great emphasis should be given here to expanding the sowings of mixed winter-resistant varieties of alfalfa (hybrid, Grimm and yellow) and American quack-grass (and also brome grass), which yield the best, of all the perennial grasses, and give a good quality of hay.

At the same time, these grasses which here are capable of setting up the basis for grass fields, help in keeping the fields clear of weed grasses. They restore the structure of plowed fields. Misuse of these fields in the trans-Urals area has resulted in black soils which easily form dust. The use of fallows often helps. Accordingly, wheat can be grown more advantageously if sown in the grassy spots rather than in fallows.

No less attention in this zone must be given to an all-out expansion of sweet clover, both in the interest of developing better pastures and better silage, and also in terms of its influence toward reviving the fertility of the soil, with the opportunity of using shorter period crop rotation than with alfalfa.



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With the development of animal husbandry in this area, it is necessary to make extensive use of silage crops, sunflower in particular, and to some extent corn, harvesting the latter when it is ripe in terms of waxiness. (The varieties of corn which are sufficiently yielding for their grain, are not cut until fully ripe, while the most quickly ripening types are too low yielding for grain and ensilage).

Potatoes and beets can be recommended, among the tuber roots.

XI(10) The zone of various grasses and feather-grass steppe is subject to drought. It is over black soils, with spots of solonetz. It is an area of an even more decidedly spring wheat grain economy. Lying within the limits of the territory which is under the influence of the Urals-Kuznetsk combination, this zone covers a wide belt from Orenburg in the west in the direction of Slavgorod, swinging further to the southeast, including Rubtsovskiy Okrug, right up to the foothills of the Altay and the trans-Altay Minusinsk steppes.

In the make-up of this zone in the Ural'sk Oblast, there is included the southern steppe part of the Troitsk Okrug. The region is typically arid (average annual precipitation 320-350 millimeters, with the mean for May-July about 140 millimeters). The temperature is high in summer (19.0-20.5 the mean for July), and heavy evaporation results in a relatively low humidity of air (43-48 percent for 1:00 p.m. during June). As a result, there is a lowering of crop yields on account of drought. Nevertheless, from year to year, the climate varies greatly, and the frequent reoccurrence of extremely dry years, makes special demands for the methods of dry farming.

The trend of field agriculture must be toward spring wheat-sunflower. Spring wheat [redacted] is the principal crop of this area and occupies from 60 to 75 percent of all sown land. Here, on the



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average, it yields not very productively (the average over the 20 prewar years being 5-6 centners). Often, the yield is as low as 1-2 centners and less.

The wheat grain of this region, however, is distinguished for its excellent qualities: in its very nature, its glassiness, protein content, and in terms of its suitability for baking. The existence of unused and virgin land, also facilitates an expansion of the area sown to wheat, particularly hard wheat.

The best varieties: Gordeiform 0189 (the Gordeiform 010 which requires more moisture, is less reliable because of droughts which are frequent here) and Tsezium 0111, with the beardless Mil'turum 0321 being permissible.

The temperature and the duration of the period without freezing weather is adequate for the quick-ripening varieties of sunflower. An expansion of the sunflower growing area as much as possible into the Troitsk Okrug (and into the respective parts of the black soil steppes of Western Siberia and Kazakhstan which are subject to drought) is an actual necessity. This is true both in the interest of vegetable oils production in the Soviet Union, together with oil-bearing flax (which here can give good yields on ground which has lain idle), and also in the interest of introducing plowed crops into the sowing rotation.

Even though the most quick-ripening varieties of corn can ripen here, yet, on account of their low yield and because of the difficulties of mechanized cultivation of these low plants, they hardly would be of interest under conditions of large-scale farming in the area. Millet and cucurbitaceous vegetables in particular, must produce here an extra reserve crop in case of years of drought, and also for sowing on the poorer sandy soils. Oats should be



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subject to a reduction of area here, to be left only as a secondary crop (the Golden Rain and Lokhovskiy varieties).

As a result of the dryness of the climate, the conditions here are not suitable for dairying (except for places near the cities and industrial centers). Specialization in the zone should go along the lines of grain agriculture -- for producing spring wheat and the oil-bearing crops indicated above on the one hand, and livestock raising for meat and goat raising, on the other hand. The abundance of land not in use and straight pasture land (on very saline soil), together with the possibility of making use of waste from grain agriculture, is more suited to this type of economy.

The demands of animal husbandry, with plowing up a large part of virgin land and land not in use, results in pulverizing the soils of the plowed lands (and a light blowing of the soil during heavy winds which are frequent in this zone). This makes it necessary, though to a less degree than in dairying on the forest-steppe, to have sowings of fodder grasses. The best ones here, as in the preceding zone, should be: a mixture of alfalfa with quack grass, the native grains, and for improvement of the pastures -- a considerable amount of salt-resisting sweet clover. Silage is of less importance here; and of the silo crops, the most worthwhile to make use of here is sunflower and sweet clover.

In working out grain farming in the future, in order to raise the production of wheat, it should be planted largely in those sections where grass grows, and should be in rotation with grass and sunflower. Fallows should be of only limited importance in the rotation of sowing, largely as a means for combating drought.



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Of the forage root-crops and tubers, potatoes and beets may be recommended.

XI (10) The zone of arid mixed-grass and feather-grass steppe, with chernozems and occasional scattered patches of solonetz soils, has a still more marked character of a spring wheat grain area. It is within the bounds of the territory under the influence of the Ural-Kuznetsk Combine, and extends in a wide belt from Orenburg westward in the direction of Slavgorod, from thence turning southeastward to take in the Rubtsovsk Okrug, up to the foothills of the Altay and the trans-Altay Minusinsk steppes.

The southern steppe portion of Troitsa Okrug forms a part of Ural'skaya Oblast section of this zone. The region is typically arid, with mean annual precipitation from 320 to 350 millimeters, a mean precipitation for May through July, of about 140 millimeters, and high summer temperatures, the July average ranging from 19.0 to 20.5 degrees. Evaporation is high, resulting in low relative humidity (43 to 48 percent at 1 p.m. in June) and in reduced crop yields because of drought. With all this, climatic conditions fluctuate sharply from year to year, and the frequent recurrence of extremely dry summers demands that special attention be paid to methods of dry cultivation.

Field crops should be centered around spring wheat and sunflower.

The principal crop of this zone, spring wheat, which occupies from 60 to 75 percent of all cultivated land, gives low average yields here (ranging from 5 to 6 tsentners for 20 prewar years), frequently dropping to 1 - 2 tsentners, and even lower.

The wheat of this region is nevertheless of excellent quality, with respect to its nature, its vitreous quality, its protein content and its bread-making characteristics. The presence of fallow and virgin



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land also favors the expansion of wheat sowings, especially of the hard varieties.

The best varieties are Gordeiforme 0189 (the more popular Gordeiforme 010 is less promising in consequence of the frequent occurrence of droughts) and Cesium 0111. The beardless variety Mil'turum 0321 is acceptable.

The conditions of temperature and the length of the frost-free period are sufficient to permit the maturation of the earlier varieties of sunflower. The advance and maximum possible expansion of its cultivation into Troitsa Okrug there (as well as in the corresponding parts of the arid chernozem steppe in Western Siberia and Kazakhstan) are most necessary at present, both in the interests of the vegetable oil production of the Soviet Union and in order to introduce a cultivated crop into the crop rotation. Flax also gives good yields here on waste land and should be cultivated along with the sunflower as an oil crop.

Although the earliest varieties of corn can also reach maturation here, this crop is hardly of interest for large-scale cultivation in this region, in view of its very low yield and the difficulty of mechanizing the culture of low-growing corn.

Prose millet and especially the cucurbits should be cultivated here as supplemental stand-by crops for arid summers, and also for sowing on the poorer sandy soils.

Oats should be curtailed and can remain only as a secondary crop, varieties to be used would be Zolotoy Dozhd' and Lokhovskiy.

In consequence of its aridity, the climate here is unsuitable for the expansion of dairy farming (except in places near cities and industrial centers) and the zone should be specialized in the direction



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of grain growing for the production of winter wheat and the above mentioned oil crops on the one hand, and for raising beef-cattle and, to some extent, sheep on the other. The abundance of waste land and of absolute pastures (on strongly saline soils) together with the possibility of using the residues of the grain industry corresponds in the highest degree to this type of enterprise.

The requirements of animal husbandry together with the plowing up of the entire surface large tracts of virgin and waste land, resulting in pulverizing the soils of such lands (and the consequent lose of wind erosion, since strong winds are common in this zone) makes sowings of forage grasses necessary (though to a lesser extent than in the case of dairy farming on the wooded steppe). As in the preceding zone, the best grasses for this purpose are: an alfalfa-couch grass mixture, zhitnyak (Triticum cristatum), and, to improve the pasture grounds, sweetclover, which has considerable tolerance for salts. Silage is less important here. It is most expedient to use sunflower and sweetclover among the silage crops.

With the rationalization of grain growing in the immediate future, wheat should be sown principally in rotation with the grasses and sunflower, in order to improve wheat yields, and should occupy only a limited place in crop rotations as a measure for combating droughts.

## XII. THE WEST SIBERIAN KRAY

It is natural that West Siberia, with its vast expanse, stretching not only from east to west, but also north to south, should offer an extreme variety of natural conditions. Being contiguous on the one hand with the Altay and Kuznets Alatau, it is linked on the other, with Turkestan in its southern steppe section, and with the tremendous perspectives opened up by the Ural-Kuznets problem, it is at the same



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time thus strongly linked with Turksib problems.

The inclusion of West Siberia in the territory of the Ural-Kuznetsk Combine will have exceedingly great organizational consequences for its agriculture. In view of the wide range of natural conditions in the kray, the realization of these consequences appears entirely possible, for these conditions favor the expansion of different crops in different sections as well as the introduction of new crops into the kray.

The tremendous industrial development of the UKK in general, and of the Kuzbas, which forms a part of West Siberian Kray, in particular, is resulting in an increased demand for agricultural products by the industrial working population, which would require the specialization of large areas for such products.

The existence of very large electric power centers in West Siberia and the construction of gigantic agricultural machinery plants within the area of UKK (Sibkombaynstroy, Chelyastraktorstroy and others) offer exceptionally favorable conditions for the rapid tractorization of production and mechanization of harvesting on the steppe expanses of Siberia. The expansion of electrification for industries on the basis of cheap coal resources also makes it possible for agriculture to utilize electric power directly, especially within the Kuzbas area and in the vicinity of great industrial centers. In the mountain and foothill regions of the Altay system, the construction of mightly hydroelectric stations also makes power available for agriculture.

In connection with all these factors, the most tremendous possibilities are opened up for West Siberian Kray, possibilities for the industrialization of agriculture both in the realm of preliminary and ultimate processing of the products of flax culture, the develop-



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ment of flour milling and oil extraction, as well as in the organization of major centers of dairy farming, and in the beet sugar, starch, distillery and other industries.

The intimate connection between agriculture and industry, based on the mechanization and industrialization of the economy, should be expressed in the form of construction, in the regions most suitable for the corresponding specializations, of agricultural combines on the largest scale: vegetable-dairying, oil flax growing and processing, butter-dairying, grain growing and beef, sugar beet growing and beef, and so on.

The realization, planned for the immediate future, of railroad construction on the largest scale, in connection with the UKK, by building southern railroad branches in connection with a super-trunkline together with the development of the North Sea Route, in its turn will have an immense influence on Siberian agriculture. The super-trunkline and the North Sea Route will make it possible not only for Siberian vegetable oil but for its flax as well to easily reach West European markets, and will also make it easier to ship the high quality wheat of Siberia and Kazakhstan to the Central Asiatic republics by supplementing its transport on the Turksib Railroad.

In connection with the improvement of agricultural production of West Siberian Kray, socialist reconstruction opens up the greatest perspectives.

Immense possibilities for the expansion of cultivated acreage are offered by the common pasture grounds, the waste and virgin lands, and to some extent by the clearing of forested tracts and the reclamation of presently inarable lands. The cultivated acreage can be more than doubled during the Second Five-Year Plan, while the major role



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in placing new expanses under cultivation is played by the broad mechanization of sovkhoz and kolkhoz construction. Major factors in the expansion of agricultural production will include the irrigation of considerable tracts in Minusinsk Kray, in Oyratiyo, and the sugar beet regions in the vicinity of the Altay, the reclamation of Baraba, and so forth.

The application of proper methods of agricultural technology, selection of varieties and crop rotations should play an especially great role in increasing production. In connection with the expansion of animal husbandry the widespread application of manures alone can increase the yield of wheat by 40 to 50 percent in the wooded steppe and mixed forest belt, according to data of the local experimental stations. New possibilities for increasing the productivity of cereals, flax and the production of forages are opened up by the expansion of sowings of the leguminous grasses (winter-hardy varieties of alfalfa, sweetclover and, in the wooded mixed forest (podurman) regions, of clover) and the application of fertilizers, especially of phosphates, using the Ural and Akmolinsk phosphorites and particularly the Khibinsk apatites, which can be brought in by the North Sea Route and processed into ammonium phosphates in Siberia.

The widespread introduction of the sunflower as a component in crop rotation will play a considerable role in the steppe portions of Siberia, as will the application of proper methods of dry agriculture in conjunction with mechanization, and the commencement of large scale irrigation works on considerable areas in Khakasiya, Oyratiya and in the sugar beet growing regions in the section in the vicinity of the Altay.

All these factors taken together will revolutionize Siberian



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agriculture and lead to a decided increase of production based on different specialized cultures in different parts of the Kray, in accordance with economic and natural factors:

Wheat: in the vast area on the steppe and wooded steppe devoted to spring wheat growing of various kinds;

Dairy products: Butter in the region of forage grasses, spring wheat, oats and flax cultivation on the flood-meadow steppe of the Baraba, on the spring wheat-oats-forage northern wooded steppe (also to some extent on the southern), and in the foothills of the Altay;

Fresh milk products and vegetable growing in the metallurgical regions of the Kuzbas, in the foothills of the Kuznetsk Alatau, Altay and on the Salairsk Ridge, and also in the neighborhood of manufacturing centers in general, with field cultivation oriented towards forages, but also including potato growing, and a large participation of spring wheat, rye, oats and flax;

Fiber flax: in the same regions, and, especially, in the belt of mixed forest;

Oil crops: sunflower and oil flax in the regions of spring wheat, sunflower and flax cultivation on the chernozem steppe and the adjacent portion of the southern wooded steppe, and also in the foothills of the southern Altay;

Sugar beets: in the Altay region of the southern wooded steppe.

Prose millet: in the arid zone of the chestnut-earth steppe with field cultivation oriented towards wheat and prose millet.

In the agriculture of the kray, the principal perspectives for a balanced and desirable development of the economy of its varied regions appear to be the following:

(1) Expansion of the sowings of spring wheat in its wooded steppe



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portions (with corresponding reduction of its relative importance in the Ukraine, especially in the Eastern steppe of the Ukraine and in the North Caucasus), in conjunction with rationalization of its production against the background of a large-scale mechanized agriculture.

(2) Intensification of the advance of the sunflower areas in the boundary portions of the chernozem steppe and the adjoining parts of the southern wooded steppe (in the latter using only the earliest varieties).

(3) Expansion of fiber flax sowings in the vast regions, where this crop is still new, of the "open taiga" near the Altay, the mixed forest zone, and the adjoining portions of the flood-meadow steppe and the northern wooded steppe.

(4) Extension of the cultivation of forage plants to help the development of fresh milk dairying in the Kuzbas, butter and milk dairying in the wooded steppe, and beef cattle-raising in the south, and also to improve the fertility of the soil and protect it against wind erosion.

(5) Reclamation and cultivation of new lands (presently forested in the north and still virgin in the south) and an expedient readjustment of crop rotation to produce more crops and reduce or eliminate fallowing.

(6) Extension of sugar beet sowings in the section near Altay of the southern wooded steppe.

XII (1) The extreme northern region of possible but definitely marginal agriculture in the West Siberian Kray is represented by the Narym-Vasyugan' West Siberian swampy taiga with bog soils and podzolic loamy soils located in the northern half of the former Tarsk Okrug and the southwestern portion of the former Tomsk Okrug. It is similar to the



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analogous region XI (6) of Ural'skaya Oblast, and constitutes the latter's easterly continuation. It is a zone of evergreen forests, w with slight development of agriculture, which meets the needs only of the very sparse local population. The abundance of swamps and the absence of routes of communication mades the region difficult to reclaim for agriculture and demands extensive drainage operations, especially in Vasyugan'. Until these are actually carried out, the principal occupations of the inhabitants will continue, for a long time, to be lumbering, hunting, and fishing. The character of the natural and agricultural conditions has been described under Region XI (6).

Oats and winter rye of the fastest maturing varieties should hold first place in the sowings, with barley, and to some extent spring wheat, peas and potatoes, being grown for local consumption. In the south of the region, where the frost-free period is longer, it is necessary to cultivate high quality flax and to sow clover. Fertilizers, including mineral fertilizer (lime) must be used. However, in contrast to the corresponding region of Ural'skaya Oblast, there are only slight prospects for dairy farming for the time being, since there are no suitable routes and any possible markets are remote.

XII (2) The region of mixed evergreen-deciduous forests ("podurman") represents a transition from the preceding region to the northern wooded steppe and the swampy flood-meadows to the south, and embraces the southern part of the former Tarsk Okrug, the northern parts of the former Barabinsk Okrug and Novosibirsk Okrug. In natural conditions and agricultural possibilities it strongly resembles Region XI (7) of Ural'skay Oblast, with poor, podzolic and frequently waterlogged soils, requiring fertilizers, but it enjoys a longer frost-free



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period than the coniferous forest region (urman), a rather warm summer and good moisture.

With its eastern section relatively close to the railroad and to the industrial centers of Tomsk and Novosibirsk, there arefar better prospects for agriculture than in coniferous forest (urman) region.

Of the grain crops, besides rye, the leading place should go to oats and spring wheat, with increasing advance of the fast-maturing varieties of the latter, as well as peas, at the expense of barley which should be reduced and, for the time being, grown for subsistence purposes.

Special attention should be paid to the planned reclamation of forested lands, and in connection with this, particularly in the south, to the development of flax and hemp cultivation, and also of dairy farming, for which, in addition to the native pastures and hayfields, clover should be sown with timothy and vetch-oat mixtures. Rye should be used for green forage; turnips, potatoes and rutabagas should be sown, and vetch-oat mixtures, potato haulm and sunflower used for silage.

After the region of the Altay foothills and the Salairsk Ridge, this is the second most important region for future specialization of flax culture of the West Siberian Kray. The crop is favored by the humid climate, the possibility of using new lands (including some presently wooded) and little-cultivated lands, and a sufficiently long growing season, while sufficient precipitation and depth of the winter snow cover assure the success of clover sowings to supplement the meadow pastures, especially along the rivers, as a base for dairy farming which is closely associated with flax growing. However, the



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relatively poor soils require the use of mineral fertilizers as well as manures - especially phosphates, with lime in some places as well.

Increased sowings of potatoes may be undertaken as a supplementary industrial crop, and also hemp in some places.

XII (3) A flood meadow with salt marsh in places, wooded steppe region is located to the south of the preceding region, in the central part of the former Barabinsk Okrug and the northwestern part of Novosibirsk Okrug (Baraba). It is relatively remote from manufacturing and metallurgical centers, but is near the Siberian Railroad.

Precipitation is adequate, amounting to 150-160 millimeters in May-July, the region being more likely to suffer from excessive rather than insufficient moisture. Wooded steppe with "kolka" (copses) of birches. There are swamps, occasionally occupied by wet meadows ("zaymishcha"). The soils are chernozem in elevated locations and saline meadow in the depressions. Temperature conditions (from 18 to 20 degrees in July), the length of the growing season (120-125 days) and the relative humidity (up to 59 percent in June) are rather favorable for good and more or less reliable yields of spring wheat (0111 variety Cesium with Gordeiforme 010 for use in the southern part) and of oats (Pobeda variety). These two crops should have the leading place among the cereals here, while winter rye may remain as a supplementary crop, and barley, peas, and beans may be grown as secondary crops. The latter two should be expanded.

However, the considerable areas of natural grazing grounds and hayfields, the soil and climatic conditions, and the proximity of the Siberian Railroad which runs along the edge of this region directs that our attention to be concentrated in the future on the widest intensification of butter and milk dairying as the leading line of agricultural



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development, giving it the character of large-scale socialist enterprise, with wheat growing optional and the organization of special wheat growing enterprises only in the more southerly section, which is transitional to the following zone. For these reasons the center of gravity of field cultivation in this region should be the production of forage to assure good feeding of the cattle. Along with this, flax culture may also be developed.

The general direction of field crop cultivation is towards spring wheat and oats, forage grasses, root crops and flax.

In spite of the relatively large areas of pasture and meadow, they require both in quality and yield of forage improvement through reclamation of a considerable part which consist of salt pans and swamp, and being supplemented by sown field crops.

Corresponding crop rotations should be of grassland character, with a large percentage for hay and grazing and sowings of silage and root crops.

A mixture of American couch grass with winter-hardy forms of alfalfa should occupy the dominant position in the grass sowings, on account of the quality and quantity of the crop, as well as for its influence on the next succeeding crop. However, in the northern part the growing of clover is probably also possible.

Since it is more expedient to pasture cattle in this region, it is more necessary here than in any other region to introduce sweetclover on a wide scale, for it is the best of the pasture plants and is, in addition, relatively salt-resistant, which is very important in view of the rather large tracts of saline soils. To supplement this, it is expedient to sow vetch mixtures for hay and winter rye for early grazing. The wide use of silos is obligatory, and sunflower



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should be sown for this purpose, but not allowed to ripan to the seed stage, while sweetclover and vetch-oat mixtures should also be used. Beets, turnips (Brassica campestris rapifera), and potatoes should be used for forage root crops. Attention should be given to the introduction of Russian beans as a source of concentrated protein.

The application of manures and mineral fertilizers is necessary.

Where wheat is sown, it should go on fallow to a considerable extent (with the object of clearing the wild grasses). In some places green fallow may also be used.

Flax should have a very important place among the industrial crops, especially in the northern and eastern sections of the region, industrial potatoes to be given less importance, and hemp grown only in some places.

Very large-scale creameries producing not only butter but also evaporated milk and the by-products of butter-churning and dairy farming, together with the organization of hogbreeding based on dairy residues, should constitute the base for the industrialization of the economy for this most important region of Siberian butter-churning. The large-scale enterprises of this region should be electrified in connection with the planned electrification of the railroad trunk line that passes along the edge.

XII (4) The peat and meadow northern wooded steppe, with a prevalence of birch "kolki" (copses) on dark gray podzolic soils, which are separated by expanses of open steppe on podzolic solonetz soils and leached chernozems, comprises an unbroken continuation of the immediately adjoining and identical region of the trans-Ural area, and embraces in West Siberia the northern half of the former Omsk Okrug, a belt along the central part of the former Barabinsk Okrug, and the southwestern



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part of Novosibirsk Okrug.

The climatic conditions in the region accordingly resemble those of Region XI (8) of the trans-Ural region. Although the annual precipitation is not great (320-380 millimeters), its distribution is such (total mean May-July precipitation 140-150 millimeters) that in connection with the mean temperature (about 18.5 - 19.5 degrees for July) the humidity is sufficiently favorable (mean relative humidity in June at 1 p.m. is 54-55 percent) not only for good yields of spring wheat in comparison to other regions but for forage crops as well. However, the temperatures in winter (with the January mean from minus 19 to minus 20.5 degrees) together with a mean maximum depth of 45 centimeters for the snow cover, do not allow the cultivation of winter wheat and require the use of sufficiently winter-hardy varieties of rye.

On the northern wooded steppe, animal husbandry associated with milk and butter dairying should have an equal position to that of cereal growing, and spring wheat and the forage crops should play the leading role in field cultivation. Oats and winter rye should be grown as supplementary crops. Flax may have a certain importance in the northern part, but here it is already inferior in quality to that grown in the preceding regions, and represents a transition to oil flax. In all parts of the region, potatoes and peas should occupy their proper place and the cultivation of Russian beans should be introduced.

The principal forage crops here should be as follows: hay, to include hybrid alfalfa, American couch grass and, in particular, mixtures of these two, sweetclover, vetch-oat mixtures, and beardless brome grass; green fattening rations to consist of the same grasses,



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with the addition of winter rye and oats; silage to include sunflower and sweetclover; and potatoes, mangel-wurzel, turnips (Brassica campestris rapifera,) and carrots for root crops.

Special attention should be paid here too to the introduction of sweetclover (mainly of the Canadian winter-hardy Arctic variety, as a pasture plant which is important for the dairy-farming of the region, since it thrives even on the saline soils often encountered here and is also valuable as a preparatory component in accelerated crop rotations.

Cesium 0111 is the best variety of spring wheat for this region. The beardless Mil'turum 0321 and the hard wheat Gordeiforme 010 are also recommended for the more southerly parts. For oats, Pobeda should be used. The yield of wheat is relatively stable, but on account of climatic conditions the quality is inferior to that grown in the preceding region with respect to bread baking characteristics and protein content. Early frosts and harvest conditions are also reflected, in some years, in the quality of the grain.

Spring wheat is often sown in fallow to combat the growth of weeds, which spread easily over long-cultivated lands in this region, which suffers from drought, but in relatively infrequent years. Part of the fallow under wheat may be occupied by silage crops, especially vetch mixtures. However, it is imperative to cultivate more land, with green fallow occupying a considerably greater area than bare fallow. Unfortunately since the mean duration of the frost-free period is only 120-125 days, it is not only impossible to cultivate corn for grain but even to grow the variety of sunflower presently distributed (variety number 169) except for silage. The introduction of early varieties of sunflower could be of very great significance, and the



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Omsk station has already commenced its work of selection, while the Karlik (dwarf) variety of the Steppe station of the VIR matures 10-14 days earlier than Number 169.

The enhancement of productivity on the leached chernozems and partially Podzolized soils of this region will depend very largely not only on crop rotation but, with the further expansion of animal husbandry, on manure as well, which can increase the yield of the succeeding rye crop by as much as 55 percent when applied to fallow, and the yield of spring wheat by as much as 50 percent if sown directly after manuring the fallow, and even increases the yield of the second cereal crop after manuring by as much as 30 percent. The application of phosphate fertilizers increases productivity of wheat as much as 20-25 percent.

XII (5) The southern wooded steppe of Western Siberia represents a transition to the steppe, with a predominance of open stretches of steppe and a considerably less frequent occurrence of birch woods than on the northern wooded steppe. A long belt of rich and ordinary chernozems, with occasional occurrence of saline and leached soils under birch woods, embraces, within the West Siberian Kray, the central part of the former Omsk Okrug, the southern part of the former Barabinsk Okrug, the former Kamensk Okrug, a large part of the former Barnaul Okrug, and the northwestern part of the former Biysk Okrug, and is the continuation of the southern wooded steppe of Kazakhstan and the trans-Ural region which we have described in our discussion of the natural conditions and desirable orientation of the field agriculture for the corresponding Zone XI (9).

The region is semi-arid, with mean total precipitation during the May-July quarter of 140 millimeters and relative humidity at 1 p.m.



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from 50 to 54 percent in June. More arid years not infrequently occur, making the wheat crop less reliable than on the northern wooded steppe. The somewhat higher aggregate temperature in summer with July temperatures ranging from 19 to 19.8 degrees, as compared with the northern wooded steppe, where the range is 18.5 to 19 degrees during that month, already makes it possible to grow sunflower if sufficiently early varieties are chosen, especially in the southern part, but there is still no guarantee that even the earliest dwarf forms of corn will have time to mature, and this crop cannot therefore be recommended.

Like the northern wooded steppe, the region is thus one for growing spring wheat and milk-butter dairying, but in consequence of the more arid and continental climate, and equally because less natural forage is available, it has a strong tendency towards wheat production. The direction of field cultivation should be towards spring wheat, oats, and grasses, with increased cultivation of the sunflower, using only the earliest varieties, in the southern part.

The massive expansion of sunflower cultivation will play an immense role not only in increasing the production of vegetable oils but also in wheat growing, since sunflower can be substituted for the bare fallow components of crop rotation.

The Barnaul-Biysk portion of the southern wooded steppe, which is located somewhat farther to the south and is already subject to the influence of the Altay Mountains, is distinguished by a somewhat warmer and less arid climate (Barnaul has 165 millimeters of precipitation during the June-August quarter), causing the sugar beet to thrive. This should serve as the base for the development of a beet sugar industry to serve the Ural-Kuznetsk zone, which industry would be included among the other large scale agricultural enterprises of this



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zone of southern wooded steppe (Kozikhinskiy, Chisstyun'skiy, Aleyskiy, and Rybtsovskiy rayons, which are partly irrigated).

The zone of the southern wooded steppe is the most densely populated part of all Western Siberia, as a result of the more favorable soil and climatic conditions and of the proximity of the Siberian trunk railroad line. Nevertheless because of the presence of large tracts of still unused lands, it offers great possibilities for the expansion of cultivated acreage, especially of wheat, the production of which is the greatest here of all the wheat-growing areas of the Asiatic part of the Soviet Union, and whose surplus, in view of its high quality, may be shipped out. Even more tremendous prospects for the agricultural production of the region will be opened up by the organization of enterprises of grain-butter-dairy type, particularly in the sections adjoining the Altay and the Kuznetsk basin. Such enterprises would be intimately linked with industry and with the utilization of its electric power.

Without going more into detail concerning the reasons for the relative importance of the crops and varieties which have been generally indicated for the southern wooded steppe in the course of our description of Region XI (9b), we shall stop here only to enumerate them, in view of certain slight differences in their composition from the trans-Ural region of wooded steppe.

The leading cereal crop is spring wheat. Varieties are Cesium 0111 and the hard wheat Gordeiforme 010, supplemented by the beardless variety Mil'turum 0321. Supplementary crops would include varieties of Pobeda and Lokhovskiy of oats, with the use of Dippe and Lokhovskiy varieties in Barnaul and Kamensk Okrugs, with their milder climate. In the southern part, increase of sunflower growing



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should be intensified, using the earliest varieties. Throughout the region, sowings of oil flax should be increased, as should sowings of sugar beet in the Barnaul-Biysk section. Barley should be grown as a secondary crop. Increased attention to forage crops is necessary, such as American couch grass, hybrid alfalfas (and yellow-flowered alfalfa) and their mixtures, brome grass, with blue Khiva alfalfa in the southern section, sweetclover for pasturage, silage, and green forage, sunflower (and to some extent corn and sweetclover) for silage, potatoes and mangel-wurzel among the forage root crops.

XII (6) The region of arid mixed-grass steppe on southern chernozems has an even more clearly expressed character as a wheat-growing area. It is the easterly continuation of similar regions of the trans-Ural and Kazakhstan, and occupies on the border of Western Siberia the most southerly part of the former Omsk Okrug, the greater half of the former Slavgorod Okrug, the larger part of Rubtsovsk Okrug and the southwestern part of Barnaul Okrug.

The soils of this zone consist for the most part of southern chernozems with a lumpy structure, and only in the former Rubtsovsk Okrug, near the foothills of the Altay, are there middle-zone chernozems rich in humus. For the most part, the southern chernozems of this zone are of loamy character, but in the former Kustanay Okrug, and in the eastern portion of Petropavlovsk Okrug in Kazakhstan, as well as in the northern portion of Slavgorod Okrug, the soils are poorer and of sandy loam type.

In the former Rubtsovsk and the former Slavgorod Okrugs, narrow "ribbon-like" belts of pine forest on sandy pine soils run from the southwest to the northeast, and continue on into Barnaul Okrug.



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Besides these areas of this zone, with very inferior soils of sandy loam or gravelly character, solonetz occurence is generally found in the soils throughout the zone, as well as continuous areas of solonetz soils, which are a major obstacle to the development of agriculture, as, for instance, in the southeastern and northern sections of the former Pavlodar Okrug. This fact also explains the slight agricultural use made of the land in the latter sections, as may be seen from the map of acreage under cultivation.

Together with the necessity for reclamation of the saline lands goes the further necessity of introducing halophytic varieties of plants for cultivation.

The entire zone is generally characterized by aridity of climate. Total annual precipitation is around 300 millimeters, of which an average of about 120-140 millimeters falls during the May-July quarter. However, the rather high summer temperatures, with the July average from 19 to 20.5 degrees, and strong evaporation, result in a low relative humidity, ranging from 43 to 48 percent for 1 p.m. in June, with consequent impairment of crop yields by drought.

Spring wheat is the principal crop of this zone, occupying up to 60-75 percent of all cultivated land, and gives low yields, averaging 5-6 tsentners for 20 pre-war years. Even these yields fluctuate sharply and sink in some years to 1-2 tsentners and even lower.

The best and most stable crops in the zone are obtained in the former Rubtsovsk Okrug.

The wheat grown in this zone, however, is distinguished by its excellent quality, both as to its general nature, its vitreous quality, its protein content and its bread-baking characteristics, and represents the highest type of export merchandise for the international



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grain market. Hard wheat should be rotated with fallow and perennial grasses. Varieties should include Gordeiforme 0189 (except in Rubtsovsk Okrug, where Gordeiforme 010 is better), Cesium 0111, and the supplementary beardless variety Mil'turum 0321.

The temperature conditions entirely assure the maturation of the sunflower (Saratov 169). Its advance in this zone and expansion of its sowings to the greatest possible extent (except on saline soils) appears particularly necessary, both to increase the vegetable oil production for the Soviet Union, together with oil flax, which can give good crops on waste land, and to introduce a cultivated component in the crop rotation. Although the earliest varieties of corn can reach maturation here (Pervenets and the Minusinsk variety Beloyaroye psheno), it is hardly of interest for large scale production because of its very low yields and the difficulty of mechanizing the cultivation of this crop.

Sugar beet growing can be widely extended in that part of Rubtsovsk Okrug which adjoins the foothills.

Prose millet should serve here as a supplementary stand-by crop for years of drought, and also for sowing on the poorer sandy loam soils. Barley and oats (Dippe and Lokhovskiy) are admissible here only as secondary local subsistence crops.

On account of insufficient precipitation, the development of dairy farming is not possible here and specialization should be directed to the production of spring wheat, sunflower and flax for oil, on the one hand, and the development of animal husbandry for meat, and to some extent sheepraising, on the other. The existence of waste land and of strongly saline soils, useful only for pasturage, corresponds to this direction of the economy.



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The introduction of such more drought-resistant crops as chick-peas and sorghum is desirable. Sorghum can be grown here only for forage, as it cannot ripen into grain.

The requirements of meat farming in connection with the future cultivation of the greater part of the virgin and unused lands, and the ease with which the topsoil is pulverized and blown away by the wind, calls forth the necessity of grass sowings, even though on a smaller scale than in the case of the dairy farming on the wooded steppe. The following are recommended for this purpose: a mixture of alfalfa with American couch grass, zhitnyak (Triticum cristatum), together with sweetclover, which has considerable salt-resistant powers, to improve the pasturage grounds. Silage is less important here, and the most advisable of the silage crops here are sunflower and sweetclover. In order to increase its yield and reliability, spring wheat should mainly be sown as a component in cultivated grass rotations, following sunflower. Bare fallow with spring wheat can thus be reduced to the minimum necessary for combating drought in the more arid sections of the region.

XII (7) The foothills of the Kuznetsk Alatau, the Salairsk Ridge and the Northern Altay represent a part of the northern foothill wooded steppe, with chernozems (in the northwest part of the former Kuznetsk Okrug), and partly open (cleared) taiga with "park-like" birch groves with degraded, leached chernozems and podzolic loams (in that part of the former Tomsk Okrug to the southwest of Tomsk, in the eastern part of Novosibirsk Okrug, and in the northwestern part of Barnaul Okrug to the west of the Salairsk Ridge.)

The soils, depending on the altitude, are more varied than in the preceding regions. A sufficiently humid climate, with precipita-



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tion of 160-185 millimeters during the May-July quarter, absence of droughts, warm summers (18-19 degrees in July) and an adequate length of the frost-free period favor not only a high and stable yield of spring wheat, but also flax culture, dairy farming if clover and root crops are sown, and vegetable growing. The latter is particularly important, since the Kuznetsk basin with its extremely large scale manufacturing and metallurgical enterprises is located in this region, which demands the expansion by all possible means of precisely these branches of the economy to satisfy the demand of the industrial population of the Kuzbas.

Accordingly, the direction of field cultivation should be towards the production of spring sheat, oats, rye and flax, with sowings of grasses, growing of potatoes and root-crops, together with market-gardening of the latter on an intensified scale in the immediate vicinity of the metallurgical centers.

Spring wheat should remain the leading cereal crop, since it gives here practically the most reliable yield of any spring wheat area in the Soviet Union, and its harvests should be used to meet the needs of the rapidly growing population of the Kuzbas. Sowings of oats should not be diminished in view of the employment of horses in the mining districts.

The cultivation of winter rye should also be continued, and in those parts of the region with deeper snow cover, the question of the possibility of growing winter wheat should be determined.

The success of fiber flax cultivation is assured here by the excellent quality of Maslyaninskiy flax and the possibility of improving its yield by the use of fertilizers (including mineral fertilizers).



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The Salairsk Ridge with its foothills should become the central region of specialization to the culture of fiber flax in the West Siberian Kray. The broadest perspectives are opened here for flax culture and the use of its production not only for the population of the Ural-Kuznetsk Combine and the USSR in general, but also for the possible export of the better grades of flax fiber by way of the rivers of the North Sea Route.

Flax culture and its associated clover sowings will be intimately linked with the development of dairy farming, which is so necessary in regions with great industrial centres.

Hemp should have a substantial significance as a supplementary industrial crop in the foothill region, especially near Biysk. Sowings of tabacco can be increased.

The development of dairy farming demands the intensified expansion of clover sowings (late red clover with timothy), also including, in the wooded steppe section, sowings of mixtures of hybrid alfalfa with American couch grass and brome grass, sowings of sweetclover for pasture, silage and green forage, sowings of winter rye, vetch-oats, sweetclover and clovers for green forage, sunflower, sweetclover, vetch-oats for silage, and finally, potatoes, turnips (Brassica campestris rapifera and Brassica napus rapifera for forage.

The current practice of sowing spring grains on bare fallow to clear the fields of weeds should be replaced by green fallow: rye for grazing, vetch mixtures and sunflower for silage. Grass sowings should be introduced with a transition to the multiple-field system of crop rotation.

In establishing large-scale agricultural enterprises in this zone, the following should be organized: milk and butter dairy farming,



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flax fiber scutching, oil flax processing, paper mills for processing brome grass [sic], and bacon-curing plants (with hogbreeding based on the residues from dairy and flax production, potatoes and the residues of grain production).

XII (7c) The southern part of the Altay foothills, which maintains its basic similarity with the preceding regions, both in natural conditions and in the proximity of industrial centers, also differs in some respects from them, so that this region should be separated according to the character of its agricultural specialization and, particularly, of its field crop specialization..

The foothills of the southern Altay have the character of a shrub-covered wooded steppe, quite stony in places, in the related parts of the former Rubtsov and Biysk Okrugs and, partly, in Barnaul and Semipalatinsk Okrugs, which represent the immediate southerly continuation (roughly from Biysk) of the previously mentioned foothills of the northern Altay and of the Kuznetsk Alatau. The soils are chernozems, some of which are leached. Precipitation is adequate (160-190 millimeters during the May-July quarter). The temperatures are higher (17.5 to 20 degrees in July) and the frost-free period is longer (120-130 days) than in the foothills of the northern Altay.

According to the natural conditions of the foothills and in connection with the proximity of mining enterprises (Ridder and others), the basic orientation of the economy could be towards dairy farming, unaccompanied by fiber flax culture, but with a certain tendency towards spring wheat and sunflower growing.

The leading crop should be spring wheat, with sunflower and oats as supplementary crops. For forage it is necessary to expand the



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sowings of alfalfa and American couch grass, brome grass, and sweet-clover (and clover in Biyskiy Rayon), vetch-oat mixtures and sun-flower for silage, and mangel-wurzel and potatoes. In addition to this, sugar beet cultivation is possible here and it is necessary to expand sowings of hemp as much as possible, especially in the Biyskiy Rayon.

XII (8a) Far to the south lies a belt of a very arid zone of southern feathergrass steppe and, in places, of grass mugwort steppe with chestnut soils. Because of natural conditions, the remoteness of industrial centers and the poor railroad connections, the region is of great significance for beef livestock and sheep-raising, together with a very sharply fluctuating field cultivation oriented towards spring wheat and prose millet.

Annual precipitation is low (225-275 millimeters), as is summer precipitation (100-200 millimeters in the May-July quarter). Summer temperatures are high (20-23 degrees in July) with relative humidity low (38-45 percent in June). These conditions are unfavorable, even in average years, for reliable and sufficiently high yields of cereals and forage plants.

The chestnut soils of this grass-mugwort steppe are of complex character, with patches and sometimes large areas of solonetz soils.

It is natural that under such conditions the average yield of wheat here during 20 pre-war years should have only been 4-5 tsentners per hectare, with complete crop failures occurring very frequently (three or four times during this period.)

An immense area of Kazakhstan is included in this region of arid southern steppe on dark chestnut soils, while within the confines of the West Siberian Kray it includes the central part of the former



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Slavgorod Okrug and, beyond the Altay, the eastern part of Khakassk Okrug lying to the west of Minusinsk.

Though the harvests of spring wheat are unreliable in this zone, the grain is excellent in all respects. It is the best of the whole Soviet Union, and is almost the best, in all respects, on the world market. The wheat harvests will necessarily find an outlet to command the best prices on the world market by being shipped through Aktyubinsk, Orsk, Akmolinsk and Pavlodar by way of the new railroad branch lines and main trunk line. The main wheat variety should be Gordeiforme 0189, Melyanopus 069, and Eritrospermum 0841 and 0341 being permissable. The existence here not only of unused lands but also of virgin lands affords some future possibilities for expansion of wheat growing (with sowings on hard soils mainly confined to hard wheat), but only with the greatest caution. There are numerous extensive solonetz tracts, occasionally gravelly and waterless as well, which offer only small probablility of successful cultivation even with all the advantages of mechanized socialist production. In view of this, careful preliminary investigation is necessary before selecting sites for large-scale grain sovkhozes.

For the immediate future, a considerable portion of the land area of this zone should continue to be the sphere of activity of the Skotovod and Ovtsevod trusts, with the organization of large-scale combines for beef cattle raising and sheep-raising for wool.

To maintain grain production, the agriculture of this zone demands for the cultivation of arable virgin and waste lands recourse to all methods of "dry farming".

Alongside of wheat, it will be necessary to permit the cultivation of the more drought-resistant proso millet, which has been



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displaced in the Ukraine, TsChO and other areas which are sufficiently favorable for more valuable crops; and to expand the growing of cultivated crops of sunflower (which is, however, apt to suffer on solonetz soils) and of cucurbits. It is also desirable to expand the sowings of curly seed flax and, as secondary crops, of cucurbits and mustard, as well as to experiment with other drought-resistant plants, such as chick-peas and safflower.

It is necessary here to become reconciled to the necessity of periodic bare fallow every three or four years as a method of coping with drought.

To strengthen the supply of forage for beef raising, especially with the reduction in the area of pastures and hayfields on virgin and waste lands, it will be necessary to sow more drought-resistant forage plants: yellow-flowered alfalfa, zhitnyak, (Triticum cristatum) and sweetclover, sudan grass and especially sorghum of the annuals for green forage, using only the early varieties, as well as for silage. Sowing of forage plants will also be of vital importance here as a means against wind erosion, which is one of the disadvantages of the local agriculture, owing to the frequent strong winds and the easily pulverized slightly-structured chestnut soils.

XII (8b) Extremely arid steppe with sandy, solonetz, light-colored chestnut and brown soils in the southern part of Slavgorod Okrug. Agriculture is extremely risky. All that has been said about the preceding zone also applies to the more favorable parts of this zone.

XII (9) The mountainous region of the Altay, Sayan and Kuznetsk Alatau includes: (a) the taiga (chern') of the Altay region, with gray forest soils, both the eastern and southern parts of the former Kuznetsk Okrug,



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the highland part of Oyrat AO, and the southern part of the former Biysk Okrug; (b) the high-mountainous taiga of Altay-Sayan type, with dark-colored, podzolic, swampy and stony soils, including the greater part of Oyrat AO, the eastern and southern mountainous parts of the former Minusinsk Okrug, and the mountainous western part of Khakass AO; (c) the Alpine rocky and glacier covered portion of the high mountains.

The great extent of the region on the horizontal plane, together with the great range of zonal conditions encountered at different altitudes make for an extreme diversity of natural circumstances.

The basic types of plant life which characterize the region are dependent mainly upon geographical location, elevation and the direction of the ridges. They are as follows: mixed evergreen-deciduous forests, birch forests (in the east) or fir-aspen forests, with occasional occurrence of linden (in the west) - "chernevyye" on the lower slopes of the mountains, mountain fir, cedar and spruce or (in the east) deciduous forests, sometimes thinning out at higher levels into park-like taiga, and still higher into magnificent Alpine meadows. On the top slopes there is Alpine tundra, passing over still higher into the "bare areas" of XII (9c) even lacking grasses and moss.

These open spaces, broken up now and then by forests and by burned-out areas ("gari") so common here, bear a very vigorously proliferating meadow vegetation. Some of the useful plants (such as the male fern, badan grass, and others) may be of industrial value even in their uncultivated state.

No clear and accurate picture of the climate of this great mountainous area can possibly be given by any generally applicable averages. Approximate values for the locations at lower levels, more favorable



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to the development of agriculture, might be given as follows: length of the frost-free period, 110-100 days, or even shorter, aggregate temperature for the growing season about 1600-1800 degrees, mean July temperature about 20-21 degrees, mean January temperature about minus 15 degrees. Summer is very humid, and snowfall in winter is heavy. There is an exceptionally great difference in total precipitation, however, between the northwestern sections, the slopes that intersect them, and the southeastern sections.

The soil cover varies sharply, disclosing a vertical zonality, both with respect to the depth of the arable layer, ranging from the rock and stony gravel of the upper ranges to the thick layers of soil in the valleys, and to fertility, running from the leached, poorly developed, skeletal and peaty soils of the Alpine belts to the gray forest soils of the foothills. The alluvial soils of the valleys are distinguished by the very considerable depth of the humus layers. In general this depth tends to increase across the zone, from north to south.

The economic importance of the region consists above all in its colossal mineral wealth. The larger part of this wealth has already been prospected and is either presently being exploited or will be in the immediate future.

This is particularly true of the more accessible spurs of the Altay and Sayan, which are closer to communication routes and possess exceedingly rich deposits of coal and ores, gigantic metallurgical and coal-mining industries are developing based on those deposits.

The inaccessible, remote and almost unprospected high mountainous part of this region, besides having great wealth in deposits of nonferrous metals and other minerals related to those of the preceding more assimilable subregion by virtue of the immense prospects for supply-



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ing it with electric power from installations on the upper reaches of the Yenisey and along the Chulim, Mana, Katun, Charysh, Biya and other rivers.

The agriculture of the region should primarily supply the large number of immense industrial centers with vegetables, fresh and fermented milk dairy products, fresh meat, and so forth, particularly in the northwestern Kuznetsk subregion "a", which is the center of concentration of the metallurgical industry.

It is clear from the data given above on the soil and climatic characteristics of the region, that cereals can be cultivated with entire assurance in the low-lying belts of this mountainous region, in spite of the relatively short growing season. This assurance is due to the very considerable aggregate temperature, high temperatures in summer, and adequate moisture. Basic cereal crops should be spring wheat and oats, the latter for the horse-breeding areas and for feeding horses used in mining and lumbering. Although barley is exposed to some danger of damage by the Swedish fly, it may still occupy a prominent place among the secondary crops in some localities. In the more humid sections of the western foothills the better grades of highly productive coarse-grained barley can be grown, both to supply the local breweries and to fatten hogs. It remains the basic grain crop in the high mountains. The high snowfall and the relatively mild winters sufficiently assure a favorable wintering period for winter rye, which may also be used in locations more favored in this respect as a regular spring stand-by crop, though only on the scale of a secondary crop. On the upper levels of the mountains, the importance of rye as compared with wheat increases with the elevation, where it tends to be grown as winter rye instead of spring rye, especially in the eastern part of the region.

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But beyond all question the agriculture of this mountainous region should be based on full and rational use of the extremely rich natural hayfields and pastures. The development of any desired branch of animal husbandry is possible on this base: horse-breeding, dairy farming, small-animal breeding, and even mountain-stag (maral) breeding on the Alpine meadow pastures in the west and large-scale breeding of northern reindeer on the Alpine tundras of the eastern Sayan mountains.

The relatively mild conditions during the wintering period makes it safely possible to grow late red clover and timothy in the northern and western foothills of the Altay. Potatoes and turnips (Brassica campestris rapifera) may be used everywhere as succulent winter feeds.

The industrialization of the region will supply immense quantities of electric power to agriculture, furnish mineral fertilizers and establish a large number of large scale agricultural enterprises to process great quantities of raw materials of vegetable and animal origin. Conditions in the region advance the possibility of extensive production of industrial crops, which in the future, with the increased supply of electric power, will obviously take a much more important place than the grain crops. They should include fiber flax, potatoes and hemp. Hemp can be grown with the aid of the mineral fertilizers obtained by the processing of coal and can also widely utilize the vast amounts of manure available in this cattle breeding area, manure which is hardly used at present either for fertilizer or for fuel. Thus, if hemp growing is organized in this manner, using only the early varieties, there are also prospects of rapidly passing to field cultivation of vegetables by utilizing the local fertilizers.

XII (10) The Tomsk-Achinsk region of open taiga and subtaiga, embracing



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the northern part of the former Achinsk Okrug and the southeastern part of Tomsk Okrug. The region is one of sharp transition from the "black" (fir-cedar-spruce), swampy West Siberian taiga, through the swampy (birch-aspen) and dry-valley, extensively cleared and plowed-up open taiga (mainly birch) and wooded steppe of the copse type, to the high Kuznetsk taiga. On the sands along the rivers are pine woods. The swamps in the north contain principally sedges, and more rarely sphagum. On the numerous burned-out areas ("gari") and extensive cleared tracts taiga meadows flourish. There are flooded meadows on the flood-plains. Owing to soil and climatic conditions, the boundary of the region in the low-lying swampy taiga also represents, for the present, the northern boundary of agricultural cultivation. At the same time the slightly elevated, semi-rolling relief of the southern portion, together with the higher aggregate temperature, furnish the requisite conditions for very intensive development of field agriculture.

The frost-free period here is about 105 days, but the aggregate temperature during the growing season amounts to about 1800 degrees. The mean monthly temperature is 18.5 to 19.0 degrees for July and minus 18 to minus 20 degrees for January. The summer is humid and the winter is snowy, favorably distinguishing the region from the neighboring wooded steppe regions, which are drier and have less snow. In the same way the temperature conditions of the region are more favorable than in the adjoining taiga region of the East Siberian plateau. The bog-podzolic soils of the north of the region change further south into argillaceous and sandy-loamy podzols, into fertile forest loams and degraded chernozems, and, in places in the south, into chernozems and complex soils. Along the rivers are sandy and meadow soils.

There are thick seams of brown coal in the region, which have

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been exploited for a long time (the Anzhersk, Sudzhensk and other pits). Lumbering is widespread. Both these factors open up extremely broad prospects in connection with the existence of an extensive network of railroad and river routes.

The industrial character and the natural conditions of this region, with its short growing season, indicate the primary necessity for developing vegetable growing and dairy farming.

The relatively low general quality of the forage grounds on the northern taiga, with its prevalent moss cover, and the considerable proportion of cultivated land in the southern section, compel attention to be turned to the necessity of organizing forage production on cultivated areas. The conditions of the wintering period here are sufficient to assure the successful use of clover. Late red clover with timothy and vetch-oat mixtures should be used for hay. Sowings of oats, barley, and vetch-oat mixtures together with stubble and cull vegetables should be used for silage. Among the root-crops, potatoes, and turnips (Brassica campestris rapifera and Brassica napus rapifera) should be widely grown. Winter rye, oats, vetch-oat mixtures and clover should be used for succulent green fattening rations.

The humid, moderately warm summer with its uniform distribution of heat and precipitation furnish very favorable conditions for the development of fiber flax culture. The industrialization of the region, which will remedy the labor shortage, which up to now has been chronic, will unquestionably result in sowings of this labor-absorbing crop on a very broad scale. Conditions are also good for large-scale potato growing for industrial purposes. In the south of the region, early varieties of makhorka tobacco can be grown.

Among the grain crops, spring wheat has the best chances of



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success in the southern part of the region, at the same time that the barley is receding northwards in its essential importance towards the northern boundary of agricultural cultivation. These two cereals generally serve as supplementary grain crops for the region, while winter rye and oats are more necessary here and remain as the basic crops for general dissemination. Special attention must be devoted to the development of pea sowings, and special facilities for protecting and drying the harvest should be arranged on the large-scale farms, so as to avoid spoilage by the autumn rains which are abundant here. Buckwheat may be grown on the scale of a subordinate, secondary crop. Widespread experimentation to clarify the possibility of growing winter wheat in some localities here is of very great interest.

The abundant spring rainfall considerably delays sowing, and for this reason the region requires the earliest possible varieties.

XII (11) The Achinsk, Chulim-Yenisey and eastern Minusinsk wooded steppe (subregion "a", embracing the southeastern part of the former Achinsk Okrug, the extreme southwestern part of Krasnoyarsk Okrug and the eastern part of Minusinsk Okrug) and the foothill belt of the Khakas wooded steppe (subregion "b", embracing the western part of Khakas AO).

The types of soils and vegetation that characterize the different parts of this region vary sharply under the influence of the strongly developed orographic systems of the Altay and Sayan. Besides this, the very considerable geographic extension of the region operates in the same direction.

Part "a" has progressed far in the transition towards the steppe, and still retains only occasionally thinned-out birch copses, with an occasional addition of aspen, and pine, and still more infrequently, of



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other species. There is a strong penetration of grass-steppe flora. The dominant cover of the foothill subregion "b" is larch, with occasional infiltration of tall, light, park-like birches. There are also to be found tall, mixed grasses.

There are pine woods on sands, lush flood-meadows, and generally a large proportion of plowed land.

In connection with the generally elevated relief in a southerly direction, the climatic conditions are fairly uniform throughout the region. The length of the frost-free period is 100-105 days; the aggregate temperature during the growing season is about 1800 degrees, with mean temperatures about 20 degrees for July and about minus 16 degrees for January. The summer is fairly humid, but insufficiently so in the interior of the region. There is little snow in the winter. The northern, Achinsk, and foothill parts of the region are considerably better situated in the latter respect.

The soil cover of the region is composed principally of complex chernozems: degraded, rich, ordinary, and common, which are greatly diversified from place to place in close dependence on the local topography. In the foothills and highlands the chernozems tend to pass over into soils of grey, forest type and into podzolic soils.

The region is located in a zone of rapidly expanding mining industry. Its intermediate position between the steppe and the mountainous taiga defines it as standing on the frontier of agricultural cultivation at its periphery and as possessing great possibilities for the development of cereal growing in the interior. In connection with this, the direction of agriculture may vary from predominantly animal husbandry in the foothills, and on the flood-meadows and lowland meadows, to a grain economy on the chernozems, together with the organization of



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vegetable-growing, cucurbit growing, and fresh milk dairying centers in the mining, coal and metallurgical districts.

Intensive development of animal husbandry demands sweeping organization of forage production on cultivated sites as well as the utilization of natural hayfields and pastures. For hay the more winter-hardy varieties may be sown here: American couch grass, beardless brome grass, hybrid alfalfa and Siberian esparsette. Sunflower, sweetclover, vetch-oat mixtures and, in the more favorable localities, corn may be used for silage. Of the root crops, potatoes, turnips (Brassica campestris rapifera and Brassica napus rapifera) may be used. For succulent green fattening rations, winter rye, oats, vetch-oat mixtures, sweetclover and corn may be used.

For grain this is predominantly a spring wheat region. Oats should be grown as a supplementary crop, with winter rye in the areas of more abundant snow. But this general distribution of grain crops is of course subject to change in accordance with both horizontal and vertical natural zoning. Among the secondary crops, in the north of the region, barley may be disseminated to a considerable extent and yields good forage, groats and brewer's malt there. The legumes should be widely distributed, especially early peas, for which conditions are entirely favorable. Spring rye, which is drought resistant and not particular as to soil may be grown as a subordinate secondary crop, as local conditions suggest. In view of the sandy soils, buckwheat may also be so grown. The short growing season compels the use of the earlier grain varieties. Definitive varieties for this region have not yet been established. Among the competing candidates we find: for wheat, Leda for the north, Mil'turum 0321 and Gordeiforme 010 for the south, for oats, Zolotoy Dozhd' and Pobeditel'-Dippe, and for barley,



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Professor Viner.

In this region, as in the preceding one, sowings of fiber flax may be expanded, especially in the north, on the Achinsk wooded steppe, and in the more humid foothill section further to the south. Great attention must be paid to this crop and to hemp, taking advantage of the possibility of great supplies of electric power and of mechanizing agriculture with the development of the electrification and industrialization of the region, and taking advantage also of the possibility of obtaining mineral fertilizers and of using the almost unutilized manures from the local animal husbandry for hemp.

Other industrial crops may also be extensively grown here, such as potatoes, makhorka tobacco, yellow tabaccos, white mustard, and so on.

XII (12) The Minusinsk steppes include the following: (a) the Chulim-Yenisey and Tubinsk, with ordinary chernozems, embracing the northeastern part of the Khakas AO and the northwestern part of the former Minusinsk Okrug; and the Abakan steppe (b) with dark chestnut soils, and (c) with southern chernozems (embracing the eastern part of Khakas AO and the southwestern part of the former Minusinsk Okrug). The smooth rolling and hilly feathergrass steppes, with an abundance of mugwort on the Chulim-Yenisey steppe and of xerophytes on the Abakan, have been considerably plowed up.

The Minusinsk steppes are isolated by a series of mountain chains from the other parts of the kray, and have a highly continental climate. Conditions, especially in winter, closely resemble those in the neighboring regions of the East Siberian Kray. The frost-free period is about 105-115 days; the aggregate temperature during the growing season amounts to 1900-2000 degrees; the mean temperatures are as high as 20.5



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degrees (in Minusinsk) in July, and about minus 20 degrees in January. The central and southern parts of the region are distinguished by the highest degree of continental climate. These parts receive the greatest amount of heat during the summer and have the lowest temperatures in the winter.

Summer rainfall is low, amounting to 140-155 millimeters for the May-July quarter, about as much as, for instance, in Orenburg. The insufficiency of precipitation is particularly felt during the winter. The depth of the snow cover is March is 10-12 centimeters. Prolonged and strong winds blow in the autumn and early spring, causing strong wind erosion.

To the basic soil types mentioned above we must add solonetz and solonchak, which are present mainly on the low-lying areas in the southern half of the region, and also the extensive areas of sands along the Abakan, as well as the alluvial and bog soils along the river valleys.

It is a region of rapidly expanding mining industry, based on the excellent combination in a single locality of coal, iron and copper ores, and so forth.

To meet the requirements of the industrial centers for vegetables, fruits and berries, and cucurbits, as well as for dairy products, the agriculture of the region can expand in two directions: animal husbandry and grain production.

As is apparent from the data on the general characteristics of the natural conditions, the general situation is not favorable for the development of a stable field cultivation. In many places on the steppe, especially on the drier Abakan steppe, its development would unconditionally require provision for a water supply. But there are great possibilities for this and great attention should be devoted to the irri-



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gation of the region. The valuable lands along the Abakan should be used for this purpose in first place, especially the areas of the Bidzhunsk and Sabinsk steppes, where soil conditions are most suitable for irrigated agriculture.

The possibility of growing winter cereal crops is excluded by the light snowfall, the low temperatures and the wind erosion in winter, and only the most cold-resistant forms of the forage perennials can be used here.

At the same time the high summer temperatures, in spite of the shortness of the growing season, assure the success of wheat, which can be the primary crop here, and even corn, if the earliest varieties are sown. Corn can serve here as one of the subordinate crops. In the group of grain crops, oats may be a supplementary crop to wheat, but the cultivation of winter rye should be continued only in areas best assured of adequate accumulations of snow. Among the crops more restricted in area sown, the legumes and groats should be included, with peas in first place. The early maturing soyotskoye proso millet is a promising and long-cultivated crop for less favorable conditions.

Definitive varieties of grain for this region have not yet been established. For wheat, the most productive has proved to be Lyutestsens 0479, though it is somewhat apt to crumble, and can be provisionally used only on unmechanized farms. Competing with this variety, from among the soft wheats are Mil'turum 0321, and, for irrigated land, Kitchener. Of the hard wheats, Gordeiforme 010 gives the best results. For corn, the local early variety Minusinsk may be used.

The forage crops for the region may be noted as follows: for hay- - American couch grass, smooth brome grass, yellow-flowered alfalfa, Siberian esparsette, zhitnvak (Triticum cristatum) and Siberian wild rye; for silage-- corn, sunflower, proso millet, spring rye with oats,

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and sweetclover; for root and tuber crops -- for extensive sowings it is more promising to use potatoes and turnips (Brassica campestris rapifera) for the time being; for succulent green fattening rations -- vetch-oat mixtures, spring rye, spring rye with oats, corn, and proso millet.

In locations with more favorable humidity, a considerable area may be planted to sugar beet, when sugar bases are organized in East Siberia.

Advantage may be taken of the hot summer to grow for industrial purposes oil flax, and the earliest varieties of sunflower and makhorka tobacco. There are also favorable locations for growing yellow tabaccos as well. In the regions of animal husbandry, the manures may be successfully used to expand the field cultivation of hemp.

There are great possibilities for the expansion of cucurbit growing on the scale necessary to supply many regions and points of the East Siberian and West Siberian Krays.

## XIII THE KAZAKH ASSR, THE KIRGIZ ASSR AND KARAKALPAKIYA

The direction of agriculture and of the specialization of field crops is exceedingly variegated, in consequence of the peculiar natural conditions and of the influence of varied socio-economic factors in the individual sections of the vast territory of Kazakhstan and Kirgizstan, which stretches over 40 degrees of longitude from west to east, and from north to south over 16 degrees of latitude, from lowlands below sea-level to ridges with crests having elevations of 5500 meters and over.

The extreme north of Kazakhstan, on its wooded steppe, chernozem portion, is located on the West Siberian lowlands. Precipitation is relatively adequate, and the summers are not so hot as in the more southern areas, so that it usually does not suffer from drought, and

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can produce rather good reliable crops of spring wheat and forages.

Further to the south, the arid steppe zone of Kazakhstan on chernozem and dark chestnut soils represents an exceedingly extensive expanse of still only slightly utilized lands, especially suitable for mechanized agriculture. It is, however, distinguished by insufficient precipitation, especially in its southern part, and suffers from severe droughts, which hamper the cultivation of forages, except in their drought-resistant forms and also render the wheat harvests uncertain, though this grain is here of excellent quality. The high summer temperatures and the long growing season make the successful cultivation of sunflower and oil flax, as oil crops, possible in both the chernozem and dark chestnut sections of the steppe zone.

Central Kazakhstan has an exceptionally arid climate and hot summers, with light chestnut and complex saline soils, so that unirrigated agriculture is almost impossible except in isolated spots. It consists to a considerable extent of grass-mugwort semi-desert, passing over in the south to mugwort-alkaline desert on grey, sandy, and solonetz soils.

Finally, southern Kazakhstan consists of desert and semi-desert wastes in the north, useful only for cattle railing, while in the south it includes the immense mountain ridges of the Tarbagatay, the Dzhungarian Alatau and the Tien Shan. In southern Kazakhstan and Kirgizstan, under the influence of the latter, belts of vertical zones are found, ranging from Alpine to sub-Alpine, below which stretch is a belt of adequately watered forest and zones of highland and foothills with native-style (bogara) unirrigated farming, down to the extremely arid mountain base country and lowlands, with grey earths, solonetz, and complex soils of Turkestan and Chu-Balkhash. This



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mountain base country, and valley area, however, is of exceptional interest not only for Kazakhstan and Kirgizstan, but for the Soviet Union as a whole, since great rivers and montain torrents, flowing from the bordering mountain systems on the south, offer immense possibilities for irrigation. Since summer is hot and the growing season is long, cotton can be grown in the southern irrigated sections of the foothill and mountain base country, while valuable bast-fiber crops, southern oil crops, forage crops, and, in places, even rice, can be grown throughout the region.

The higher foothill and upland portions, which have a large amount of precipitation but less heat and a shorter growing season are entirely suitable for growing cereal crops without irrigation in the native (bogara) style.

Together with great plans for agriculture arising from the natural conditions in Kazakhstan and Kirgizstan, the development of industry is proceeding at a rapid pace, with especially in the expansion of its power resources. The tasks for agriculture, and more particularly for field cultivation, should be set to take account of the availability of this power.

Great prospects for the mechanization and industrialization of agriculture, and of the processing of agricultural products, are offered by the expanding coal-mining center of Karaganda (and Ekibastus) in the center of Kazakhstan, which is the third largest in the Soviet Union, by the exceedingly large water power ("white coal") from the mountain rivers of the Altay in the east and the T'ien Shan system in the south, by the oilfields of Emba-Dossor in the west, and, finally, by the prospects of utilizing wind power ("blue coal") on the broad open expanses.



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Other centers of expanding industry, such as Kounrad, Ridder, Karsakpay and other areas of non-ferrous mining, et cetera, besides Karaganda, make huge demands on agriculture and, particularly, on farming to supply its working population with agricultural products in general and, especially, with perishable vegetable products and fresh milk dairy products (and also to supply the necessary forage for the dairy industry.

The existence of phosphorite deposits in the Aktyubinsk Rayon of Kazakhstan assures the supply of phosphate fertilizers, not only for Kazakhstan, but for the whole Asiatic part of the Soviet Union and can be of great help in raising the productivity of wheat and forage cultivation (as well as beets) on the wooded steppe and the chernozem steppe, and also of the valuable crops in the south of the Kazakh republic and in Kirgizstan.

The possibility of a mighty development of the agriculture of these republics depends to an exceptional degree on the maximum possible realization of irrigation projects, especially in the southern and central portions with an annual precipitation of 100-300 millimeters.

In southern Kazakhstan and Kirgizstan the following are of particular significance in this connection: expansion of the irrigated acreage in the downstream areas of the Amu-Dar'ya River and the areas to be watered by the Syr-Dar'ya and its tributaries (the Chirchik, et cetera), which is of immense importance for the increase of cotton production; the irrigation of the Chu Valley (for kenaf, kendyr, rice, sugar beet and, in places cotton and other crops); the expansion of the acreage irrigated by the Talas River (for cotton); the irrigation of the valleys of the Ili, Kartal, Charyn, Chilik and other tributaries of the Ili (for rice and the new bast fiber crops); and the construction of irrigation systems fed by the mountain tributaries of the Irtysh



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(the Uba, Kurchum, et cetera). Unfortunately, the possibilities for irrigating the semi-desert Central Kazakhstan are more limited, since most of the rivers rise elsewhere than in the high mountains and are of steppe character, losing themselves in the sands (the Emba, Uil, Sagiz, Sary-su, Nura, Tokrau, et cetera).

However, even these may be utilized for irrigating quite considerable tracts either by constructing reservoirs to impound their waters or by using their spring waters for single watering inundations (Liman method). This makes it possible to strengthen the forage base by sowing grasses on the watered liman areas, to solve the vegetable and dairy problems in the vicinity of the newly arising heavily populated industrial centers (Karaganda), and to obtain promising yields of grain crops where irrigation is provided for large tracts. The Ural-Kushumsk problem is especially significant in this connection, for its solution would make it possible to irrigate hundreds of thousands of hectares in the arid steppes of the former Ural Okrug with the waters of the Ural River.

Kazakhstan is included within the sphere of influence of the immense Ural-Kuznetsk Combine, and together with Kirgizia constitutes the principal object of the functioning of the Turksib.

The Ural-Kuznetsk Combine, with its mighty development of industry and the demand from the growing major centers of industrial population, set before Kazakhstan the task of supplying meat, animal and vegetable fats and oils, and also, to some extent, grain. The projected Siberian super-trunk-line can provide an outlet for the export of high-grade Kazakhstan wheat. The Turkestan-Siberia trunk line is in turn charged with the function of relieving the cotton areas of Central Asia and southern Kazakhstan from the necessity of growing their own wheat by



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making available to them the spring wheat produced in its own areas, especially via the recently planned construction of the Kazakhstan branch railroad lines.

In the last analysis, under the complex influences of special economic tasks and activities and of natural conditions, the following are the prospects of agricultural specialization for their separate zones of Kazakhstan and Kirgizstan.

The wooded-steppe chernozem belt nearest to the Ural-Kuzbas and the Siberian trunk-line should be the basic zone of butter and milk dairy farming (with parallel strengthening of the production of spring wheat and all forages). The production of dairy products will also be the base of the agriculture of the upland regions, and will be a supplementary branch on the irrigated lands (based here on alfalfa as a component of the crop rotations of the leading industrial crops).

The belt of southern chernozem and partly dark chestnut steppe should be devoted mainly to raising high-grade wheat to supply Central Asia and possibly for export. Here too the production of oil crops (sunflower and oil flax) should be concentrated. In the southern part of the zone the cultivation of cereal and oil crops should be associated with animal husbandry for meat.

For the immediate future, the extremely arid central part of Kazakhstan should follow its present pattern of animal husbandry and sheep-raising for meat and wool, based on the native forage grounds, supplemented as far as possible by sowings of drought-resistant forages (especially near the rising industrial centers), with measures for taking advantage of all possibilities for irrigation. The unirrigated native-style (bogara) farming that is possible in places should be based on prose millet and the most drought-resistant varieties of wheat.



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Finally, southern Kazakhstan by the expansion of irrigated acreage in every possible way, should become one of the principal centers in the Soviet Union for the production of the southern industrial crops: cotton, the new bast fiber crops, the southern oil crops and rice, together with alfalfa, on irrigated lands, while the production of wheat should be mainly confined to land suitable to native-style (bogara) unirrigated farming, especially in the upland country, and broad possibilities for the cultivation of the opium poppy and of the rubber-yielding plants (tau-saghyz and kok-saghyz). In accordance i with what has been pointed out above, the major demands of farming in these republics during the next few years appear to be as follows:

(1) Reclamation and cultivation of as much land as possible; however, in northern Kazakhstan, only in those regions that are not too arid and allow more or less reliable unirrigated production of spring wheat, while in the south these operations should mainly consist of the organization of extensive irrigation systems for growing cotton and the valuable industrial crops.

(2) Expansion of wheat sowings and advance of the sunflower areas into the southern wooded steppe and chernozem steppe, and the investigation and development of the best methods of dry farming and of drought resistant varieties, including the forages.

(3) Expansion of cotton sowings with the extension of irrigation, and reduction to the greatest possible extent of grain sowings on irrigated cotton lands, and also the conversion to cotton-growing of lands in the low-lying sections of the foothills, now used for native-style (bogara) unirrigated agriculture.

(4) Improvement of the necessary acreage for the large-scale development of rice growing in the valleys of the Ili and Chu and in other suitable areas.



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(5) Advance of the industrial crops into the suitable areas of southern Kazakhstan and Kirgizia: opium poppy, kenaf, kendyr, abutilon, sesame, peanut, fuller's teasel, castor plant, and the rubber-yielding plants (tau-saghyz, kok-saghyz, and chondrilla).

(6) Use of lands to expand the cultivation of grain in the foothill regions of southern Kazakhstan and Kirgizia which are unsuitable for industrial crops by reason of the short frost-free period or the insufficient moisture.

We pass now to the separate natural regions, and shall go into greater detail on southern Kazakhstan and Kirgizstan, while only briefly touching on the northern chernozem regions, since their natural and economic conditions duplicate those we have already described in our discussion of the corresponding areas of the trans-Ural and Western Siberia.

XIII (1) The region of southern wooded steppe with ordinary, partly saline and leached chernozems in Kazakhstan comprising the northern part of the former Petropavlovsk Okrug. Since it is located between the region of southern wooded steppe in the Ural'skaya Oblast (XI 9b) and that in Western Siberia (XII 5), it resembles both of them in its natural conditions and in the characteristics of its farming. Its agriculture should be generally oriented towards grain-growing and butter and milk dairy farming, with spring wheat and the forages as the leading crops, oats as a supplementary crop at the lower altitudes, and winter rye, seed flax, potatoes and hemp as secondary crops.

The varieties of wheat should include Gordeiforme 010 and Tsezium 0111(as well as the beardless Mil'turum 0321). Oats should consist of Pobeda and Lokhovskiy varieties. Forage grasses should take in yellow-flowered and hybrid alfalfas, American couch grass, esparsette, and



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beardless brome grass, sweetclover for pasture, silage and green forage, also for green forage: winter rye, alfalfa, corn and proso millet, for silage, sunflower, corn and proso millet, forage squash and for succulent feed and silage.

The advance of sunflower of the earliest varieties is desirable such as Karlik (Dwarf) of the Steppe Station, which matures 10-14 days earlier than Saratov 169 and the new varieties of the Omsk and Saratov selections.

In the crop rotations of this region special attention should be paid to the cultivated (sunflower), and also in a few places, to bare fallow before wheat, mainly as a method of weed control. In the milk and butter dairy sovkhozes and kolkhozes, forage production should be the center of gravity, with special attention to silage crops and sowings of alfalfa with mixtures of couch grass and sweetclover. The last should also be grown by the grain sovkhozes of the region to increase fertility of leguminous grasses and to control weed growth, and, in the case of strongly depleted soils, to reestablish soil structure.

XIII (2) The arid steppe, with varied grasses, with southern chernozems comprising the northern part of the former Kustanay Okrug, the southern part of the former Petropavlovsk Okrug, and the northern part of Pavlodar Okrug. All that has been said about the arid southern-chernozem steppe of region XII (6) of Western Siberia is equally applicable here.

The Kokchetav Highlands XIII (2b) in the southern part of the former Petropavlovsk Okrug which are a part of this region, already belong to the "Kirgiz Fold Country" and have a somewhat higher precipitation than the surrounding steppe, but are covered to some extent by detritus and undeveloped soils growing with pine forests.

Varieties of spring wheat should include Gordeiforme 0189 and



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Cesium 0111, with Mil'turum 0321 being permissible. Among the supplementary crops, sowings of sunflower (Saratov 169) should be expanded by all possible means. Proso millet should have its place, especially on soils more sandy loam in character. Oats (which should be reduced) should include the more drought-resistant varieties such as Zolotoy Dozhd and Lokhovskiy varieties. Flax should be grown for oil.

The forage crops are less important than in the preceding region and may include yellow-flowered, hybrid and also blue Khiva alfalfas, American couch grass, brome grass, proso millet, and Sudan grass, sweetclover for pasture and green forage, corn, sorghum, sunflower and proso millet for silage, forage squash and watermelons, corn, proso millet, sweetclover and Sudan grass for green forage.

The general direction of agriculture should be given over to the growing of spring wheat, oil crops from sunflower and flax, and proso millet.

XIII (3) The southern very arid steppe with dark chestnut soils comprising the northern parts of the former Ural'skaya Okrug and Aktyubinsk Okrug, the southeastern part of Kustanay Okrug, the northern part of Akmolinsk Okrug, and the southern part of left bank region of Pavlodar Okrug, and also with light gray chestnut saline sandy loam and sandy soils of the right bank of the Irtysh in the former Pavlodar Okrug and Semipalatinsk Okrug. The natural conditions which have been described under Region XII (8) of Western Siberia apply here.

Because of the extreme aridity of the region (annual precipitation is 225-275 millimeters and precipitation for the May-July quarter is 100-129 millimeters) and unfavorable soils, farming is extremely unpromising and agricultural specialization for the time being should be along the lines of cattle and sheep-raising. This is particularly



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applicable to those parts of the region which are located in the former Akmolinsk Okrug to the south of the Ishim River and in the western part of the former Pavlodar Okrug, almost up to the southern boundary of the former Omsk Okrug, and, in part, along the right bank part of the Okrug in the especially arid part of the Kulunda, where the alkalinity of the soils is most unfavorable for farming.

In the event that sowings should be undertaken, it is necessary to give preference, as the leading crop, to spring wheat of the most drought-resistant varieties such as Eritrospermum 0841 and 0341 among the soft wheats and Gordeiforme 0189 and 0432 among the hard wheats (with Meiyanopus 069 ruled admissible), and also to proso millet. For secondary crops, oil flax, saffron, squash, watermelons, and sunflower may be grown. As forage crops there should be cultivated yellow-flowered, hybrid and Khiva alfalfas, zhitnyak (Triticum cristatum), Sudan grass and proso millet, with sorghum, Sudan grass and proso millet for silage, forage squash and watermelons for succulent forage and silage, and sweetclover for pastures.

XIII (3a) and XIII (4a) Farther to the southeast, in the southern part of Akmolinsk Okrug, in the former Karkaralinsk Okrug and Semipalatinsk Okrug, there is a region of elevated, hilly (sopochnyye) expanses with gravelly, chernozem-type dark and light chestnut soils, partly of coarse skeletal character. Although the aridity of this region is somewhat moderated on the more elevated portions, the gravelly nature of the soils and their frequent alkilinity do not represent favorable conditions for farming in these parts of the zone. In the lower parts of this hilly region the soils are of complex solonetz-light chestnut character, and the climate is even more arid



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than in the preceding region. Annual precipitation is less than 250 millimeters, of which 100-120 millimeters and less falls during the May-July quarter, with high summer temperatures (21-23 degrees) and low relative humidity (averaging 35-40 percent in June). Thus field cultivation involves exceedingly great risk.

However, notwithstanding all risks involved in farming, the development of mining in the hilly region (Karaganda, Ekibastus, Kounrad, et cetera) demands a considerable expansion of some branches of agriculture near the industrial centers (growing of vegetables, cucurbits and dairying) to supplement those field crops of the preceding region that can permissibly be raised here, such as the drought-resistant varieties of spring wheat, proso millet, zhitnyak (Triticum cristatum), and Sudan grass and sorghum for silage.

Until a more fundamental study of the hilly region is made with respect to the possibility and methods for a more stable field cultivation, the development of this branch, primarily for local consumption, will proceed in the first place on irrigated lands in the valleys of minor rivers - the Nura, Tokrau, and their tributaries.

For a long time to come, cattle and sheep-raising will retain their primary importance here.

XIII (4) The extremely arid, semi-desert, grass-mugwort steppe with light chestnut soils, and occasional patches of solonetz soils, in the southern parts of the former Ural, Aktyubinsk, Akmolinsk and Karkaralinsk Okrug, and the northern parts of Kzyl-Orda and Syrdar'ya Okrug. The extreme aridity of the climate, scanty precipitation, amounting annually to 150-225 millimeters, of which only 80-100 millimeters, on the average, fall in the May-July quarter, together with the extremely sharp drop even from these levels in some years, and hot summers (23-25 degrees in July), are causes of the very low relative humidity,



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the mean value of which is 33 to 40 percent for 1 p.m. in June. This is a region of beef cattle raising, and field crops can be grown only under irrigation.

In this connection, the realization of the Ural-Kushum irrigation project will be of tremendous significance for the region. This will make it possible to irrigate very substantial part of the former Ural Okrug, which in the first place should be used for growing forage and grain crops. Without irrigation proso millet is more promising and can be termed the leading crop. For spring wheat, the most drought-resistant varieties must be used: with irrigation Grekum 0289 and Eritrospermum 0841 thrive better than the others. Muskmelons, watermelons and abutilon should be included among the field crops of the forage plants, proso millet, sorghum, zhitnyak (Triticum cristatum), yellow-flowered alfalfa (and blue alfalfa on well-watered sites), and Sudan grass should be grown, with sorghum, proso millet, sweetclover and corn for silage.

XIII (5) The extremely arid, mugwort-halophyte semi-desert with solonetz, sandy light-chestnut and brown soils of the former Adayevs and Gur'yev okrugs, the southern parts of Ural and Kustanay okrugs, and the central parts of Kzylorda and Syrdar'ya okrugs. The mean precipitation during the May-July quarter is under 80 millimeters, summer temperatures are high (23-25 degrees) and relative humidity low (under 35 percent for 1 p.m. in June), so that unirrigated field cultivation is impossible.

Given the necessity for supplying the local enterprises with vegetables and forage for dairy farming, the development of the latter is possible with irrigation in conjunction with measures to prevent salt saturation (osoleniye). Good results may be obtained here in



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crops grown by the application of methods mentioned in connection with the preceding region, as has been shown by the experience of the Embaneft Trust near Gur'yev.

Southern Kazakhstan, which includes in its northern part immense desert expanses stretching away to the south and south-east, is, together with Kirgizia, under the influence of the Tarbagatay and Dzhungarian Alatau, and the T'ien Shan mountain systems, which is the reason for the great diversity of natural conditions within the territory. Schematically the territory may be divided into the following zones:

(1) Desert steppe, with elevations under 700-1200 meters above sea level.

(2) Arid steppe foothill zone, with elevations over 700-1200 meters and up to 1200-1700 meters above sea level.

(3) Meadow (wooded) steppe zone from 1200-1700 meters up to 2000-2200 meters above sea level.

(4) Sub-Alpine non-agricultural zone, from 2000-2200 meters to 2800-3000 meters above sea level.

(5) Alpine and snow non-agricultural zone, above 2800-3000 meters above sea level.

In the desert-steppe portion of southern Kazakhstan are included, besides the above described XIII(5):

XIII(11) The sandy desert expanse between the lower reaches of the Syr-Dar'ya and Amu-Dar'ya Rivers, between the Talas and Chu Rivers (Kizylkum, Muyun-kum), and also to the east and west of the downstream areas of the Ili River (Kurgan-kum), which correspond to the similar deserts of the Central Asian republics, and which, owing to the aridity and absence of water, offer no



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possibilities for agricultural cultivation and are suitable, in part, only for winter pastures. They include the greater part of Karakalpakiya, the former Kzyl-Orda and Syrdar'ya Okrugs and part of Alma-Ata Okrug. Only the wild rubber-yielding plant chondrilla can be grown here.

XIII(12) The low-hill, mugwort-halophyte desert steppe with gravelly and detrital gray-earths, frequently strongly gypsiferous (Bedpakdala, Ust'-Urt, etc.). It embraces a considerable part of the former Gur'yev, Kzyl-Orda and Syrdar'ya Okrugs. Agricultural cultivation is impossible.

XIII(6a) The extremely arid mugwort steppe with loamy gray-earths of the low foothills of the Tarbagatay, Dzhungarian Alatau, T'ien Shan and Kirgiz Alatau, embracing the former Semipalatinsk and Alma-Ata Okrugs, the southern part of Syr-Dar'ya Okrug and reaching into the Frunze Canton. The precipitation is very insignificant, and its annual value does not exceed 250 millimeters, frequently dropping to 150 millimeters, while the mean precipitation for the May-July quarter does not exceed 60 millimeters, with July temperatures varying from 22 to 25 degrees. Although to judge by soil conditions and relief alone, the whole region could be used for agriculture, its extreme aridity makes it exceptionally dependent on the utilization of irrigation. There is a considerable difference in latitude between different parts of the region, with consequent differences in the length of the frost-free period and the aggregate temperature. Winter wheat is the leading grain crop throughout the region, and it is possible to grow the earlier varieties of corn and soybeans. Forage crops are alfalfa, dzhugar, sweet clover, fodder squash and watermelon, and silage crops are

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sorghum, sunflower, and corn, while in the more southerly sections, the extensive adoption of various industrial crops is possible.

In those parts of the region situated on the northern and southern foothills of the Tarbagatay and on the upper parts of the Zaysan Depression (where irrigation from the Kal'dzhir and Kurchum Rivers is possible) sunflower, sugar beet and opium poppies can be grown as supplementary crops to winter wheat, and alfalfa among the forages. In the foothills of the Dzhungarian Alatau extending from Lake Alakul' to the Ili River, in addition to winter wheat, the following crops should be grown: sunflower, opium poppies, the early varieties of kenaf and fuller's teasel. These crops, while secondary in acreage, should be subject to vigorous expansion.

The part of the region at the base of the T'ien Shan and Kirgiz Alatau, adjacent to the right bank of the Ili River and stretching from Borokhudzir to the Ili settlement, as well as the Chokparskiy and Kurdayskiy rayons (and in part the Suzakskiy and Chayanskiy rayons) appear to have no agricultural prospects because of absence of water.

In the remainder of the Kirgiz Alatau and T'ien Shan base country, in the southern parts of Alma-Ata and Syrdar'ya okrugs and the northern part of Frunze Canton, there are great possibilities for industrial crops. The early varieties of cotton (only in the southern part) and kenaf should be grown as leading crops, with the opium poppy, sugar beet, soybean and kendyr as supplementary crops. The following may be grown as secondary in acreage, but subject nevertheless to vigorous expansion: castor plant, sesame, peanut, yellow tobacco and fuller's teasel.



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Cucurbits may be grown throughout the entire region. A conspicuous place should be given to the above indicated forage crops, especially alfalfa, as components in the crop rotations with the leading crops of cotton and bast fiber. Here should also be the center of dissemination of alfalfa (semirechenskaya) for local seed.

In general, specialization is toward the southern industrial forage and grain crops for cultivation on irrigated lands.

The Chustroy project is located in this region. Its construction will result in placing over 100,000 hectares under irrigation, and in the establishment of a major source of hydroelectric power. This will furnish the conditions for the organization of an exceedingly large-scale agricultural enterprise, with Kendyr as its leading product, followed to a limited extent by kenaf and hemp. Rice is also to be grown in the lower part of the flood-plain of the Chu River, irrigated by the discharged water, supported by alfalfa, soybeans and other crops, and the local processing of bast-fiber crops.

XIII (6b) The extremely arid desert steppe of the Syr-Dar'ya region of low foothills and the valley of the Syr-Dar'ya itself with loess-type gray-earths located in the former Syr-Dar'ya Okrug. This is a region of early cotton growing and native-style (bogara) unirrigated grain growing on the more elevated sites.

Irrigation is necessary in the less elevated sites on account of the exceedingly scanty precipitation (10-90 millimeters during the May-July quarter). On the higher sites, somewhat better moisture conditions allow sowing in the native (bogara) unirrigated style. The hot summer (25-29 degrees in July) in conjunction with a not very long frost-free period (over 170 days) allows only the earliest varieties of cotton to be grown. The region is suited for early cotton, southern bast-fiber and industrial crops, and, to some extent, grain crops.



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The basic crops are winter and spring wheat (principally grown in native (bogara) unirrigated style). Supplementary crops, which should be expanded by all possible measures at the expense of the grain crops, are early cotton and, south of the 44th parallel, kenaf, abutilon, sesame, together with proso millet and barley grown in native (bogara) unirrigated style. Secondary crops are the herb azhgon or Ammi copticum, (to be advanced onto the native (bogara) unirrigated sites), sunflower, soybean, muscatel sage in the Chimkent Rayon, muskmelon, watermelon and squash.

The forage crops on irrigated lands should have a very great significance, especially blue alfalfa, corn, soybeans, dzhugar, fodder squash, watermelon and sweetclover.

XIII (6c) The delta of the Amu-Dar'ya (in Karakalpakiya) on alluvial clay and sometimes mineralized detritus (gray-earth and primitive soils). The agriculture of Karakalpakiya is principally an irrigated agriculture, concentrated exclusively on the delta and the lower reaches of the Amu-Dar'ya. The rearrangement of the existing irrigation systems and the construction of new ones would make a major expansion of cultivated acreage possible by several hundred thousand hectares. Climatic conditions are similar to those in the preceding zone, but with a hotter summer and a long frost-free period (up to 200 days), which circumstances make it possible to grow the early American varieties of cotton. Cotton should be the leading crop, with winter and spring wheat temporarily admissible on irrigated lands, and continued on liman lands, because of the difficulty of supplying this region with outside grain, due to its remoteness from convenient communication routes.



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Kendyr is a supplementary crop which should be expanded (there are also considerable amounts of it growing wild.) Secondary crops are sesame, muskmelon, watermelon and pumpkin, together with sorghum and irrigated barley and liman-grown barley among the grains. These barley crops may temporarily be continued. Forage crops which may be grown on watered lands are: blue alfalfa, dzhugar, forage cucurbits and sweetclover. In the Chimbay region, is the center of alfalfa growing for seed.

XIII (6d) Desert plains with alkalized, argillaceous or sandy alluvial detritus (gray-earths) and low foothills with loess-type soils in the extreme southern part of the former Syr-Dar'ya Okrug, nearest to Tashkentskiy Rayon. The extreme aridity of the climate (15-50 millimeters of rainfall during the May-July quarter), a hot summer (with mean July temperatures upwards of 26 degrees) and the length of the frost-free period (over 190 days) combine to make this a typical region for the development of cotton-growing, principally with irrigation. The basic crops are irrigated cotton and blue irrigated alfalfa. Supplementary crops are cotton grown in native (bogara) unirrigated style, peanuts, soybeans, muskmelon, unirrigated yellow alfalfa, unirrigated sulla, unirrigated small-grained lentils, spring wheat and unirrigated barley, the mash bean (Phaseolus mungo), and rice (which latter is subject to reduction). Secondary crops are unirrigated oil flax, unirrigated saffron, watermelon, gourds, an irrigated clover (Trifolium resupinatum) and irrigated lobelia. Of the plants growing wild wormseed is important for santonin.

XIII (7) The river and lake floodplain lowlands of Dzhetys, on alluvial complex soils, meadow soils, meadow-solonchak soils, meadow-



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bog soils and gray-earths, are distributed over various places: in the former Syr-Dar'ya Okrug along the Chu and Talas rivers, in the former Alma-Ata Okrug, on the downstream areas along the Ili River and south of the city of Dzharkent and along the other rivers emptying into Lake Balkhash, in Semipalatinsk Okrug, around Lake Zaisan. The valley of the downstream portion of the Syr-Dar'ya, in the former Kzyl-Orda Okrug, also belongs to this region.

Ground-water is usually near the surface throughout all these expanses, and in some places the ground water issues from the surface, which is sometimes inundated to from either a "tugai" river of lake valleys with reed marshes, damp and solonchak meadows, overgrown with willows, eleagnus and other brushwood plants, and also with meadow vegetation, or else "sazy" mountain base plains, also with ground water close to the surface, and occupied, depending on the degree of moisture, by thickets of a certain grass (Stipa splendens), reeds or meadows.

Climatic conditions in this region depend on the latitude of these expanses. There is naturally a very considerable difference between Lake Zaisan in the north and the Auliyeata River in the south, especially in temperature, but as a general rule precipitation is scanty throughout (60-80 millimeters during the May-July quarter) and summers are moderately hot (with mean July temperatures 22-24 degrees). However, the closeness of ground water to the surface in many places makes it possible to raise unirrigated crops successfully.

Where irrigation is provided, a considerable part of this region should be specialized to rice, kendyr and kenaf. Vigorous development of rice growing here is necessary in order to release for cotton growing the irrigated lands eminently suited for it of the more



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southerly Central Asian cotton areas, that are still occupied by rice.

It is, however, also necessary to bear in mind that the greater part of the Dzhetis flood-plain regions, with ground water close to the surface, are strongly alkaline in places and thus cannot be used for cotton in that condition, until properly improved. Moreover, with the existing varieties and under the existing temperature conditions, the growing of cotton (early varieties) is possible only in the southernmost parts of the region.

Rice is moreover a crop that is relatively little affected by alkilinity of the soil, and a proper system of drainage outlets can serve to dealkilize and thus reclaim new lands now under thickets of willow and reeds in the river valleys of this region. The culture of Vendyr, of which there are thickets growing wild here, is advisable on the less alkiline and less waterlogged sections. This crop may be sown on lands unsuitable, for one reason or another, for irrigation necessary for rice growing, and even without watering if ground water is close to the surface.

Kenaf also thrives on non-alkaline soils.

The forage crops (alfalfa and soybeans) and the grain crops, varying according to the locality, should be introduced into the crop rotations of all these crops, wherever the sites are appropriate by reason of soil and water conditions.

The environs of Lake Zaysan have only scanty precipitation (about 200 millimeters annually) and require irrigation. This is possible with the aid of tributaries of the Irtysh, the Kal'dzhir and Kurchum rivers. In this northernmost subregion the leading crop is winter wheat. Supplementary crops are the opium poppy, cucurbits, and forage crops (alfalfa and the earlier varieties of sorghum under



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irrigation). As secondary crops, subject however to vigorous expansion, the early varieties of soybean, rice, sunflower and Kendyr may be grown.

In the subregion extending from Lake Alakul' to the Ili River, winter wheat is the leading crop. Rice is a supplementary crop. Soybean, Kendyr and kenaf are subject to dissemination.

In the more southerly flood-plain valley fo the Ili, Karatal, Chu and Talas rivers, the leading crops are rice (except in the Talas valley), kendyr, kenaf, and cotton (only the early varieties, along the Chu River from Karabulak to Il'insk settlement, along the Talas River, and in the Dzharkent area). Supplementary crops include winter wheat, the forages alfalfa and dzhugar under irrigation, sugar beet, castor plant, and cucurbits. Secondary crops should consist of the soybean, fuller's teasel, and yellow tobacco.

Special attention to rice growing should be given in the flood-plains of the Ili and Karatal rivers (in Kastekskiy and Balkhashskiy rayons), and also of the Charyn and Chilik rivers (in Kegenskiy, Chiliksskiy and Enbekshinskiy rayons).

The present very considerable rice acreage may be supplemented by adding new extensive tracts. Besides the great importance of this region (together with the Far Eastern region) in expanding the total rice production of the Soviet Union, rice will also play a great part in improving these alkaline lands, which are also sandy in places, and making them subsequently available for other more valuable crops. Sowings of rice on lands subject to flooding and discharge waters serve to de-alkalize the soils, but result in silting on the more sandy sites.

Kendyr may be intertilled with rice, especially on the first and second terraces of the Ili and Karatal rivers, but also on the level



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expanses of the delta of the Ili and its branches except for the shore belt around Lake Balkhash, which is distinguished by high alkalinity.

XIII (8) Within the confines of the arid-steppe and meadow-steppe belts of the foothills of the Dzhungarian Alatau and the T'ien Shan mountain system, in the former Alma-Ata, Frunze, Dzhellabad and Syr-dar'ya okrugs, there are located: (1) the mugwort-grass and feather-grass steppes with loamy chestnut soils, frequently gravelly and detrital, located on the less elevated portion of the foothills (with altitudes up to 1200-1700 meters) in the dry steppe belt. (2) the meadow steppes in the higher meadow-wooded-steppe belt of the foothills, with thickets of steppe brush (and woods) on the mountain chernozems of ordinary, thick and degraded, loamy or gravelly (sometimes stony) type soils.

The arid steppe belt of the foothills is better supplied with moisture than the regions of the semi-desert steppe, as the annual precipitation is 250-400 millimeters (somewhat more in places), and summer is only warm (20-21 degrees in July). Agriculture is usually irrigational, though unirrigated native-style (bogara) farming is entirely possible.

Precipitation is also entirely adequate (400-700 millimeters per year) in the belt of meadow-steppe foothills, due to its higher elevation, while enough rain also falls during summer, which is however somewhat cooler (18-20 degrees in July) Unirrigated farming here is entirely assured, and there are great possibilities for it (and equally for dairy farming) except on gravelly, stony ground and on



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steep slopes.

The first region - that of grass-wormwood and feathergrass steppes on mountain chestnut and chernozem soils, may be subdivided by crop distribution, on account of the wide range of latitudes, into the following subregions:

XIII (8a) The Sarkan-Kuglin subregion, its basic crops should be spring wheat and opium poppies. Supplementary crops should include winter wheat, sunflower, and, in the low-lying parts, cucurbits. Secondary crops are to consist of corn, soybeans, proso millet, flax, saffron (in the lower zone), sugar beet, makhorka tobacco, hemp, oats, winter rye, and barley (in the upper zone). Forage crops should include alfalfa, forage squash, dzhugar (for green forage - at the bottom of watered belts), and proso millet in native unirrigated style, with sunflower and corn for silage.

The Karakol'-Ketmen subregion should have for leading crops spring wheat and opium poppies, for a supplementary crop, winter wheat, for secondary crops, barley, winter rye, oats, proso millet, early sunflower, curly flax, hem and mustard, and for forage crops, alfalfa and squash.

In the region of the Kegen River, a tributary of the Charyn, attention should be paid to the newly discovered rubber-yielding plant kok-saghyz (Taraxacum sp.) which is richer in rubber than tau-saghyz and is thus of greater interest.

In the areas along the Karatau and along the upper foothills of the Kirgiz Alatau (the Aleksandrovsk Ridge) and of the Alma-Ata (trans-Ili) Alatau, there should be grown as basic crops, spring wheat (in the upper zones) and winter wheat, as supplementary crops, corn, opium poppy, sunflower, and the rubber-yielding tau-saghyz (Scorzonoratau-sahhis)



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on the Karatau, as secondary crops, the soybean, kenaf (early varieties), curly flax in the lower zone, and proso millet, oats, barley, and winter rye in the upper zone, as irrigated forage crops, alfalfa, forage squash, dzhugar, as unirrigated forage crops, grown in native (bogara) style, proso millet, oats, mogar (for silage and green forage), sunflower and corn (for silage).

In view of the absence of water for irrigation and of the particularly arid conditions in the Kastek-Kudray parts of the lower zone (dry steppes) of this subregion, the only crops on this list that can be grown are wheat, proso millet, and barley. In the Burno-Dzhuval areas where it is dry and the frost-free period is short, only spring and winter sheat, safflower and flax can be grown, together with the legumes, chickpeas, peas, and lentils.

To the east of Tashkent, in the southernmost part of this region of Kazakhstan and Kirgizstan, unirrigated cotton, grown in native (bogara) style, may already be grown as the leading crop, using early varieties, together with kenaf (in the lower zone). On acreage not used for these crops, especially in the upper zone, winter and spring wheat may be the leading crops. Supplementary crops should include corn, dzhugar, sesame, saffron and soybeans.

Finally, in the Naryn Kray (of Kirgizstan), the leading crops should be spring wheat, opium poppy, and alfalfa (with irrigation), and proso millet as a supplementary crop.

XIII (9) The mountain-forest region of the southern part of the Altay, within the former Semipalatinsk Okrug, with podzolic, often stony soils and gray forest soils, is similar to Region XII (7b) of Western Siberia, which has been described above.

Basic crops should include spring wheat and hemp, supplementary crops - oats and flax, and secondary crops - winter rye and potatoes, with early sunflower and opium poppies subject to expansion.



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XIII(10) The high Alpine and sub-Alpine belt of mountain forests, mountain steppes and pastures, with elevations over 2000 meters, have low temperatures during the growing season and strongly broken-up relief. They can therefore be utilized only in places on their lower ranges for growing only the early varieties of barley, flax and rye.

This is a region of summer pasturage.

- - - - - - - -

We pass now to the Central Volga and Lower Volga Krays. However, before going into an exposition of the desirable redistribution of crops in these krays, we must first pause in order: (1) to sketch those natural conditions which on the whole are common to and characteristic of all the arid provinces of southeastern USSR; (2) to consider the socio-economic factors which shape and determine the basic pattern of the task of reconstruction of the agricultural economy of this extensive natural province, together with the characteristics of its industry and power resources; and, finally, (3) to consider those forms of action by man upon nature which, in the framework of the planned economy of the USSR, can serve as a mighty instrument for the transformation of the southeast, with its frequent droughts and crop failures, into a principal base of stable grain growing for the entire country.

The continental character and the aridity of the climate, the richness of the soil and the flatness of the relief are the basic features of the natural conditions in the southeast (if by this term is understood the left bank of the Central Volga, the Lower Volga Kray and the arid zone of North Caucasus that adjoins it on the south.



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Although the mean annual precipitation is not uniform throughout the zone, falling from 400 millimeters in the northwest to 230 millimeters in the southeast, in the area of the Malyy Uzen' River (of which 130 and 60 millimeters, respectively, fall during the May-July quarter, which is the growing season of spring wheat), it fluctuates sharply from year to year and is not entirely sufficient to assure stable yields even in the more favored northwestern parts of the zone. Further to the southeast, because of strong evaporation, high summer temperatures (24-25 degrees in July) and the consequent low relative humidity (under 40 percent at 1 p.m. in June), the insufficiency of moisture is reflected in low and extremely uncertain yields, resulting, in frequently occurring years, in total crop failure.

The continental character of the climate, which is expressed in the sharp contrasts between summer and winter temperatures (though to a lesser degree than in Western Siberia and Kazakhstan) is a cause of the difficulty in growing winter crops here, complicated by the shallowness of the snow cover, the depth of which on the average ranges from 35-40 centimeters at the end of the winter in the northwest of the zone, down to a minimum of 10 centimeters in the extreme southeast portion.

However, the general length of the frost-free period and the aggregate temperature of the growing season, together with a hot summer, suffice throughout the entire extent of the zone (in contrast to the corresponding conditions in Western Siberia and Kazakhstan) for the maturation not only of sunflower but also for the rather early varieties of corn.

The soils of the arid zone are composed of various chernozems and chestnut soils, which are distinguished by their fertility and



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abundance of dissolved salts (especially further to the southeast), which characteristics aid in obtaining high yields in favorable years, or under irrigation, and at the same time account for the high export grades of the wheat. However, the excessive concentration of salts in the chestnut soils and especially in their complex-solonetz varieties, in conjunction with insufficient precipitation in the extreme southeast, make it difficult to grow successfully such drought-resistant, but not alkali-resistant, crops as sunflower and corn.

The characteristic level relief of the southeast and the absence of any obstacles to the movement of machinery over the immense open stretches in the steppe part of the zone afford especially favorable conditions for the mechanization and collectivization of agriculture, but at the same time this requires measures for coping with the siroccos, dust storms, and wind erosion.

The Central Trans-Volga, Lower Volga regions and the adjoining belt in the North Caucasus, all of which share these general natural characteristics peculiar to arid zones, exhibit them in increasing degree passing from the northwest of the zone to its southeast. In a direction parallel to the shores of the Caspian Sea, and, as it were, drawing a semicircle around them, the different elements of the climate alternate in complex interdependence: precipitation grows scantier, the snow cover more shallow, the continental character of the climate more pronounced, the heat of summer more intense, and in connection with this, a sharp change in moisture conditions takes place in the same direction, ranging from the semiarid regions of the northwestern sections of the zone through the arid central regions to the extremely arid regions in the extreme southeast. The



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nature of the soils similarly undergoes a consistent change: from the rich, ordinary soils of the northwest, through the southern chernozems in the direction of the southeast, to the chestnut soils, and, finally, the light-chestnut and complex-solonetz and brown soils of the extreme southeast. Under the influence of these changes in climatic and soil conditions, changes in the zones of natural vegetation are also observed in the same direction: from the wooded steppe in the north of the Central Trans-Volga region and the northwest of the Lower Volga region to the variegated-grass steppe which is characteristic of the greater part of the zone, and, still further to the southeast with southern-feathergrass varieties of steppe vegetation, to reach at last the grass-mugwort and mugwort halophyte Caspian semidesert.

This succession of natural regions in the arid zone, with their corresponding combination of climatic and soil conditions and types of native vegetation, as well as the average productivity and stability of spring wheat, the principal cereal crop of this zone, may be easily followed over a 20 year period from an inspection of Table 2, on the following page.

The arid zone of the southeast constitutes, for the time being, a region where the importance of agriculture (grain and grain-livestock) dominates the vigorously expanding industry. In this province the leading roles are assumed by the sovkhozes (especially for grain growing), and by the powerful development of the MTS and of complete, unbroken collectivization. The Machine Tractor stations have the significance of a power base, and [redacted] (are) organizers and guides for the work of reclaiming and cultivating new lands, [redacted] constituting, alongside of the body of agricultural technology, one of the powerful means by which a collective agriculture can be organized -- an agriculture stable in general and stable, in particular, under conditions of drought.



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SUMMARY OF THE NATURAL CONDITIONS IN THE REGIONS OF THE ARID ZONE

(Proceeding from Northwest to Southeast)

| Degree of Aridity, Types of Soil and of Native Vegetation | Administrative Subdivisions | Mean Precipitation in Millimeters | | Relative Humidity in June at 1 p.m. |
|---|---|---|---|---|
| | | May-July | July-August | |
| Semi-Arid wooded steppe with rich chernozems. | Former Buguruslan, northern part of former Samara (Central Volga), northern part of former Atkarsk and Balashov (Lower Volga) Okrugs. | 110-130 | 80-100 | 50-53 |
| Semi-arid mixed-grass steppe with ordinary chernozems | Northern part of former Orenburg(Central Volga, Central parts of former Atkarsk and Khopersk, and southern part of Balashov Okrug. | 110-135 | 85-110 | 47-50 |
| Arid mixed-grass steppe with southern Chernozems | Southern parts of former Samara, Orenburg, Vol'sk, northern part of Kamyshin, southern part of Khopersk, right bank of ARNP (Lower Volga) Donetsk, W. ch. Shakhtinsk (North Caucasus) Okrug. | 100-150 | 75-100 | 45-47 |
| Very arid southern feathergrass steppe with dark-chestnut soils | Northern part of left-bank ARNP, Northern part of former Pugachev, Southern part of Kamyshin, Northwestern part of Stalingrad, central part of Shakhtinsk and Al'sk (North Caucasus) Okrugs. | 75-125 | 60-85 | 40-45 |
| Extremely arid grass-mugwort, semi-desert on complex solonetz sandy light chestnut soils | Southern Trans-Volga part of ARNP, Pugachev and Stalingrad okrugs, Astrakhan Okrug, Northern part of Sal'sky and eastern part of Shakhtinsk (North Caucasus) okrugs. | 50-1000 | 30-70 | 40 |

1 Without the northern

their wheat crops.

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NATURAL CONDITIONS IN THE REGIONS OF THE ARID ZONE OF THE SOUTHEAST OF THE USSR

ceeding from Northwest to Southeast)

| | Mean Precipitation in Millimeters | | Relative Humidity in June at 1 p.m. | Mean Depth of Snow Cover in Centimeters at end of Winter | Mean July Temperature | Average Length of Frost-Free Period, in Days | Yield of Spring Wheat During 20 Pre-War Years in Centners per Hectare | |
|---|---|---|---|---|---|---|---|---|
| | May-July | July-August | | | | | Average (without irrigation) | Number of times yield fell below ½ centner per hectare during 20-year period |
| nara rsk | 110-130 | 80-100 | 50-53 | 35-40 | 20-21 | 140-145 | 6[1] | 1 - 2 |
| a, | 110-135 | 85-110 | 47-50 | 30-35 | 21-22 | 145-160 | 6 | 1 |
| l'sk, netsk, | 100-150 | 75-100 | 45-47 | 20-30 | 22-23 | 150-170 | 4-5 | 2 |
| rt n, t of | 75-125 | 60-85 | 40-45 | 15-20 | 22-24 | 150-170 | 4-5 | 2 - 3 |
| v hern sk | 50-1000 | 30-70 | 40 | 10-15 | 24-25 | 150-170 | 4 | 3 - 4 |

1 Without the northern parts of former Atkarsk and Balashov okrugs, which belong in the "white spot" area, showing a decrease in their wheat crops.

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But hand in hand with agriculture, and in close interaction with it, the development of industry has come to play a larger and larger part. The greatest significance for agriculture, in this connection, will be held by the giants of the agricultural machine manufacturing industry: the Saratov Kombaynstroy and the Stalingrad Tractor Works, as well as by the projected immense expansion of the agricultural processing industries: flour-milling, vegetable oil processing, tannery plants, meat combines (Pokrovsk), and cannery plants of nation-wide significance (Akhtuba-Volga), etc.

The existence of local deposits of phosphorites within the most arid zone (Obshchiy Syrt) as well as others nearby on the right bank of the Volga (Undorov, Kashpir, Mordov) should result in the existence of a superphosphate industry and in the widespread application of phosphate fertilizers, which can strongly improve productivity, especially with irrigation.

The presence of an immense area of naturally alloyed iron ores, and of highest grade nickel ores as well, should facilitate the further development of tractor and motor manufacturing in general, and consequently of a powerful local base for the industrialization of agriculture.

In turn, the development of large-scale industrial centers (Stalingrad, Saratov, Samara, Astrakhan') and of whole industrial regions (Khalilovo) will result in the necessity of specializing the agriculture in their vicinity to vegetable and dairy farming with a corresponding intensification of forage cultivation in these regions, against a general background of grain and grain-meat production in the zone as a whole.

The industrialization of agriculture and the development of the agricultural processing industries in the southeast will be



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based on power resources of various kinds. One of the most important sources, especially with the construction of the Volgostroy, will be the oil shales from the exceedingly large deposits within the confines of the Central Volga Kray (Obshchiy Syrt, Kashpir and Undorov shales).

The water power of the Volgostroy Project itself will furnish a very considerable amount of electric energy, and together with this, the resources of petroleum brought from outside the area and of coal from Karaganda will also be available (for Khalilovo).

The existence of extremely large power resources will play an extraordinary role in the mechanization of agricultural production (MTS and manufacture of agricultural machinery), in the realization of gigantic irrigation projects (Volgostroy), as well as in the organization of very large scale agricultural processing enterprises. The great Stalingrad, Saratov, Astrakhan' and other power stations will be especially important in this respect.

However, the reconstruction of agriculture, and of farming in particular, in the arid zone of the southeast, will only then stand on firm foundations when the forces of socialist construction eliminate the baleful influence of drought as a fundamental natural obstacle to the organization of a stable grain economy. A decisive part in this respect will be played by the fulfillment during the Second Five-Year Plan of the Government order for the erection of a giant dam near Kamyshin, to irrigate 4,300,000 hectares, as a major base to produce a stable annual harvest of up to 50,000,000 centners of wheat, with [redacted] large-scale forage procurement [redacted] for the development of animal husbandry.

Application of the various methods used in "dry farming" should accompany this fundamental and radical measure of technical



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reconstruction of the agriculture of a very considerable portion of the arid zone.

The very first of these measures should be the selection of drought-resistant crops and varieties and their proper combination in crop rotations. Special attention should be paid to the mass dissemination and advance of such drought-resistant cultivated crops as corn and sunflower, and of the even more drought-resistant but warmth-loving safflower. It is necessary to push forward the areas in the southeast for growing the more drought-resistant, and consequently, earlier maturing, winter crops (wheat mainly on the right bank and only using frost-hardy varieties), cucurbits, mustard, a few seed-pod legumes (Phaseolus acutifolius beans and chickpeas) and especially drought-resistant forages. Among the latter, special attention should be paid to yellow-flowered alfalfa, sweet clover and zhitnyak (Triticum cristatum), while of the annuals, Sudan grass may be used for hay and sorghum for green forage (grain sorghum does not mature in this zone), and also the silage crops.

To escape the harmful effects of drought, on spring wheat sowings, it is not only necessary to use the more drought-resistant varieties, but also to apply all possible methods for accelerating maturation, such as the earliest possible sowings, and artificial acceleration of maturation by preliminary processing of the seed (Lysenko method).

The use of the whole complex of agrotechnical methods for arid conditions should play no lesser role: proper crop rotations with early bare fallows for the winter crops (in specially arid regions for spring crops as well), sowing of winter crops in the furrows, use of cultivated crops and grass sod (with timely removal) for the

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succeeding spring crops, autumn plowing, punctual and proper presowing soil cultivation, sowings as early as possible, vigorous weed control.

Finally, the large-scale application of artificial methods of retaining the snow should be used wherever possible. The more expedient of these methods should be applied: corridors of fallow, tree shelter belts, etc.; and, equally well, the local supplies of snow and rain waters should be used for irrigation from ponds in ravines and gullies.

By the combined action of all these measures, and especially by the realization of the Volgostroy project, the task of establishing a stable grain growing economy in the southeast will be solved, and the southeast of the USSR will fulfill the basic tasks assigned to it by the general Government plan in the field of agricultural cultivation:

1. To provide, together with West Siberia and Kazakhstan, a basic production of high-grade spring wheat, to be used to a considerable extent for export;

2. To become one of the principal suppliers of raw material for the production of vegetable oils (sunflower, and also, in the Akhtuba-Volga region, peanuts and sesame).

3. To produce forage for beef cattle raising and hog breeding (corn, forage grasses, in irrigated sites -- alfalfa in particular).

4. To develop cucurbit growing on irrigated sites (and also vegetable growing for canning in the Akhtuba-Volga region) to supply not only local requirements but also the centers and industrial regions all over the USSR.



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## XIV. THE CENTRAL VOLGA KRAY

The kray should be subdivided into a number of regions, in accordance with the differing soil and climatic conditions. In this respect, the sharpest contrast is between the well-watered right bank of the Volga, with its field agriculture based on rye, oats, potatoes and hemp, together with grasses -- and the more or less arid left bank, with spring wheat dominating the scene.

The left bank sounds the keynote for the farming of the entire kray, and since the acreage under spring wheat could be increased, the major task of farming in the kray as a whole is the increase in spring wheat harvests and the solution of the problems of dry farming under the conditions of large scale mechanized socialist grain production. The expansion of sowings of sunflower and corn is of substantial importance, as is that of potatoes, lentils and hemp on the corresponding sections of the right bank.

The increase in the acreage of all these crops may be attained by reclaiming and cultivating new lands, accompanied by the reduction in the acreage now under oats, and, to some extent, rice and proso millet as well.

XIV(1) Consists of: (a) the forested part of the right bank of the Volga, with pine woods on sandy podzolic soils (in the western part of Mordov AO), and (b) the wooded steppe of the right bank of the Volga, with degraded and leached chernozems, and partly podzolized soils (the eastern part of Mordov AO and the former Penza Okrug).

The average total precipitation during the growing season of spring crops, from May to July inclusive, is sufficiently favorable: 140-160 millimeters; July temperatures are 19-20 degrees; and the mean relative humidity is about 57 percent. Although the winters



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are cold (minus 11 to minus 12 degrees in January), the snow cover is rather deep (40-50 centimeters).

Leading crops should consist of winter rye, oats (Moskovskiy A-351 and Pobeda), potatoes, hemp (principally in Region $XIV_{1b}$), and clover. The proportion of the last three crops, and also of lentils for human consumption, should be increased at the expense of the coarse grains and of proso millet, which is being displaced.

Potatoes yield a high percentage of starch here if the proper varieties are selected. Though the crop yield for the time being is considerably lower than in the more northerly and westerly potato growing regions of the USSR, productivity can be considerably increased by the use of mineral fertilizers and manures, and also by sowings of clover, which are necessary to raise in general the level of farming on sites with poor, sandy loam, sandy and podzolized soils. Potato growing should be primarily for industrial purposes and forage.

One of the centers of hemp culture in The Soviet Union is located in subregion $XIV_{1b}$. The future expansion of its sowings here would be entirely expedient and linked with the expansion of clover sowings (mainly late red clover), which is also necessary here as a basic crop for the dairy farming and hog breeding of this region. Silage on the whole should be based on sunflower and corn. Root crops and tubers for forage should include potatoes, beets, and carrots. Sowings of lupine on sandy soils are desirable.

Sufficiently humid conditions in this region favor the development of the Swedish fly and thus for the time being exclude the possibility of pushing forward the areas of spring wheat and barley. Winter wheat does not thrive because of soil conditions and frosts.



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Special attention should be paid in the former Penza Okrug, and in the neighboring Balashov and Tambov Okrug, to the growing for export of lentils for human consumption which are unaffected here by the pea weevil, and also, to some extent, of peas.

The culture of makhorka tobacco as a secondary crop is desirable in region $XIV_{1b}$, while sugar beet sowings should be encouraged by all possible means.

XIV(2) The wooded steppe (a) with forest soils and podzolic sandy loams for the elevated parts of the region (the former Kuznetsk Okrug), and (b) with leached chernozems in the former Ul'yanovsk and Syzran' Okrugs.

The climate is somewhat drier (relative humidity about 53-55 percent for June) than in the preceding region, as a result of the somewhat lower precipitation (120-140 millimeters for the May-July quarter), and a warmer summer, with the exception of the elevated and better watered former Kuznetsk Okrug, where the soils, however, are much poorer.

This region, though similar to the preceding region in its primary crops -- winter rye, oats and potatoes -- differs from it in the inexpediency of growing clover and lentils for human consumption which give lower yields because of the arid climate, except in region $XIV_{2a}$, where these crops can be grown. It also differs in that hemp can be grown only in the better watered Kuznetsk section of the region.

The proximity of the Volga, with its cheap water transportation and the development of great industrial centers, dictates the necessity of growing the edible varieties of potatoes, impelling a development of vegetable growing (and also of horticulture in the region of the Volga itself) together with dairy farming.



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For forage, hybrid alfalfa, brome grass and esparsette should be grown, and the development of silage crops -- corn, sunflower and especially the paleaceous gourds -- should be vigorously pushed. Of the root crops and tubers, potatoes, mangel-wurzel and carrots should be grown.

This region, which represents a transition from the preceding region, to the arid spring wheat region of the left bank, suffers less from the Swedish fly, and thus the growing and introduction of spring wheat ([redacted] Cesium 0111) and the earliest varieties of sunflower in Ul'yanovsk and Syzran' Okrugs are permissible. Lentils, mainly the small grained varieties, and peas can also be grown.

Taking into account some possible risk of failure in occasional years, it is nevertheless desirable to extend and propagate the sowings of the most winter-hardy varieties of winter wheat (Lyutestsens 1060/10,0329, Eritrospermum 72-01) selected by the Bezenchuk and Kuznetsk stations. According to data furnished by the latter station, the average yield of winter wheat during 18 years was 15.4 centners per hectare, against 7-8 centners for spring wheat during the same period.

Sowings of proso millet and buckwheat may be reduced.

In this region, as in the preceding region, the use of fertilizer is most essential

The next regions of the Central Volga to be mentioned constitute a part of the spring wheat area of the USSR.

XIV(3) The wooded steppe of the left bank with fertile chernozems in the northern part of the former Buguruslan Okrug. This region is less forested and more arid than the preceding region, but has better soils, which do not require fertilizing.



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Spring wheat is the leading crop (T[redacted] Cesium 0111, with Lyutestsens 062 being permissible) and gives higher and more certain yields here than in all the other areas of the Central and Lower Volga.

Supplementary crops should include winter rye (Bezenchuk) and oats (Pobeda variety). Of the cultivated crops, potatoes are recommended for the northern part of the region, while the earliest varieties of sunflower (Karlik (Dwarf) of the Steppe Station and the new early varieties of the Saratov Station) are recommended for the south. Corn for grain, even the early varieties, does not always have time to mature.

Sowings of winter wheat involve great risk, even where snow is retained. The best of several varieties are Eritrospermum 72/01 and Lyutestsens 1060/10.

Forage crops should include hybrid alfalfa, beardless brome grass, American couch grass; corn, sunflower and paleaceous gourds for silage; and forage potatoes and carrots of the root crops and tubers.

XIV(4) The semiarid wooded steppe, passing over into steppe, with rich chernozems on the left bank of the Volga, embracing the northern part of the former Samara Okrug, the southern part of the former Buguruslan Okrug, and the northern, extreme northeastern belt of the Cis-Ural (the former Orenburg Okrug).

Annual precipitation is 350-375 millimeters, of which 115-130 millimeters fall during the growing season, and the mean July temperature is 20-21 degrees, which alone are enough to make conditions considerably more arid here (June relative humidity 50-53 percent) than in the preceding regions. The severe conditions of the more



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snowless winters, with mean January temperatures from minus 13 to minus 14 degrees, and mean depth of snow cover at winter's end of 35-40 centimeters, do not permit the reasonably secure growing of winter wheat. If this crop is sown, with snow retention an indispensable prerequisite, the best of several varieties is Lyutestsens 1060/10.

In this region, marked by a transition from wooded steppe to steppe, spring wheat stands very decidedly in the first and foremost position among all other crops. Furthermore, although hard wheat gives yields on long cultivated, repeatedly plowed land averaging about 10 percent lower than those of the best soft wheats, this difference is compensated by higher export prices for the hard wheats, as well as by their lesser tendency to shatter during mechanized harvesting. The following varieties are recommended for hard wheat: Gordeiforme 0189 and 0432, with Melanopus 069 being permissible, for soft wheat: ~~Tsesium~~ Cesium 0111, with Lyutestsens 062 permissible only for unmechanized farms. Supplementary crops should continue to include as winter rye the Bezenchuk variety and for oats, the Pobeda and Lokhovskiy varieties. Attention should also be given to expanding sunflower sowings of Saratov 169 and especially corn sowings of the early varieties, Burley Kaunti (Burleigh County) and Bezenchuk. The latter are particularly necessary both for the expansion of hog breeding and because corn should be introduced as one of the best predecessor crops for spring wheat. The early varieties that thrive here are usually dwarfed and especially suitable for fattening swine on the roots, but the availability of proper machinery for mechanized harvesting is an indispensable prerequisite for growing this crop on large tracts.

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Grasses should include: hybrid and yellow-flowered alfalfa, and brome grass and, for an annual, Sudan grass. For silage crops, there should be planted corn, sunflower, sorghum, sweetclover and paleaceous fodder squash. Root crops and tubers should include carrots and potatoes.

XIV(5) The mixed-grass steppe on the left bank of the Volga: (a) a semi-arid steppe with ordinary chernozems in the northeastern part of the former Samara Okrug and in the central part of the former Orenburg Okrug, to the north of Orenburg, and (b) an arid steppe with southern chernozems in the southern part of the former Samara Okrug and the greater part of the former Orenburg Okrug, except its southernmost part). The climate is still more arid and of still more continental character; the average precipitation during the May-July quarter is 105-120 millimeters and 300-350 millimeters for the year. With a mean temperature of 21-22 degrees for July, the mean relative humidity is 47-50 percent, and even lower in the south. In occasional years the precipitation falls to a very low level, resulting in total crop failure. This happened three times during 20 prewar years. The low winter temperatures (minus 3 to minus 15 degrees in January) and the shallowness of the snow cover (30-35 centimeters at winter's end) make it impossible to grow even the most winter-hardy varieties of winter wheat.

Spring wheat is the single primary crop, and although the region is insufficiently promising with respect to certainty of yield, and also gives smaller harvests than the preceding region, it is here of very good quality. Taking into account the existence of heavy soils and wastelands, hard wheat should still retain its dominant position for the time being. Even on the soft light soils



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where they are not overgrown by weeds, it still yields harvests which are only about 10 percent less than the best varieties of soft wheat. The same varieties are recommended as for the preceding region. Oats cannot resist the summer drought, give low yields, and should be excluded from the planned sowings of this region, while rye should be retained only to relieve the sowing and harvesting campaigns for extended periods from the consequences of the impossibility of growing winter wheat.

Here as in the preceding region measures should be taken to expand the sowings of the early varieties of corn and sunflower as much as possible. Corn varieties should consist of Bezenchuk, and, in addition Burley Kaunti (Burleigh County) in the northern part and North Dakota in the southern part, while that of sunflower, Saratov 169.

Cucurbits crops should consist of watermelon and squash. It is desirable to continue proso millet sowings, as the most drought-resistant crop, for use as a stand-by crop. The same is true of barley (Pallidum 045).

Sugar beet sowings are possible, especially under irrigation.

Hybrid and yellow-flowered alfalfas, brome grass and zhitnyak (Triticum cristatum), and, among the annuals, Sudan grass, are recommended for forage and to help reestablish the structure of overplowed lands and clear out weeds. For silage, corn, sunflower, Sudan grass and sorghum should be grown. For autumn feeding and silage, forage watermelons and squash may be grown.

XIV(6) A very arid steppe with chestnut and often solonetz soils located in the southern part of Orenburg Okrug towards Ilek River and east of Orsk.

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The climate is strongly continental, with an average total precipitation of 90-105 millimeters during the May-July quarters, a mean July temperature of 22-23 degrees, and a low relative humidity (only 40-45 percent in June).

The leading crop is wheat. Varieties as drought-resistant as possible should be introduced, such as Eritrospermum 0841, 0341, and Melanopus 069. The yields, however, are relatively low and very uncertain. There were three to four total crop failures within a 20 year period, but the grain is of excellent quality. On over-cultivated lands, hard wheat gives considerably lower yields than soft wheat and is therefore recommended only for virgin and wastelands.

Growing not only of winter wheat but even of rye is rendered impossible by the low winter temperatures, the dry autumns and the scanty snowfall, measuring 25-30 centimeters and less.

The solonetz soils and excessively arid climate are unfavorable for corn too, which may nevertheless be successful if midsummer failure from drought is avoided. Only the early varieties, such as North Dakota, may be used. For the same reason, only the early varieties of sunflower are permissible.

Supplementary to wheat, proso millet and cucurbits may be grown, and of the leguminous seed crops, chickpeas. Forage crops should include yellow-flowered alfalfa, zhitnyak (Triticum cristatum), corn, Sudan grass, sorghum, sweet clover, sunflower, and palaeceous squash for silage, as well as proso millet, forage squash and watermelons.

## XV. THE LOWER VOLGA KRAY

This kray should also be divided into a number of regions, the natural conditions of which vary mainly due to the change in aridity



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of the climate progressing from northwest to southeast.

The necessity for taking measures to combat the drought is true for the whole kray and should include methods of dry farming, land reclamation, snow retention, and the selection of more drought-resistant crops and varieties. Because of these conditions, it will be necessary through reconstruction and mechanization of agriculture to bring under cultivation very extensive tracts of waste and virgin lands which, however, are located for the most part in the more arid section of the kray, with periodic droughts and extremely uncertain harvests.

Throughout the kray particular attention should be given to the further expansion of spring wheat sowings, by opening up new lands and reducing the sowings of the less valuable crops, especially of oats(with the exception of the first region).

All possible measures should be taken to increase the percentage of cultivated crops, corn and sunflower in particular, with the exception of the most arid southeastern regions of the kray, to serve as stand-by crops, to combat weeds, and to help better retain soil moisture.

If these labor-consuming crops are to be sown on large tracts, however, the simultaneous provision of ample machinery and equipment to mechanize their cultivation and harvesting must be regarded as an indispensable requisite.

Along with the cultivated crops, fallows are necessary too for clearing the weeds and conserving soil moisture. The grasses will be necessary not only in regions of animal husbandry but also to reestablish a better structure of overplowed chernozems, and to help control weeds and wind loss of the sowings.



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XV(1) The southern wooded steppe with the rich chernozems of the right bank of the Volga (embracing the northern part of the former Balashov and Atkarsk Okrugs and the western part of Vol'sk Okrug). This is a region with rich soils and a climate less arid and continental in character than the other regions of the kray. Precipitation is sufficient, as a rule, its average annual value amounting to 400-450 millimeters, of which 135-155 millimeters falls during the May-July quarter. Mean July temperatures are 20.5-21.5 degrees. The relative humidity for June is 50-55 percent. Winter is somewhat less severe, with January temperatures ranging from minus 11 to minus 12 degrees, and the snow cover relatively deeper than in the other regions of the kray, amounting to 35-45 centimeters at the end of the winter. This even affords some possibility of growing winter wheat, though only the earliest varieties.

However the prevalence of the Swedish fly prevents the cultivation of spring wheat and barley, with the single exception of the southern part of the region.

The leading crops are winter rye, oats -- Pobeda variety -- and sunflower -- Saratov 169.

In the southern part of the region, spring wheat may advance from the southeast as a supplementary crop. The varieties are as follows: Eritrospermum 0341 (and also Cesium [redacted] 0111) and Lyutestsens 062 (for unmechanized farms). Of the hard wheats, (which give approximately a 20 percent lower yield on long-cultivated land here than do the soft wheats), Gordeiforme 0432 may be grown.

Corn gives good crops here because of sufficient moisture, but requires using early maturing varieties -- Burley Kaunti (Burleigh County) -- and organized drying facilities, especially for the seed.



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Expansion of its sowings, especially in the southern part of the region, is rendered necessary by the desirability of developing hogbreeding here.

One of the centers for the development of exportable lentils for human consumption should be located here, since this crop does not suffer from the pea weevil here. The sufficiently large acreage allotted to potatoes should be maintained.

The most winter-resistant varieties of winter wheat, Lyutestsens 1060/10 and Eritrospermum 72-01, may also be introduced in place of rice.

Though proso millet also gives good yields here, its acreage could be reduced in favor of more valuable crops.

Questions of forage production here should be properly taken care of by sowing hybrid alfalfa, beardless brome grass, sweet clover, Sudan grass, forage potatoes, carrots, beets, and also forage squash and watermelons. The Minnesota 23 and Northwestern (Norsvestern) varieties of corn, which mature later than those grown for grain -- should lead the silage crops.

XV(2) The mixed-grass steppe of the right bank: (a) the semi-arid steppe with the ordinary chernozems (the central part of the former Vol'sk Okrug, the southern parts of the former Atkarsk and Balashov Okrug, and the northern part of Khopersk Okrug); (b) the arid steppe with southern chernozems (the right bank region of the Volga, German ASSR; the northern part of the former Kamyshin Okrug; and the southern part of Khopersk Okrug).

The average annual precipitation is 350-400 millimeters, of which 110-135 millimeters fall during the May-July quarter. Summer is hotter than in the preceding region (July temperature 21.5-22.5



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degrees). The climate is therefore more arid (average relative humidity at 1 p.m. in June was 50-45 percent [sic]).

Since the depth of the snow cover is small (25-35 centimeters), winter conditions are less favorable for winter crops, especially in the south of the region.

Field agriculture is oriented towards spring wheat and sunflower, with acreage in winter rye being maintained and sowings of corn expanded.

The absence of Swedish fly infestation here and the not yet great degree of aridity, favor wheat among the cereal crops, although yields are lower than in the Ukraine, the Don River area, and the wooded steppe of Western Siberia, and harvests are also somewhat more uncertain. The grain grown here, however, is of very good quality. On long-cultivated land the soft wheats give considerably higher yields (ranging up to 20 percent) than the hard wheats. Eritrospermum 0341 (in the TsChO and Don regions, this variety is susceptible to Race B of chokeweed, which does not occur in the Povolzh'e) and Lyutestsens 062 are recommended (the latter only for unmechanized farms) and, of the hard wheats, Gordeiforme 0432.

In expanding the cultivation of sunflower, it must be borne in mind that this crop should not be repeated too frequently in the crop rotations, so as to avoid infestation by chokeweed, and that varieties resistant to race A of chokeweed should be grown, which have the additional advantage of low stature, thus making them more suitable to mechanized harvesting. Among these varieties belongs Saratov 169, which is recommended for this region. (In the TsChO and Don regions, this variety is susceptible to Breed B of chokeweed, which does not occur in the Povolzh'e).



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The winter rye, Yeliseyevskaya, should be grown. The varieties of winter wheat approved for introduction into this region are Lyutestsens 1060/10, 0329, and, with snow retention, Gostianum 237.

Oats should be excluded in favor of other crops; but in the case of sowings, the more drought-resistant variety Pobeda is recommended, and as a supplement to this, Zolotoy Dozhd.

Among the cultivated crops, in addition to sunflower, the growing of corn (North Dakota and Fal'koner, Spakovskoy permissible) and gourds should be encouraged as the best predecessors for spring wheat. These crops are also drought-resistant and give relatively promising harvests.

Of the forages, yellow-flowered and hybrid alfalfa, smooth brome grass, zhitnyak (Triticum crystatum), and Sudan grass are recommended; for silage: corn, Sudan grass, sorghum and sweet clover; forage squash and watermelons for succulent autumn feed and silage; sweet clover may be tried for pastures.

The following secondary crops should be included: barley (Pallidum 043, 045 and Medikum 026 and 046), sugar beet (only in the former Balashov Okrug), potatoes, Makhorka tobacco, coriander, and dragon's head.

Because of the natural conditions, the crops and varieties for the southern part of this region are almost the same in all respects as in the Region $XV_{4a}$ of arid steppe with the southern chernozems of the trans-Volga (the trans-Volga part of the former Vol'sk and the northernmost part of Pugachev Okrug).

A third region in the $XV_{3a}$ section, and a fourth region in the $XV_{4b}$ section, comprise the very arid steppe with dark-chestnut soils (in the southern right-bank region of the former Kamyshin Okrug and the northwest part of Stalingrad Okrug, and also in the northern part



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of the trans-Volga cantons of the Volga German ASSR and the northern part of Pugachev Okrug).

The average precipitation for the May-July quarter is 100-125 millimeters, and falls as low as 85-100 millimeters in the trans-Volga part of the region (average annual precipitation 300-350 millimeters). July temperature varies from 22.5 to 23.5 degrees. The average relative humidity is only 40-45 percent in June. Winter snowfall is light, with the snow cover at the end of winter only amounting to 15-25 centimeters.

This is a typical spring wheat region, with low and very uncertain yields (there were three or four total crop failures during 20 years), but grain of excellent quality is harvested.

The varieties Gordeiforme 0189, Melanopus 069, Eritrospermum 0831 and 0341 and Lyutestsens 062 are permissible only for conditions excluding prolonged standing (prestoy) as they have a tendency to shatter.

Al'bidum 0604 which gives grain of excellent quality, but with a strong tendency to shatter, and thus unsuitable for harvesting by combines, should be replaced as quickly as possible by non-shattering varieties.

Among the cultivated crops, in consequence of the hot summers and the very considerable expanses of sandy loam and sandy soils, especially in the Kamyshin-Stalingrad section, the gourds (watermelon, muskmelon and squash) should take the most prominent place, while that of sunflower and corn should be far more inconspicuous.

Sunflower (Saratov 169) thrives considerably less well here than in the preceding region, as a result of the arid climate, and should, like corn, be grown only as a supplementary crop. Even during the



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sufficiently long frost-free period of the region corn growing nevertheless demands early varieties to escape failures from drought in the blooming and ripening periods. For the right-bank area of the region these varieties are: North Dakota and Fal'koner, with Ivory King (Ayvori King) permissible; when irrigation is used: Brounkonti; for the trans-Volga part: North Dakota and Fal'koner. Indian mustard is a very important crop.

Only the specially winter-resistant varieties of winter wheat can thrive, with snow retention work: Lyutestsens 1060/10, 0329; while in the trans-Volga part, if any winter crop is required, it is necessary to be satisfied with continuing the sowing of winter rye.

Proso millet, as a drought-resistant crop, should continue to be grown, together with chickpeas among the legumes. Sowings of drought-resistant beans (Phaseolus acutifolius) (tepari) and saffron should be increased. Among the other secondary crops, the following should be used: barley (Pallidum 043 and 045 and Modicum 046 and 026), coriander, seed flax, and squash.

The perennial grasses—yellow-flowered and hybrid alfalfa and Triticum Crystatum (zhitnyak)—must be sown to meet the requirements of beef cattle raising and to prevent pulverization of the soil by strong winds and dust storms. Sweet clover should also be experimentally sown on grazing grounds.

Of the annual forages, Sudan grass and sorghum should be recommended, the latter for green forage and silage, along with corn and proso millet. Forage squash and watermelons should be used for succulent feed and silage.

The region needs reclamation, especially irrigation, and also requires the anchoring of the large amounts of sandy soils.



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XV(3b) The subregion of the third region, together with region $XV_5$, forms an extremely arid, grass-mugwort, semidesert steppe with complex solonetz-chestnut soils, which includes the southern parts of the trans-Volga cantons of the Volga German ASSR and of the former Pugachev Okrug, and also those parts of Kamyshin and Stalingrad Okrug that do not belong to the preceding regions, together with the whole of the former Astrakhan Okrug with the exception of the Volga-Akhtuba valley.

The average precipitation for the May-July quarter is only 75-100 millimeters, and for the entire year is 275-300 millimeters. Because of the high summer temperatures (from 23.5 to 25 degrees in July), the relative humidity is very low (under 40 percent for 1 p.m. in June). The climate is extremely arid and continental. Farming is generally possible only in the lowlands (pada) or under irrigation.

Without irrigation, harvests are very low and extremely unpromising.

Growing of spring wheat of the most drought-resistant varieties -- Eritrospermum 0841, Melanopus 069, and Eritrospermum 0341 -- still involves great risk; but the grain is of excellent grade both in its vitreous quality and its protein content. It is necessary to increase the sowings of Indian mustard, gourds (watermelon, muskmelons, squash), and proso millet, as the most drought-resistant crops, and to undertake experiments with the early maturing varieties of grain sorghum, drought-resistant beans (tepari) and safflower.

Corn and sunflower cannot be grown under these conditions, because of the insufficient moisture, and corn as well because it does not tolerate such saline soils. Under irrigation, however, the



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varieties Brounkonti and King Phillip Kosticz (Korol' Filipp Kostych) can be grown.

In case additional forage is needed for beef cattle raising, sorghum, Sudan grass, proso millet, yellow-flowered alfalfa and Triticum crystatum (zhitnyak) can be grown in greater quantities on the unirrigated virgin and wastelands; also forage watermelons and squash; while sweet clover may be used for supplementary sowings on pasture grounds. Alfalfa can give very good yields here with irrigation.

The use of the region for farming purposes is possible only by the construction of large-scale irrigation works.

The realization of the large-scale Volgostroy project during the course of the Second Five Year Plan, by means of the construction of a dam near Kamyshin, confirmed by the decree of the SNK of May 22, 1932, should transform the arid Zavolzh'ye with its frequent crop failures into an immense region of stable irrigated agriculture with a wheat production up to 65,000,000 centners and a different allocation of crops, as we noted in the preceding account, in the course of describing the corresponding regions, under the subject of ordinary "dry farming".

The territory included in the planned irrigation of 4,000,000 to 4,300,000 hectares is located in general between the Samarka River on the north, the Yeruslan on the south and the systems of the Syrt and Bol'shoy Uzen' on the east.

Within these confines it includes parts of three natural zones of the trans-Volga: (a) the arid steppe with southern chernozems, immediately to the south of the Samarka River (our subregions $XIV_{5b}$ of the Central Volga Kray and $XV_{4a}$ of the Lower Volga Kray; (b) the very arid steppe with dark-chestnut soils (our subregion $XV_{4b}$ of the



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Lower Volga Kray; and (c) the extremely arid semidesert steppe with light-chestnut and complex-solonetz soils (our subregion $XV_{5a}$ in the southern parts of the Volga German ASSR and of the former Pugachev Okrug).

Agriculture for all this territory must mainly keep two objectives in view: the establishment of a principal mass base for the stable production of high-grade wheat for local consumption and export, and, at the same time, the establishment of a forage base for beef cattle raising and also, to some extent, for dairy farming as well.

The primary crops for all this immense territory to be served by the projected irrigation system will thus be wheat and alfalfa, together with other forages in various combinations, supplemented by forms of cultivated oil crops and industrial crops, according to the natural peculiarities of the various zones.

Of the spring wheat sown on irrigated lands, the hard wheats should be grown in the first place on those components of the crop rotations which are sown directly on the sod from the preceding alfalfa crop (which is more fertile and freer from weeds), while the soft wheats should be sown on the other fields (in the rotations during the first years before the introduction of alfalfa -- on the long-cultivated, more weed-infested lands). Together with this, varieties should be selected which are more resistant to droughts, rust, stem-bending (poleganiye) and shattering.

Unfortunately, since there are no well-organized [redacted] experimental and selecting stations stations [redacted] operating under the irrigation conditions of the trans-Volga, we are not provided with sufficient data to make any recommendations of varieties. (At the present time, under the conditions of the Lower Povolzh'ye, there are only three experiment stations operating under irrigation conditions: the Tingutin,



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Ilovlin and Baluy Stations; all of them until very recently with negligible budgets, personnel and equipment. Of these, only the situation of the Baluy Station has been somewhat bettered during the last two years, and it now issues a printed report.) Similarly, we can make no recommendations on most of the questions connected with the expedient organization of irrigated agriculture in the trans-Volga. The task of properly and immediately equipping large-scale experimental stations and experimental farms appears to be a matter of such urgent necessity that it cannot under any circumstances be postponed; otherwise, the lack of conclusions as to the best varieties, methods of cultivation under conditions of irrigation, hydrologic moduli, and so forth, may cause tremendous and irreparable errors in organizing the irrigated farms on the millions of hectares of the Volgostroy system.

Overa period of 17 years the Baluy Experimental Station obtained an average yield of 16.4 centners of spring wheat per hectare, under irrigation, from light chestnut soils with weak solonetz content, while without irrigation the yield was several times lower. Moreover, according to the data furnished by this station, very important factors in growing wheat under irrigation, besides the seed selection, are the presence of sod from alfalfa, sowings after a row-cultivated crop (increases up to 40 percent as against sowings of wheat directly after another wheat crop), a higher rate of seeding, and, apparently, the use of mineral fertilizers.

Finding a solution of the problem of introducing winter wheat as a supplementary crop to spring wheat on irrigated land is very important, for according to the data of the same station winter wheat suffered significant crop losses in only two seasons out of 18, and its average yield over these 18 years was 50 percent higher than that of



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spring wheat. Under the conditions of dry farming in the trans-Volga, however, winter wheat is only slightly more productive than spring wheat, failing far more frequently than under irrigation. At the same time it is not so sensitive as spring wheat to the influence of weeds, which grow profusely under irrigation, and in case of failure of the winter wheat crop the fields can be reseeded with spring wheat, which reacts favorably under irrigation to fallow cultivation. In view of all this, the question of winter wheat should be subjected to large-scale experimental study. The more suitable winter-resistant, non-bending, and rust-resistant varieties should be developed and methods of autumn winter-proofing established.

The sufficiently winter-resistant varieties of alfalfa should unquestionably be given first place among the forage crops in irrigated crop-rotations, for they can provide the principal volume of forage required by the animal husbandry of the trans-Volga. Under irrigation it usually gives three mowings, and high yields are possible for not less than three years after sowing. According to the data of the Valuysk Station its average annual yield is 75-100 centners per hectare. Alfalfa, under irrigation, also proves to be an excellent component of the grain rotations, increasing the yield of wheat and preventing salinification of the soils. Among the other forage grasses, sweet clover may be important to supplement alfalfa; it is suitable for the short-term grain rotations, when used primarily for silage and the improvement of the nitrogenous content of the soil. It will be particularly useful as a forage crop in the more southerly irrigated zone of the trans-Volga, since it is more salt-tolerant than alfalfa.

Among the cultivated crops for the irrigated regions, corn should take first place. The varieties Korol' Filipp Kostych and

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Brounkonti should be used for the zone of chestnut soils, and Bezenchuk for the southern chernozems of the Central Volga. It is, however, a prerequisite for growing corn on large irrigated tracts that its cultivation and especially its harvesting be mechanized, with machinery suitably adapted to the peculiarities of irrigated farming.

The sugar beet should under all circumstances be included among the cultivated crops for the irrigated farming of the trans-Volga, for it responds to irrigation in a particularly favorable manner and can give high rewards for the labor and expense of irrigation, while it is also useful in the zones of chestnut and complex soils as a relatively salt-tolerant crop.

A certain amount of the area of the cultivated fields should be devoted to the sufficiently early-maturing varieties of soybean, which, under irrigation, yield good crops, are valuable predecessor crops and in addition can be used for forage (including silage).

It goes without saying that proper space should be assigned for forage root crops on those parts of the irrigated area that are suitable for this purpose (close to, or within, livestock raising Sovkhozes), and in particular to fruit and vegetable growing.

The combination of crops on the irrigated lands of the various natural zones of the trans-Volga may be summarized as follows:

Zone of southern chernozems: 3 years of alfalfa (or two of sweetclover); two years of wheat; a cultivated crop (corn, sugar beet, silage crops); and wheat -- with 42 percent of it in [redacted] crop rotation.

In the more southerly zone of dark-chestnut soils, while the same general character of crop rotation should be retained, somewhat



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greater attention should be paid to sweet clover, and, on the cultivated fields [redacted], to soy and sugar beet, with the possible introduction of harvested (pozhnivnoye) proso millet into the second [redacted] field before the row-cultivated crops.

In both zones, it is possible to allot a portion of the field after alfalfa to winter wheat, sowing it on late fallow, after turning under the stubble from the first alfalfa mowing.

Finally, in the third zone, with its light chestnut soils, and especially in the last zone, with complex solonetz soils (to the south of Kamyshin-Novouzensk, where the zone of irrigation will probably overlap with the "liman" area) it is desirable to clarify the possibilities of setting aside an area in rotation with the early-ripening varieties of rice, and also with oil crops and bast-fiber crops, while increasing the cultivation of forage and improving the natural pastures. The question of whether rice and the bast-fiber crops can be grown here requires preliminary experimental work.

The realization of the Great Volga project will be very essentially reflected in the direction of agriculture in the last and most southeasterly natural region of the Lower Volga Kray: the Volga-Akhtuba flood plain and delta with the adjacent belt of semi-desert steppe (embracing the former Astrakhan Okrug and the Leninskiy and Central [Sr.] Akhtubinskiy Rayons of the former Stalingrad Okrug).

The climatic conditions in this region are sharply continental. The extremely scanty precipitation (annual average value for Astrakhan only 160 millimeters, of which 47 millimeters falls during the May-July quarter), the high temperatures (25.5 degrees in Astrakhan in July), the strong drying winds and the evaporation, which exceeds by several times the amount of the precipitation, combine to produce extremely unfavorable moisture conditions, which permit agriculture



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(except on the Volga-Akhtuba flood plain and the adjacent areas with high ground water levels) only on the areas of depressed relief, or padiny. The soil cover, too, is unfavorable to agriculture, being composed of brown and complex soils of loamy and not infrequently solonetz character, with grass-mugwort vegetation in the northern part of the region; to the southward these soils gradually pass over into sandy loams and drifting sands, with the mugwort-halophyte and sand-habitat flora of the semidesert.

Spring wheat is the ruling crop in lowland agriculture, and gives extremely low yields. In the north of the region it has averaged 4 centners per hectare over many years, while in the South, in the former Astrakhan Okrug, this drops to 3 centners and below, with 11 years of crop failure during the past 37 years. Winter rye holds second place, especially on sand-loamy soils, and also gives poor yields. Gourds, proso millet and mustard are supplementary crops.

On the whole, animal husbandry is and will remain the leading branch in the semidesert part of this region, while farming is of very little importance. What there is is purely of a subsistence nature.

However, there are tracts within the confines of this region which can be of exceptional interest, under the influence of the Volgostroy and with proper reclamation, not only for the economy of the kray, but also on a national scale.

This is the Volga-Akhtuba flood plain and delta, which is subject to the excess watering by the waters of these rivers and is covered to a considerable extent and for a long period (20-60 days) by their floodwaters, and represents, in its various parts, various types of land, according to the relief: (a) the elevated, unflooded crests



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(and the delta hillocks), occupied by settlements and fields requiring irrigation; (b) the terrace along the flood plain, only slightly subject to inundation, with peaty, saline and solonchak soils, used for vegetable gardens and orchards; as well as considerable expanses of: (c) the inundated flood plain between the Volga and Akhtuba Rivers, with alluvial soils having surplus moisture and of meadow-bog character; and (d) the delta, at the mouth of the Volga, with transported bog-meadow soils, some of which are lightly saline in the most depressed locations, with il'men (lakes remaining from the floodwaters).

Proso millet, potatoes and a few late garden vegetables are the only crops that have time to ripen if sown after the recession of the floodwaters. However, with the proper reclamation to assure an entire normal growing season and eliminate the delay in sowing due to the inundations, very considerable areas of the Akhtuba-Volga flood plain and delta, and of the adjacent il'men territory, could be used for growing especially valuable crops and could become one of the most important agricultural regions of the Volga region; since it enjoys abundant warmth, a long frost-free period (on the average, 192 days for Astrakhan' and 169 days in the Akhtuba area), and immense resources of water for irrigation.

The construction of the Volgostroy will exert an influence towards the regulation and reduction in the volume of the floodwaters and towards the release for cultivation of the inundated lower reaches of the Volga. However, the lowering of the floodwaters should proceed only within definite limits, for if those limits are exceeded lower levels might be reflected in reduction of the volume of fertile alluvial deposits on flood plain and delta, increased activity of the sands, and sharply changed temperature conditions.



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Another means of improving the Akhtuba-Volga is the construction of embankments, which will be rendered necessary, to a greater or lesser extent, by the scale of operation of the Volgostroy dams.

Not only the extensive natural possibilities argue in favor of the transformation of the region into a region for growing valuable crops, but also the immense prospects for future progress, due to [redacted] the particularly favorable transportation facilities, the existence of energy resources to facilitate the organization of a local processing industry (canning and oil processing plants), and the possibilities of a rational link between farming, animal husbandry and the fishing industry of the region.

The land reclaimed and made available by this program should be used for the following crops, with varying emphasis on one or the other of them and with their combinations into types of enterprise depending on the varying natural and economic conditions in the various parts of the Akhtuba-Volga flood plain and delta.

Vegetable growing should occupy the first place, led by cantaloupes, tomatoes and peppers, which should be grown on the scale of one of the major vegetable areas in the USSR, and other vegetables should be grown to supply the local market in the large industrial centers (Stalingrad, the fishing industry).

Fruit growing (apricots, peaches, plums, and grapes) and cucurbit growing should go hand in hand with vegetable growing. Fruit and vegetable production should be connected with a major canning center, which should also process the products of the fisheries and of the steppe cattle raising.

Of the field crops, the greatest attention should be paid to the oil crops, the more so in view of the fact that natural conditions allow the production of precisely those crops that yield the oils of

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greatest use for canning, peanut, sesame, soybean, as well as a few others, including the castor bean.

The peanut, which yields one of the best edible oils, is valuable for canning fish (the poorer grades of peanut oil can be used for soap making) and needs light sandy loam and loamy soils, which are plentiful in this region, but it cannot tolerate even slight salinity. There is also a surplus of heat and light in the delta of the Volga. The length of the frost-free period in the southern part of the flood plain is also entirely sufficient for the early varieties of peanut (Valencia), even in years of very late spring morning frosts and early autumn frosts, for only about 135-140 days of growing season are required. According to the experiments of the Astrakhan' Station, peanuts give satisfactory crops, with a good yield of oil, under irrigation. Yields at experimental installations have run up to 20 centners, and are up to 12-15 centners per hectare in practical farm operation.

The most suitable lands for the peanut in the Akhtuba-Volga region are the light sandy loam soils of embanked il'men. When these soils are periodically inundated (the so-called "water fallow"), the peanut does not require irrigation, since it can utilize the subsurface moisture, but on the sandy loam (cucurbit growing) lands of the hillocks, irrigation is necessary. Like the legumes, the peanut is also of value in the rotations with other intensive crops, and with cucurbits.

Sesame is an oil crop which may be grown in this region as supplementary to the peanut, on the good soils of embanked il'men. The early varieties, with a growing season of about 115 days, should be used. The oil is used as table oil and in canning, with the inferior grades going for margarine.



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The soybean thrives on the hillock lands, with irrigation, and on embanked il'men, without irrigation. Soils must be free from salt in both cases, and must not be close to ground water. On the il'men lands it vigorously develops lush masses of forage, in consequence of the richness of the soils. This involves a certain impairment in the quality of the crop. The soybean may also be grown on more northerly parts of the flood plain than the peanut and the sesame.

The culture of rice and the new bast-fibers (kendyr) may come to have no less importance on the Volga Delta than that of the oil crops.

Conditions on the delta part of the Volga are favorable for rice. The maturation of its early varieties is assured by the great amount of heat and light. The rich alluvial soils help to produce a high yield and at the same time solonetz and solonchak soils are no obstacle for rice, while even the irrigation waters of the Volga do not contain harmful salts, and, if properly constructed, the "discharge outlets" for rice culture may even help to improve lands containing a certain amount of salt.

The fact that flood waters remain for more or less protracted periods on considerable stretches of delta land makes it very much easier to inundate the rice fields on the embankment areas, while the generally even topography also makes it possible to grow rice on a considerable portion, even without embankment, provided the land is flat and inundated for an extended period. In the latter case, conditions are especially favorable for cooperating with the delta fish breeding industries (with which embankment interferes) by assuring the availability of vegetable food for the fish fry, and at the same time these conditions facilitate the mechanization of rice culture by large scale "cheki".



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In selecting sites for rice culture in the delta it is necessary to bear in mind, however, that to assure the normal level of the water during the period of inundation it is very important to keep percolation through the soil, and especially through the subsoil, as low as possible. Stratification of the alluvial deposits is characteristic of the wet-meadows [zaymishcha] and delta; the presence of heavy argillaceous underlying strata cannot be relied on, though the fact that waterlogging and gleying exist on considerable expanses forces us to postulate the presence, in places, of impervious underlying strata, capable of retaining the waters on inundated rice lands. In any event the nature of the soils and subsoils in the Volga delta deserves special attention when selecting sites for rice culture.

We are compelled by the existence of naturally growing thickets of kendyr in the Volga-Akhtuba region to assume the possibility of successfully cultivating this perennial there. Its fiber, when properly processed, is especially rot-resistant and can be used for making fishing nets, as well as for other purposes.

Kendyr stands inundation well, and can be grown on low-lying sites, even without embankment.

The question as to the chances of large scale cotton growing is somewhat more complicated. Since precipitation is far too scanty to accelerate maturation, its unirrigated cultivation is impossible here. Although the average length of the frost-free period is very considerable in the delta, as we have already pointed out, years do occur in which meteorological conditions are very unfavorable and the growing season of the usual early Turkestan varieties (which is generally 22-18 days longer here than in Turkestan) is badly delayed, so that a large part of the harvesting must be done after the first



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frosts. However, the work of selecting new and earlier varieties, and the new techniques for growing this crop (transplantation of seedlings), may very shortly result in accelerating its maturation and making its cultivation in this region look promising. For the time being it should now enter the stage of mass experimentation, being primarily adaptable to the substeppe il'men on the west side of the delta.

In the specialization of the various farms of the region of some of the leading valuable crops, the incidental supply of forage for the animal husbandry of the adjoining semidesert stretches must also be kept in mind. In this respect the growing of alfalfa could play a great role, together with that of sweet clover, which is also necessary in many cases for considerations of crop rotation and soil regeneration, and soybeans, as well as the utilization in animal husbandry of the by-products of the oil crops and industrial crops (silage and oil-cake).

The specialization of the subregions within the Akhtuba-Volga flood plain and delta, with proper reclamation and taking advantage of the influence of the dams, may be summarized as follows: (1) the Stalingrad suburban subregion of vegetable gardening and dairy farming, with vegetables grown for local consumption and intensified forage production; (2) the vegetable and fruit subregion of Kharabalinsk-Sasykol'sk, in the central part of the flood plain, as one of the major bases of vegetable production (for canning) in the USSR; (3) the large subregion in the central and lower parts of the flood plain where the oil crops are dominant; (4) the Astrakhan' subregion of southern vegetables, fruits and vineyards; (5) the rice and kendyr region on the Volga delta, which is connected with the zone of fishing industries; (6) a possible subregion of cotton predominance



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on the western substeppe il'men, but only in the future, after clarification of the results of mass experiments and discovery of ways to achieve more accelerated maturation.

## XVI. THE CENTRAL-CHERNOZEM OBLAST

Within the confines of the TsChO (Tsentral'no-Chernozemnaya Oblast') soil and climatic conditions vary over a very considerable range, especially in passing from the well-watered zone of northern wooded steppe in the northwest (where forests are liberally included, especially in the former Orlov Okrug) towards the southeast, with gradual reduction in precipitation and gradual change in the character of the vegetation, up to the Rossoshansk Okrug, where there is already a typical arid steppe on southern chernozems along its boundary with the former Donets Okrug of the North Caucasus.

The characteristic economic features of the TsChO, as compared with the other krays and republics, are as follows: predominance of the agricultural industry over other branches of industry; a marked density of population; and, in connection with this and with the favorable natural conditions, the particular importance of the industrial crops, which facilitates the successes of collectivization and the development of the sovkhoz sector.

The keynote of the national economy in this oblast is sounded, and will, during the near future, continue to be sounded by agriculture and the agricultural processing industry, which produces 75 percent of the total production of all industry in the TsChO. The beet sugar industry stands in first place, followed by oil-milling, potato processing, flour milling, distilling, makhorka tobacco preparation, rope and cordage manufacture, etc.

However, together with the expansion of the agricultural industry,



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there are also data for the prospective expansion of other branches as well.

Unfortunately the TsChO has no power resources of its own, and the construction of the great Lipetsk, Kursk, Voronezh and Tambov power stations (which are necessary for the agricultural industry also) is closely connected with the transportation of outside coal from the Donets Basin.

The existence within the TsChO of the so-called "Kursk anomaly" indicates immense deposits of iron ore, which are unfortunately at deep levels but offer prospects for the possible solution of the metallurgical problem. In the near future, the Lipetskiy Rayon, with its metallurgical plants operating on their own ores, will be of great significance for the organization of the manufacture of agricultural machinery (tractors and agricultural machinery for the cultivated crops).

There are large deposits of phosphorites, though of low grade. This makes it possible, with proper processing, to supply the agriculture of the province (especially sugar beet, hemp and potato growing), operating on wooded steppe chernozems and leached chernozems, with phosphate fertilizers, which may be supplemented by Thomas slag, which is a by-product of the Lipetsk plant.

The TsChO, especially its western and northwestern parts, is one of the most densely populated parts of the USSR, which makes further industrialization of the oblast expedient, and, at the same time, favors the development of intensive industrial crops -- sugar beet, sunflower, potatoes, hemp, and corn — which even with mechanization require a greater amount of labor than the grain crops. The absence of free and unappropriated land as well as the high proportion of acreage under cultivation demands the development of agriculture



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along the lines of intensification and of expansion of the sowings of the industrial crops, which, also because of the natural conditions, have every reason for giving good crops of high quality.

The development of collectivization and of the sovkhoz sector, (with its establishment during 1932 in the grain areas of the oblast) on over a million hectares of lands of the Soyuzsakhar, the Svinovodtrest, the Zernotrest, the Ptitsetrest, etc., will facilitate the introduction of agricultural specialization in general and in the direction of the industrial crops in particular.

In the allocation of crops for the oblast with a developed agricultural industry, we should take into account not only the natural conditions but also the present existence of plants and centers of industries processing the various types of agricultural raw materials.

The predominance of the agricultural industry within this oblast will make for the general orientation towards a complex of large agricultural enterprises with the primacy of the industrial crops (especially sugar beet, sunflower, hemp and potatoes), together with the processing of the raw materials derived therefrom, and the development of animal fattening industries (hog breeding, poultry farming, and to some extent dairy farming) based on the residues and culls and on the by-products from the agricultural industry, supplemented by the production of forage crops.

Although the various specializations in field crops for the different regions appear expedient for the TsChO, as we shall see below, where these are considered as a whole for the entire province, the following changes in the relative importance and proportions of the individual crops may be noted as desirable:



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First in order of importance is the necessity for vigorously increasing the harvests of the industrial crops: potatoes and hemp in the north, sugar beet in the southwest, sunflower and corn in the southeast.

Among the grain crops, it is necessary to expand the sowings of winter wheat as much as possible, particularly in the southwestern half of the province, which has a milder climate (as far as the Don River), and it is also necessary to advance its area more cautiously into the northern section and into the eastern section beyond the Don, using sufficiently winter-hardy varieties.

Special attention should be paid to the development of the leguminous crops, especially lentils, and, to a lesser extent, of peas and kidney beans, and, in connection with the demands of hog breeding and poultry raising, and in part also of cattle breeding, the production of forage should be forced ahead, and silage crops, grass sowings and root-crop plantings expanded in every possible way.

The expansion of these sowings may be mainly accomplished by increasing the rate of seeding in the less arid parts (green fallows) and in part by reducing the sowings of such relatively less valuable crops as winter rye, and, especially, proso millet and buckwheat.

Although proso millet gives high yields here, it belongs, basically, because it is a drought-resistant crop, as a standby crop to the immense expanses of the particularly arid parts of the Lower Volga and Kazakhstan, in view of the uncertainty of wheat harvests in those regions. But in the Central Chernozem Oblast its sowings should be drastically cut, and should be restricted to a small



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percentage, and sown exclusively in poultry-farming regions. Buckwheat, also, can be transferred to the poorer sandy and sandy loam soils, to which it adjusts itself better than other crops.

The province may be divided schematically into the following regions, the natural peculiarities of which, and the consequent selection of crops for which, should be studied in planning the specialization of the economy under the decisive influence of social-economic factors.

XIV(1) A transitional wooded steppe, with forests and islands of broad-leaved trees, passing over into forest region, with degraded chernozems (forest loams) and their leached variants. It embraces the former Orlov Okrug, the northern parts of the former Kursk, L'gov, Tambov and Voronezh Okrugs and the larger part of the former Kozlov Okrug and represents the immediate continuation of the corresponding region of the southern part of Moscow Oblast.

In its western part the region has a relatively mild climate and suffers only slightly from drought, with average annual precipitation of 500-550 millimeters, of which 175-200 millimeters fall in the growing season, a moderately warm summer (20 degrees in July) and a not-too-severe winter (from minus 9 to minus 10 degrees in January). The relative humidity is adequate, with mean values of 53-55 percent at 1 p.m. in June. The eastern part of the region is more arid, with average annual precipitation 450-500 millimeters, of which 150-175 millimeters fall in the growing season.

The leading crops throughout the entire region should be, [redacted] of cereals, winter rye and oats (Moskovskiy A-0315 and Shatilovskiy 056) and, [redacted] of industrial crops, potatoes, and, in the western part, also hemp.



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Strong infestation by the Swedish fly makes it impossible to grow spring wheat and barley (and, according to data of the Shatilovskiy Station there is also infestation by the "fuzariosa"). Oats, which give relatively high and certain yields here, should therefore be continued as a leading crop. Winter wheat is not entirely reliable, especially in the eastern part of the region, and may be extended only with the use of the most suitable varieties such as Eritrospermum 0917 for the west and Lyutestsens 1060/10 for the east, through introduction on the best, heavier soils, on which it can give higher yields than rye.

The western part of this region, to the north of Kursk and in the former Orlov Okrug, should become a major center of our hemp culture, both with respect to size and quality of harvests.

Although potatoes still give lower average yields than in the other western and northern oblasts of the Soviet Union, these yields can be greatly increased by introducing better agrotechnical methods and especially by introducing more productive forage and industrial varieties, inasmuch as this crop here should be grown primarily for industrial processing and to some extent for forage, but not for human consumption.

Sugar beets should be a supplementary crop in the southern part of the region. This is also one of the main regions for the development of lentil growing. Spring vetches may also be grown as a seed crop.

The growing of forages and the development of animal husbandry, including hog breeding and goose raising, is favored by the relatively good precipitation. The primary forage crops should be clover with timothy, vetch mixtures and brome grass for hay and green forage; as root crops and tubers, potatoes and mangel-wurzel; sunflower and,



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to some extent, corn, for silage. All these crops should be expanded by every means, both here and in the following wooded steppe regions of the TsChO. Mixtures of meadow grasses should be sown on the flood plain sites.

XVI(2) Region of northern wooded steppe of (a) leached chernozems in the former Yelets Okrug, the eastern part of Kursk Okrug and the northern part of Starooskol'sk Okrug; and (b) rich chernozems of the southern parts of Kursk and L'gov Okrugs and the western part of Belgorod Okrug.

The climate of this region is somewhat milder, especially in the southern part (b) and the soils are somewhat better, than in the prceding region.

Sugar beet growing should be the keynote of the agriculture of the region, particularly in its more southerly part. Though the sugar content of the beet declines progressively from the southwest (from the Ukraine) towards the northeast (towards the former Tambov Okrug of the TsChO), its productivity in the southern part (b) of this region is no lower than in the sugar beet regions of the Ukraine. Not only in the southern part is this true. According to the data of the Sakharotrest for 1924-1928, the same phenomenon is observed even in the former Voronezh Okrug. Although the yield of sugar per hectare may be lower for the TsChO as a whole than the Ukraine, it is almost equal to it in the southwestern part of the oblast in Kursk Rayon, according to data for 1911-1915. The industrial center of gravity formed by the majority of the plants is likewise concentrated in the southwest.. The southwestern area, supplemented by the region to the east of Voronezh (situated within the former Voronezh Guberniya), thus advances to the first rank among the regions where natural



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conditions make sugar beet growing possible.

In the northern part (a) of region XVI(2), potato growing should be continued on its present scale, while in subregion (b) it, and likewise hemp, should only be supplementary to sugar beet as an industrial crop.

The productive specialization of this region should be of the sugar beet-winter wheat type, accompanied by dairy farming, based on the fodder supplied by the residues from beet sugar production (molasses and oil-cake), the residues of the grain industry, and by the growing of forage and silage crops.

Together with the sugar beet and the primary grain crops, oats (Pobeda variety) and rye (Nemyshlyanskoy variety), rye being subject to some reduction, vigorous attention should be given to the expansion of acreage of winter wheat at the expense of rye. The main variety should be Eritrospermum 0917, with Dyurabl' being permissible for the northern part and Ukrainka for the extreme southwestern part.

Legumes should consist of peas, spring vetches as a seed crop, and, on a smaller scale, lentils.

The development of cattle breeding based on beet sugar residues should be supplemented by such forage crops as esparsette, hybrid alfalfa (and clover in the northern part) and winter vetch mixtures, mangel-wurzel and potatoes with corn, sunflower, etc., for silage, and in the southern part Sudan grass and soybeans (primarily for forage). Meadow-grass mixtures should be sown on the flood plain.

Although the earliest varieties of corn as a grain crop, such as Burley Kaunti (Burleigh County), can yield sufficiently high harvests here, their primary use should be for hog fattening. Large scale sowings of corn for grain are hardly advisable, in view of the frequent



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necessity for drying the harvest and of the difficulty of competing with sugar beet. But all the greater attention should be paid to corn as a silage crop -- Minnesota 23 variety.

XVI(3) Southern wooded steppe with rich chernozems of the eastern part in the former Belgorod Okrug, the southern part of the former Starooskol'sk Okrug, the southern part of the former Voronezh Okrug, the northwestern part of the former Ostrogozhsk Okrug, the larger northern part of the former Borisoglebsk Okrug and the southern parts of the former Kozlovsk and Tambov Okrugs.

The climate is more arid than in the preceding zone. Precipitation in the May-July quarter averages 135-160 millimeters. Average annual precipitation for Voronezh is 457 millimeters. Summer is hot (21 degrees in July) and the relative humidity at 1 p.m. in June is only 51-52 percent. Winter is cold, from minus 9 to minus 11 degrees in January and snow is frequently insufficient, resulting in damage to the winter crops through freezing.

The leading crops for this region should be winter rye (permissible variety Shatilovskaya) and oats (Pobeda variety with Pobeditel' Dippe being permissible) which should be reduced, also sugar beet in the northern part and sunflower (Fuksinka, Voronezh 10 and 3 varieties) in the southern part. Both of these crops should be expanded as much as possible.

The average yield of sugar beet for sovkhozes of the so-called Eastern Division of Soyuzsakhar, mainly in the former Voronezh Okrug, has been even higher during the past five years than in the former sugar beet region, and for this reason expansion of sowings is desirable and may be intensified in that part of this region (in the ring formed by Voronezh, Yelets, Gryazi, Tokarevka and Anna) where



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sugar beet processing plants already exist. Supplementary industrial crops are potatoes and makhorka tobacco, and coriander, poppies, mustard, gold-of-pleasure, and squash should serve as secondary crops.

Special attention should be paid to the mass introduction of sufficiently winter-hardy varieties of winter wheat (Gostianum 237), and, subject to this condition, its culture on the right bank of the Don should be pushed forward by all means. More risk, however, is involved in planting it on the left bank areas, where winter is more severe and there is less snow, even where more winter-hardy varieties (Lyutestsens 01060/10) are used. In the more southerly parts of the region the advance of the Cesium 0111 variety of spring wheat is possible, as this is more resistant to the Swedish fly, but for the time being only as a minor crop. To further the development of cattle breeding, sowings of hybrid alfalfa, brome grass, esparsette and Sudan grass should be undertaken, as well as of the root and silage crops of the preceding region. Proper attention should also be paid to growing the earliest varieties of corn as a grain crop such as Burley Kaunti (Burleigh County), with North Dakota in the south, particularly in the southern non-beet growing part of the region. Meadow mixtures should be used for the flood plain.

Vigorous support and development of lentil growing are necessary. In the former Tambov Okrug lentils are also an important export crop. Proso millet, buckwheat, peas and vetchlings should be grown as secondary crops.

The economy of the region has a transitional character with respect to [redacted] of production types. In the northern part, it is a beet sugar economy. In the southern part it is a sunflower-wheat-hog-breeding economy, with feed based on corn and residues from the oil-processing industry, and with possible development of poultry farming.



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XVI(4) A region of semi-arid mixed grass steppe with ordinary chernozems, including the southeastern part of the former Ostrogozhsk Okrug, the southern part of the former Borisoglebsk Okrug, and the whole of the former Rossoshansk Okrug, and in its southernmost part to an arid steppe with southern chernozems at the boundary of the former Donets Okrug. Precipitation during the May-July quarter is only 150 millimeters, and 400 millimeters for the year, with July temperature 21 to 22 degrees and relative humidity 47 to 50 percent in June. Though winter is not colder than in the preceding region, the snow cover is considerably shallower.

The arid climate does not permit sufficiently successful sugar beet growing. This is already a typical region of the spring wheat area, with the leading crops being spring wheat (Gordeiforme 010, Cesium 0111, and Lyutestsens 062) and sunflower (Zelenka of the Khar'kov Station and Fuksinka 10 of the Voronezh Station).

Winter wheat can successfully compete with spring wheat here, especially on the right bank of the Don, where it can give sufficiently reliable and much higher yields -- up to 50 percent higher than spring wheat, if winter-hardy varieties are sown, such as Gostianum 237 and Lyutestsens 01060/10. Sowings of winter rye, which still continue here, will be displaced by winter wheat.

Sunflower should be the basic industrial crop of this region. According to statistical data, its average yield in 1925-1928 was 8 centners per hectare in the south and southeast of the TsChO, 7.1 centners in the North Caucasus Kray, and 6.0 centners in the Ukrainian SSR and on the Lower Volga. The higher productivity of sunflower in this region as compared to other regions is confirmed also by data from the experimental stations. It would, however, be undesirable to force



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sunflower production or to increase the density of its present sowings by more than 15 percent until varieties resistant to the "malignant" chokeweed are generally available, since there are a number of regions within this sunflower area of the TsChO where infestation by this parasite is particularly severe. However, the recent experiments of L. A. Zhdanov at the Rostov Station have already resulted in varieties resistant to this parasite, thereby eliminating this difficulty.

Measures should also be taken to expand considerably the sowings of corn for grain, as a supplement to sunflower, for corn can give here sufficiently high and reliable yields. The early varieties of Falconer and North Dakota should be sown. This is especially necessary in those parts of the region where the density of sunflower sowings has been very much increased, and this crop often placed in the first position, and where subsequent severe infesting of the fields by chokeweed has been noted, forcing postponement of the further expansion of this crop until the development of varieties completely resistant to chokeweed.

Barley should retain its present position in the southern part, because of its good yield here, which is relatively not far behind that of corn, for use as a supplementary ration in fattening for bacon; and also for export. Varieties are Pallidum 043 and Medikum 026, the latter mainly for unmechanized farms; while Kol'khikum 010/30 may be sown in areas nearer to the north which suffer less from the Swedish fly. Smooth (golyy) barley, which gives relatively good yields here, is also of interest.

The growing of the soybean is already possible in this part of the TsChO, but only as a secondary crop, in view of its insufficient and uncertain yield. The early varieties Krushulya 9/3, Mandarin and



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Kharbinskiy 199 should be sown. Development of anise and coriander crops is desirable.

Oats give poor yields in this arid region, and its sowings may be reduced to zero. If desired, however, the more drought-resistant variety Leytevitskiy should be sown. Legumes do badly. Proso millet is permissible.

For forage, the following grasses should be considerably increased: hybrid and blue alfalfas, brome grass, esparsette, Sudan grass, corn for silage, fodder squash, soybeans and sorghum for green fodder and silage.

Measures to anchor the sands are necessary over considerable areas of the Don River region.

The basic direction of the agriculture of this region is sunflower-grain, and hog breeding, with development of poultry farming and both beef and dairy cattle farming based on forage from the residues of the oil-pressing and grain industries, corn and the forage crops.

## XVII. THE NORTH CAUCASUS KRAY

In its natural and agricultural aspects, the kray is divided into a number of zones and regions. The distribution of the belts depends, on the one hand, on the influence of the arid Caspian semi-desert to the northeast, and, on the other hand, on the moderating effect of the Caucasian chain, which also influences the allocation and character of the altitude zones closest to it.

Corresponding to these zones and regions of the North Caucasus there are belts which, in the northern section, run from north to south, parallel to the semidesert, and, in the southern section, run from northwest to southeast in the direction of the chain of the Caucasus Mountains.



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The characteristics of the soil conditions and climatic conditions of the separate natural regions of the North Caucasus will be given in the following descriptions.

In the projected allocation of crops and the agricultural specialization of the regions, in addition to the natural peculiarities of the various parts of the kray, we start from the following basic assumptions.

The North Caucasus is a kray of unbroken collectivization, with the Sovkhoz sector powerfully developed, and with especially favorable conditions for the mechanization of agriculture and for the cultivation of a number of very valuable crops. The increase in agricultural production in this kray, which represents the very granary of the USSR, thus has a profound significance and is intimately connected both with the efficient redistribution of crops and the closest, most detailed and universal attention to the improvement of the agricultural techniques used in their cultivation.

Inasmuch as this is a kray which combines large-scale commercial agriculture with an expanding extractive and processing industry, any project for the allocation of crops and the agricultural specialization of the various regions must very attentively take into account, on the one hand, those possibilities of which agriculture can take advantage in the course of the development of industry in the kray, and, on the other hand, the demands which will be made on it with respect to raw materials for that industry and in relation to the interests of the consumers of its production.

In the field of industrialization in the North Caucasus, the fuel industry takes first place. It is closely connected with [redacted] power resources, which, among other consumers, also serve agriculture itself.



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Part of the Donets Basin, included within the confines of the kray (in the former Shakhtiy Okrug), forms the center of the coal-mining and metallurgical industry which furnishes the basis for the electrification of the Donets Basin itself as well as for the region of the city of Rostov with its major industrial enterprises. The oil industry is a second source of power, and is located in the foothills parallel to the chain of the Caucasian range.

The Grozniy region is second in the USSR only to Azneft' as a source of petroleum products and is first in the production of gasoline, being supplemented by the Maykop installations. Finally, in the mountainous regions of the kray, the "white coal" from the mountain rivers is an important source of energy, on the base of which the Gizel'don and Baksan hydroelectric stations are being constructed and the Sulak station is being planned.

Coal and petroleum products -- the power resources of the North Caucasus Kray -- which are of immense significance for the whole of the USSR, also make it possible to supply fuel for a mighty expansion of the mechanization and tractorization of the agriculture of the kray. At the same time they provide a base for the electrification of two major branches of North Caucasian industry, the manufacture of agricultural machinery and the food industry, as well as agriculture proper.

The Shakhtiy, Grozni and Krasnodar power stations, together with a number of hydroelectric stations in the foothills, are the major centers of electrification. All of them, in the field of agriculture, make it possible to electrify the specialized processes of production -- in dairy farming, hog breeding, poultry raising -- while in the interests of plant cultivation the repair workshops



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of the MTS and the Sovkhozy serve the cleaning and grading of the seeding material, the primary operations with some crops, and also, to some extent, the threshing of the harvests. Electrification can be of particular importance for agriculture in the foothill regions (north Osetiya, the former Maikop Okrug) where the most immense possibilities for the development of the valuable industrial, fruit and vegetable crops are linked to the supply of electric power from the great superpower stations (especially the hydroelectric plants) at exceedingly low rates. A number of farming enterprises here could be provided with not only full stationary equipment for electric power but with experimental field loading as well. This possibility should be studied in drawing up a regional plan (for instance, in the Maykop seed-breeding region).

The giant establishments in the kray for manufacturing agricultural machinery -- Rostsel'mash with its production of hundreds of thousands of agricultural machines and tractor trailers, the Rostov combine plant, the Armavir plants and others of nationwide importance -- should in the first place assure the complete mechanization of the agriculture of the kray, including that of the cultivated industrial crops, where the need is especially urgent and acute.

The Donets Basin, Grozniy and Maykop installations, together with the industrial centers at Rostov and elsewhere, which assure the supply of energy and instruments of production to the agriculture of the kray, demand in turn from that agriculture the proper production for the consumption of the industrial population. In particular, in formulating the project for the allocation of crops, special attention should be paid to the development of vegetable growing, the cultivation



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of edible potatoes and the supply of forage for dairy farming.

Together with the fuel and metallurgical industries and the manufacture of agricultural machinery, the various forms of the food-processing industry are also of major significance for the kray: flour-milling, oil-pressing, canning, beet sugar, starch and glucose and other corn product processing. With the closest coordination effected between the regional distribution of crops and the allocation of the processing plants, the volume and quality of the raw materials for such plants derived from corn, sunflower, soybeans, new bast-fiber plants and the other industrial crops, should play an especially essential part in the industrialization of the agriculture of the kray. Thus, the location of the Beslanstroy and the organization of major corn combines at Armavir should exert a powerful influence in the specialization of the adjoining regions to corn and in the work of selecting corn varieties; while the tempo of the northward advance of sunflower from the south of the kray, the development of soybean cultivation and so on, are intimately related to the existence of plants to process their respective products.

The intimate connection between plant cultivation and animal husbandry makes the proper location of crops and animal husbandry [redacted] interdependent. In connection with the variation in natural and economic factors, the major branches of the latter may be planned as follows:

Hog breeding, connected with corn growing, is primarily for the zone of sufficient but not always certain moisture, and in combination with corn, potatoes and pasturage, in the forest steppe, foothill and forest zone of the highlands.

Dairy farming, especially fresh milk dairying, around the



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industrial centers (Donets Basin, Groznenskiy and Rostovskiy Rayons) and also in the foothills and highlands and, in general, in the zones with more or less sufficient precipitation demands special attention to the nature of the plants furnishing succulent forage (silage, root crops, perennial grasses). The same is true of the meat and dairy animal husbandry of the semiarid steppe zone of the kray.

Beef cattle ranching and sheep raising for wool in the particularly arid steppe and semidesert regions of the northeast and the east of the kray require the successful development of drought-resistant forage crops to supplement the native steppe forages and the by-products of the grain industry. Finally poultry raising is also linked with the corn economy, with urban and health resort regions.

The existence within the kray of nearby ports for the most facile and inexpensive export of agricultural products makes it necessary to continue the cultivation of hard wheat and barley and favors the production of legumes for export.

The efficient location of field crops in the kray is intimately connected with the other measures to improve their stability of yield and their quality. The most important of these measures are:

1. Improvement of agricultural engineering in general, and, in particular, application of all measures to control weed growth, especially in zones with sufficient precipitation. The major significance in this respect should be assigned to the introduction of proper crop rotation with the cultivated crops (with proper inter-row tillage a prerequisite condition), and with the perennial grasses, which also require suitable and timely tillage of the fallows, together with suitable and timely seeding.



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Selected seed stock should be substituted, without exception, for mixed and impure varieties now in use. This should play a great role, for in those zones of the North Caucasus where precipitation is sufficient, this factor has a greater effect on productivity than in the other krays of the USSR. In the more or less sufficiently watered regions, the application of fertilizer can also have a certain importance -- mineral fertilizers (superphosphates) being included, for use, in the first place, on vegetables and industrial crops -- beet, cotton, kenaf, tobacco, and so forth. According to data of the Rostov and Kuban stations, it should also be used on winter wheat.

2. The further development of mechanized agriculture, not merely quantitatively, but also qualitatively, should play an exceedingly important role. Mechanization as complete as possible is especially important in the North Caucasus to assure the rapidity of field operations, and in particular to assure timely sowing and very rapid harvesting (as a means of checking losses and to guarantee the timely delivery of export grain to the world market). Finally, mechanization is an absolute prerequisite for the success of cultivated crops on large tracts. Exceptional attention should be paid to the supply of machinery to assure not only the rapid but also the best tillage of the fields (as a means of weed control), and to the availability in proper numbers of efficient trailer attachments to tractors for sowing, inter-row cultivation and especially for the harvesting of cultivated and industrial crops.

3. The expansion of the cultivated acreage of the North Caucasus Kray is possible at the present time principally by reclamation in two directions:

a. Organization of irrigated lands in particularly arid regions of the kray, used primarily, for the time being, for animal



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husbandry;

b. Reclamation of the low banks, islands and flood plains (on the lower reaches of the great rivers of the kray), now utilized for cultivation, as a result of the annual inundations by the floodwaters, [redacted] only to a small extent and at great risk.

The problem of the Don and Manych Rivers has first priority in this respect. When the Manych Canal, which will be fed by the waters of the Don and Kuban', is constructed, it will not only open up major perspectives in the fields of navigation and water supply, but will also make it possible to irrigate, already during the Second Five-Year Plan, up to 600,000 hectares of land, situated within a very arid zone of the kray, and supplemented by some additional acreage where irrigation will be possible from the waters of the Sal River. With proper reclamation of the downstream areas of the Don and Aksaye Rivers (by embankment, drainage and correct irrigation), as much as 300,000 hectares of downstream floodland and wet meadow can be used for valuable crops.

The realization of the Terek-Kuma canal project can be of vast significance for the utilization of new lands, with the irrigation of the adjacent semidesert wastes of the Dagestan Republic from the waters of the Terek and Kuma Rivers and the formation of new forage reserves on irrigated lands for local animal husbandry.

The Malo-Kabardinsk, Alkhangurt and Digor systems now under construction are mainly important not for irrigation but for drainage and can have far less significance for agriculture, since precipitation in the regions affected is sufficient.

In view of the exceedingly wide range of variation of climate, soil and relief conditions within the kray, and the possibility of



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very different directions being taken by agriculture in different regions, it is difficult to give a generalized statement of the specializations which would be desirable in connection with the reconstruction of agriculture in the kray.

Bearing in mind, however, the fact that the position of greatest importance in the agriculture of the North Caucasus belongs to the sufficiently watered regions, which sound the keynote for the agricultural possibilities of the entire kray, it may be said that the major perspectives for the future agricultural development of the kray lie in the area of the maintenance of present acreage and the increase in yield of winter wheat, which is a promising crop here, and in the expansion and distribution, by all possible measures, of corn and the industrial crops, as well as of those forage crops which can serve as the base for the development of hog breeding and large scale livestock raising.

Accordingly, priority should be given to the maximum possible expansion of acreage in the following crops: corn, soybean, castor bean, kenaf, [redacted] sesame, peanuts, and tobacco, and also of cotton and rice, grasses and root crops, as well as kidney beans among the legumes. Such acreage must be located in those regions which actually offer possibilities for the crops in question, and where natural and economic conditions are sufficiently favorable.

Expansion of the kray's acreage in winter wheat is desirable, but in all cases and under all circumstances it should at least be maintained at its present level, while expanding the industrial crops. The size and certainty of winter wheat harvests in the sufficiently watered zone of the North Caucasus forces us to refrain from any reduction in this crop, which [redacted] serves as a major [redacted] reserve for the event of a failure of the winter wheat crops



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caused by unfavorable wintering conditions in other parts of the USSR and of the event of poor harvests in the southeast because of drought.

It may, moreover, be entirely advisable to cut the acreage in rye to a minimum, except in the northern and northeastern regions of the kray, where drought and lack of snow may make the sowing of rye seem completely unavoidable, at least until the introduction of more drought-resistant and winter-resistant varieties of winter wheat than are at present available.

In connection with the prospects for the gradual advance of spring wheat to the east into the wooded steppe and steppe regions of the trans-Ural, Siberia and Kazakhstan, its relative importance among the other crops of the North Caucasus may be diminished. In the region of the Don River, it should, together with rye, gradually give way to the winter-resistant varieties of winter wheat; and the possibilities for this, even at the present time, are sufficient. In the more watered regions, too, (Kuban'), corn and the industrial crops may be grown.

The same observations apply to spring barley.

The actual acreage now in each of these spring crops, however can hardly be reduced, bearing in mind that some regions of the kray are interested in the higher yield of hard wheat as compared to soft wheat, while other regions are interested in the high yield of barley (including winter barley). The great export possibilities for hard wheat and barley and the proximity of the seaports forces us to refrain from reducing the acreage in these crops, but at the same time every effort should be made to transfer them to the more northerly regions of the kray where conditions are not so favorable for the industrial crops.



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Bearing in mind the general advisability of expansion of acreage and shifting of the sunflower to suitable regions of the Central Volga, the Bashkir Republic, and especially Western Siberia and Kazakhstan, on the one hand, and the prevalence of chokeweed affliction affecting this plant in a few parts of North Caucasus, on the other, we should refrain from any further forcing of this crop in the kray.

Acreage under oats and proso millet should be reduced as much as possible.

In the course of our further exposition, we shall proceed in order from the more arid parts of the Northern Caucasus, bordering on the Lower Volga Kray, with gradual transition to better watered regions as the Caucasus mountain range is approached.

XVII(1b) The extremely arid grass-mugwort steppe with the complex solonets light-chestnut soils of the eastern part of the former Sal'sk Okrug and along the northern boundary between Stavropol' and the Kalmyk Oblast, represents the immediate extension of the adjacent extremely arid region of the Lower Volga, to which it is in all respects analogous.

The extreme aridity of the climate and the unfavorable soil conditions give agriculture here an almost exclusively cattle breeding character and permit crops to be grown only in the best-watered locations and under irrigation.

In those cases where sowings are made, the preferable crops would be proso millet, the drought-resistant spring wheat varieties Melanopus 069 and Eritrospermum 0841 and 0341 and the local winter rye, and also the more drought-resistant and winter-resistant crops for conditions of little snow -- Indian mustard, pumpkins and safflower.



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On cattle ranches the most drought-resistant forage crops should be sown: for hay: yellow-flowered alfalfa, Triticum crystatum (zhitnyak) and Sudan grass; for silage: sorghum, sweet clover, forage squash and watermelons; for succulent fattening rations: winter rye, Sudan grass, sorghum and yellow-flowered alfalfa.

There is some possibility for the expansion of agricultural cultivation in the event of the construction of an irrigation network along the Sal River.

But especially good prospects for the reclamation of land for cereals and forage crops -- and to some extent for the industrial crops also -- will be afforded in the event of the solution of the Manych River problem. It assumes the construction of a canal in the valley of the Manych to link the Aral and Caspian Seas, and the formation of an immense reservoir fed by the waters of the Don River system and from the upper reaches of the Kuban' through the Kalaus River. If this project is realized, it will open up the vastest possibilities, particularly for the development of cattle ranching in this region and on the adjacent Kalmyk steppe, because of the very considerable reserve of forage which could be obtained from sowings of forage crops on irrigated land.

XVII(1a) The very arid southern-feathergrass steppe with the chestnut soils of the eastern part of Shakhtiy Okrug, the central part of Sal'sk Okrug, excepting its western part, and the northeasternmost part of Stavropol'.

The relatively low precipitation (average value during the May-July quarter 100-125 millimeters and average annual value 325 millimeters and lower) with high summer temperatures (average July



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values 23.5 to 24 degrees) make the region very arid during the growing season of field crops (relative humidity 40-45 [sic] percent and lower). It is no less unfavorable for winter crops, for snow is scanty (with depth of snow cover only 10-20 centimeters at the end of winter), while January temperatures are minus 6 to minus 9 degrees. For these reasons cultivation here is most unpromising, with frequent crop failures; and the region represents a transition to the region of pasturage for cattle raising and sheep raising that lies further to the east.

Field crops are spring wheat, sunflower and gourds, with some proso millet and rye.

Though spring wheat growing here involves risk because of the droughts, it must nevertheless be recognized as the leading crop, the more so in view of the fact that there is still much waste and virgin steppe here, on which hard wheat gives good results, though on long-cultivated land here its yield is considerably lower than that of soft wheat. The recommended varieties are the more drought-resistant Melanopus 069 and, of the soft wheats, Eritrospermum 0841 and 0341.

Winter wheat can practicably be grown here only if the most winter-resistant varieties are sown - Lyutestsens 1060/10 and 0329, with the higher yielding Gostianum 237 for more favorable locations. But there is some risk of winter killing. Thus, if it should be necessary to sow a winter field, the crop will have to be rye, and sufficiently winter-resistant varieties should be used. To prevent winter killing snow retention works are extremely desirable, as is experimental sowing of the winter crops with a trench seeder.

Forage barley of the Pallidum 043 and Medikum 026 varieties should be kept in mind as supplementary crops. The latter, which is



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of the best productivity and highest quality, is of low stature and therefore can only be grown on unmechanized farms.

Among the row crops attention should be paid to the further development of cucurbits (!), sunflower (Saratovskiy 169), safflower, which gives a large late harvest here, and corn, which should be followed by spring wheat but not by winter wheat. The latter should be sown exclusively on bare fallow (or on corridor fallow). The special forcing of corn is, however, inadvisable, since its yield is low -- considerably less than that of barley -- because of the arid climate in general and in particular during the blooming and ripening periods of corn (precipitation during the July-August quarter being 30-70 millimeters). Varieties of corn are North Dakota, Fal'koner and Ivory King (Ayvori-King).

Oats may be grown only for local consumption (for horses). The variety planted should be Leytevitskiy.

Attention should be paid to sowings of seed flax, mustard, chickpeas and to experimental sowings of grain sorghum varieties. Sowings of proso millet may be maintained.

Of the grasses, Ukraine Left Bank alfalfa and Grimm alfalfa should be recommended, together with Triticum crystatum (zhitnyak) and Sudan grass; sweet clover should be sown to improve the pastures. In addition, corn, Sudan grass, sweet clover, sugar sorghum, squash and watermelon should be sown for green forage and silage.

XVII(2a) The arid mixed-grass steppe with the southern chernozems in the former Donets Okrug and the northwestern part of Shakhtiy Okrug, constituting the immediate continuation of the analogous belt of the Lower Volga Kray.

The average precipitation during the May-July growing season



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is 125-150 millimeters (during July-August 75-100 millimeters), and its annual value is 325-400 millimeters. Summer is rather hot, with average July temperature about 22.5-23.5 degrees, and relative humidity 45-47 percent for 1 p.m. in June. Winter temperatures, which are rather low in comparison with the other parts of the kray (minus 8 to minus 10 degrees in January) together with the scanty snow (depth of snow cover only 10-15 centimeters at the end of winter) cause conditions which are not entirely favorable for winter crops.

In this region the leading crop should remain spring wheat, with considerable acreage in winter wheat, sunflower, corn, barley, and, temporarily, rye.

In this remote region hard wheat gives yields no less than those of soft wheat, even on long-cultivated land, if it is free from weeds, and therefore should be energetically supported. Recommended varieties are Melanopus 069; of the soft wheats Eritrospermum 0341, and, for the still unmechanized farms, the beardless variety Lyutestsens 062.

Inasmuch as winter wheat is subject to some hazard of winter killing, due to the insufficient supply of seed of winter-resistant varieties, considerable sowings of local varieties of rye must still be allowed, especially on the sandy loams of the northern part of the region (Veshenskiy and Verkhnedonskiy Administrative Rayons).

The displacement of rye by the winter-resistant varieties of wheat Gostianum 237 and Lyutestsens 01060/10, together with the desirable snow retention work, is (, however,) being planned. [redacted]

The expansion of sunflower cultivation must await the development of varieties resistant to strain B of chokeweed, as the



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region is badly infested by this form. In this connection large scale experimental sowings of another oil crop in this region would be desirable: safflower, which is more winter-resistant and not susceptible to chokeweed. The work of the Don Selection Station also holds out great hopes for the solution of the problem of a chokeweed-resistant sunflower. For the time being, use of Saratovskiy 169 must be continued.

Corn does relatively well because of the sufficient length of the frost-free period in this region (150-170 days) and because of the July-August precipitation (75-100 millimeters) which is not too low; and its acreage may be expanded. Varieties recommended are Minnesota 23, Minnesota 13 Extra, and Ivory King (Ayvori-King). However, due consideration should be given to the advantages and disadvantages of the latter variety: optimum suitability for industrial starch manufacture, distillery and milling qualities; good forage quality of grain and straw; ease of harvesting the roots for hog feed; together with easily detachable cobs, which may cause trouble in mechanized harvesting, and with a somewhat poor durability when stored.

We are compelled to maintain sufficient acreage in barley because of its relatively high yield in this region compared to corn and spring wheat, because of the proximity of the seaports and because of the need for it as a supplement to corn in fattening hogs for bacon. The varieties used should be: Pallidum 043, Medikum 046 and 026. The latter is only for farms which are still unmechanized. Persikum 064, a black-grain variety, is permissible.

If oats are sown, Leytevitskiy variety should be used.

Sunflower and corn should serve primarily as predecessors to spring wheat. Winter wheat, however, should be sown on bare fallow



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region is badly infested by this form. In this connection large scale experimental sowings of another oil crop in this region would be desirable: safflower, which is more winter-resistant and not susceptible to chokeweed. The work of the Don Selection Station also holds out great hopes for the solution of the problem of a chokeweed-resistant sunflower. For the time being, use of Saratovskiy 169 must be continued.

Corn does relatively well because of the sufficient length of the frost-free period in this region (150-170 days) and because of the July-August precipitation (75-100 millimeters) which is not too low; and its acreage may be expanded. Varieties recommended are Minnesota 23, Minnesota 13 Extra, and Ivory King (Ayvori-King). However, due consideration should be given to the advantages and disadvantages of the latter variety: optimum suitability for industrial starch manufacture, distillery and milling qualities; good forage quality of grain and straw; ease of harvesting the roots for hog feed; together with easily detachable cobs, which may cause trouble in mechanized harvesting, and with a somewhat poor durability when stored.

We are compelled to maintain sufficient acreage in barley because of its relatively high yield in this region compared to corn and spring wheat, because of the proximity of the seaports and because of the need for it as a supplement to corn in fattening hogs for bacon. The varieties used should be: Pallidum 043, Medikum 046 and 026. The latter is only for farms which are still unmechanized. Persikum 064, a black-grain variety, is permissible.

If oats are sown, Leytevitskiy variety should be used.

Sunflower and corn should serve primarily as predecessors to spring wheat. Winter wheat, however, should be sown on bare fallow



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(possibly on the corridor portions).

Cucurbits [redacted], proso millet, seed flax, coriander, chickpeas and peas should be mentioned among the secondary crops.

The following forage crops are recommended: hybrid alfalfa, esparsette, and Sudan grass; corn, sorghum, Sudan grass for silage and green forage; fodder squash and watermelons for silage and succulent forage; sweet clover for pastures.

The center of the coal mining and metallurgical industries of the kray is located in Shakhtinskiy and Krasnosulinskiy Rayons on the Donets ridge. In connection with this, special attention should be paid to the development of vegetable growing in this region, and to the production of potatoes, as well as forage for the fresh milk dairy farming industry.

XVII(2b) The semiarid mixed-grass steppe with the Azov Sea type chernozems of the larger part of the former Don Okrug, including Yeyskiy Rayon, the southwestern part of Sal'sk Okrug, the central and northwestern parts of Stavropol' Okrug and Tamanskiy Rayon in the former Kuban Okrug.

Climatic conditions are somewhat milder in this region than in the preceding one. Precipitation for the May-July quarter is 140-160 millimeters (but for July-August it is 75-120 millimeters, as in the preceding region), and for the year 375-450 millimeters. July temperature is 23-24 degrees, with June relative humidity at 47-52 percent. Winter conditions are also somewhat more favorable, for although snowfall is light, with only about 10 centimeters of snow cover, the mean January temperature is only from minus 4 to minus 7 degrees.

The following is the combination of field crops: winter and



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spring wheat, corn, sunflower and barley.

Spring wheat at the present time occupies an exceptional position among the other crops in that its acreage is 40-45 percent of the total; but there is every reason for desiring some displacement of it by winter wheat.

According to data from the experimental installations of the region, winter wheat gave an average yield during the past six years 40-45 percent higher than that of spring wheat, using the best varieties of both. Moreover, the varieties Gostianum 237 and, for the southern part, Stepnyachka, completely guarantee the stability of winter wheat yields here, so that it should gradually assume the leading position and completely displace rye, which is still sown on a fairly large acreage -- 5 percent -- without proper reason.

Among the spring wheats, hard wheat should very decidedly be preferred to soft wheat, since its yield is equal in any case to that of the latter here, even on long-cultivated lands, provided they are weed free. Recommended varieties are Melanopus 069; of the soft wheats, [redacted] Cesium 0111 and Eritrospermum 0341; while Lyutestsens 062 is permissible, but only for unmechanized farms.

Corn should have a rather conspicuous place here, in view of the demand for it for hog breeding purposes and the favorable natural conditions. Since the frost free period is 175-190 days, less early and higher-yielding varieties (Minnesota 13 and, for the south Sterling) can be grown here than are necessary in the preceding regions, reserving Ivory King(Ayvori King) for pre-winter sowings on green fallow.

Oats are not recommended here; if they should be grown, Leytevitskiy may be sown.

For the reasons indicated in the description of the preceding



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region, acreage in barley should be reduced. Varieties are the same as for the preceding region; the high-yield American variety Trebi is also permissible.

Sunflower culture may be expanded, but only if sufficiently chokeweed-resistant varieties are found. If this crop should be sown on fallow, before spring wheat, attention should be paid to the introduction of the earlier varieties (Karlik).

Among the other crops we may recommend castor bean (for the more southerly parts), gourds, abutilon (in Yeyskiy Rayon), lallemantia and coriander. The soybean gives no particular prospects of success, since precipitation is insufficient for it. If it should nevertheless be sown, the early varieties are preferable: for the southwestern part of Sal'sk Okrug, Krushulya 9/3, Druzagsoya 907, Mandarin, Krushulya 10/10 (unfortunately lacking sufficiently strong attachment of the beans); for Don Okrug, Kharbinskiye 231-a 199 and 111 and Krushulya 10/10.

Grass sowings should be extensively developed here, with preference for hybrid alfalfa, Left Bank Ukraine alfalfa, and Sudan grass; sweet clover for pastures; corn, sugar sorghum and Sudan grass for green forage and silage; forage squash and watermelons for silage and succulent forage.

Extraordinary attention should be paid to cotton growing in the rather ideal environment of the hotter and more arid parts of this region in the western part of the former Kuban' Okrug, and in Akhtorskiy, Slavyanskiy Rayons and especially in the former Tempryukskiy Rayons. Among the other crops in this latter part of the region, winter wheat, corn, sunflower and barley should be primary and spring wheat should be completely excluded.



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All that has been said about giving primary attention in suburban areas to vegetables, potatoes and forage crops equally applies to the region around the city of Rostov. In the event of reclamation of the wet meadows in the downstream areas of the Don and Aksay Rivers by embankment, drainage and regulation of the overflow (orosheniye), very great perspectives in this direction may be unfolded, as well as for the industrial crops. These wet meadows at present are only great stretches of hardly utilized waterlogged land, subject to annual inundation by the floodwaters of these rivers.

The Taman peninsula is of a character transitional to the following natural and agricultural region (and also to the adjoining steppe part of the Krimea). It is distinguished by a hotter and far more arid climate (with annual precipitation at 300-350 millimeters), and by its southern chernozem soils. The considerably longer frost-free period and the large amount of heat in the Taman' (Tempryukskiy Rayon) as well as in the adjoining parts of Primorskiy-Akhtarskiy and Anapskiy Rayons, render these areas exceptionally favorable for growing unirrigated cotton, which should be the leading crop, accompanied by winter wheat, corn, sunflower and barley, while spring wheat should be entirely eliminated.

XVII(3) Region of very arid southern-feathergrass southeastern steppe of North Caucasus, with the chestnut soils of the eastern part of the former Stavropol' Okrug (excepting the Stavropol' plateau), the greater part of the former Tersk Okrug (excepting Yessentukskiy and Mineralovodskiy Rayons and part of Georgievskiy Rayon) and the northern-most part of Chechin. It is in rather sharp contrast to the preceding regions both in natural conditions and desirable crops.



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High summer temperatures (from 24 to 25 degrees in July), powerful drying winds and low precipitation (with annual values only 250-350 millimeters and 120-160 millimeters during the May-July quarter), result in aridity of the climate (with relative humidity about 40 percent at 1 p.m. in June). This is extremely unfavorable both for spring wheat and the late spring crops, corn and soybeans. At the same time, winter is not too cold (January temperatures from minus 5 to minus 7 degrees), which favors the drought-resistant varieties of winter crops even where snowfall is minimum or absent, while the length of the frost-free period and the high aggregate temperature during that period favor the cultivation of the warmth-loving plants (cotton and sorghum), especially under irrigation.

This is a region of vitreous winter wheat, the southern industrial crops (cotton) and barley, and has many similarities with the southern steppe of Krimea.

Winter wheat here gives yields 2 to 2½ times as high as spring wheat, and its quality is excellent, being little inferior to Krimean wheat. The best varieties are Kooperatorka, with Novokrymka 0102 permissible, together with the local Buyvolinka; in the northernmost part of the region it may be necessary to use the more winter-resistant Gostianum 237; Ukrainka is permissible.

This is one of the most important of the new cotton regions. Cotton is grown here principally with irrigation in the Mozdok, Prikumsk, Vorontsovo-Aleksandrovsk Okrugs, and the Sunzhen and Gudermessk Okrugs of Chechin.

Spring barley of the Pallidum 043 and Medikum 026 varieties (the latter only for unmechanized farms) may continue to be grown, to supplement the winter crops, on lands where cotton has not yet been introduced -- and also the more productive winter barley.



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Castor bean and seed flax can also be grown in the more southerly Mozdok part of the region.

The region is not favorable for sunflower, corn and especially not for soybeans, since July-August precipitation is scanty and there are frequent failures from drought during the blooming and ripening periods. The best of the varieties of corn are the early North Dakota, Fal'koner and Minnesota 23; I~~v~~vor~~y~~-King is permissible.

Among the more secondary crops we may recommend cucurbits, grain sorghum, safflower, mustard, [redacted] sesame, chickpeas, and Caucasian hemp (the latter only for the Mozdokskiy Rayon along the Terek River). Proso millet is permissible.

Only the most drought-resistant of the forage crops may be sown here without irrigation: yellow-flowered alfalfa, Triticum crystatum (zhitnyak) and Sudan grass; sweet clover for grazing; sorghum for silage; forage cucurbits for succulent forage and silage.

For the proper utilization of the existing possibilities in this region, great irrigation works along the Kuma, Terek and other rivers should be provided.

XVII(4) Zone of unsteadily watered mixed-grass steppe with the Azov Sea type chernozems, located in the southernmost part of the former Don Okrug, the northern parts of Kuban and Armavir Okrugs, the southwestern part of Stavropol' (except the Stavropol' plateau) and a narrow belt along the northern steppe boundary of the level parts of Kabarda, Ingushetiya and Chechin (including the former Sunzhensk Okrug).

The climate of this zone is already subject to the tempering influence of the Caucasus range, though the zone itself is still flatland.



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The region has a considerably milder climate, with annual precipitation of 450-500 millimeters, of which 165-190 millimeters fall in the May-July quarter. The July temperature is 24 degrees. Relative humidity, at 52-55 percent in June, is markedly higher than in the preceding regions.

Winter is mild, with average January temperatures from minus 2 to minus 4 degrees, frequent thaws and light snow cover, and conditions are thus sufficiently favorable for the assured cultivation of winter crops.

The leading crops here should be winter wheat, corn, sunflower and the southern industrial crops (soybean, castor bean and a few others).

The region is entirely favorable for those high-yield and moderately winter-resistant varieties of winter wheat such as Ukrainka which we recommend for the entire region. The quality of the wheat harvested here, however, is inferior to that of the preceding regions. Winter wheat can here be cultivated after green fallows in corn, sunflower or soybean, provided late varieties of the latter crops are not used. Of these crops, primary importance should be assigned to corn, which here can successfully compete in advantageousness of production not only with barley but with sunflower as well, for under normal operating conditions its yield is one and a half times to double that of barley, and double that of sunflower. In view also of the threat represented by chokeweed infestation to many fields of this region and the possibility of shifting sunflower to new regions for it in the Central Volga, Western Siberia and Kazakhstan, we must recognize that in the future more emphasis should be placed on corn than on sunflower. Its varieties are: Minnesota 13 ekstra and Ayvori-King for the northern part; in the southern part, with its



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frost-free period of 185-195 days, the later varieties Sterling and Minnesota 13 Standart give better harvests, though even here the former varieties are preferable for cultivation on green fallow before winter crops, to avoid any delay in sowing the latter.

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## ZONING OF FIELD CROPS

V. V. Talanov

Until more stable varieties of sunflower are developed, it is the A 41 Kruglika variety.

It is necessary to extend further the cultivation of some southern technical crops; namely, the castor bean and tobacco.

Climatic and soil conditions make it desirable to increase further the cultivation of sugar beets.

The conditions in this area are not entirely favorable to soybeans by reason of insufficient precipitation during July and August, and frequent heat siezures. With a view to an increased overall production of soybeans in the Union, however, it is desirable to maintain and even possibly increase somewhat the area under cultivation, on condition that early varieties are used, such as Kharbin 23la, 199, Mandarin, Krushulja 10/10.

This area, as well as the one that follows, may be earmarked as one of the centers of the kidney bean in the Soviet Union. In this area the yield of spring barley is almost double that of spring wheat, as it is less subject to fungus disease, Hessian flies and other blights, connected with the more humid climate. The area given over to the growing of barley may be curtailed in favor of corn, but its cultivation should be continued as a supplement to corn, in order to export it and also as a means for improving the quality of bacon. The kinds recommended are: for the more humid southern part - Kolkhikum 10/30; for the rest Tetrahedral 043 (Persikum 064 is acceptable); and the double-row Medium 026, with the previously stipulated reservations.

As for spring wheat, in the eastern part of the region, it suffers so heavily from blights and fungus diseases that it can be entire-

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ly omitted from planned crops. However, in the Don and Kuban sections of the area, hard varieties of wheat (which are less susceptible to rust, Hessian fly and bending than the soft ones), yield good crops; these yields, however, are by 30 to 40 percent lwer than those of winter wheat and can be used only as secondary crops. The kind to be used is Gordeiforme 010; the soft wheat is acceptable (if it is sown); Marquis and Tsesium 0111; and for non-mechanized farms - Lutestsens 062. In case oats are grown, the Lokhovsky variety should be used. This area is very favorable for fodder crops, which fact is of great importance to dairy farming, hog raising and poultry farming in this region. The following grasses are the best for the area; French alfalfa (which here is not killed by frosts), and along the Ukrainian left bank, esparset and sudan grass, which yield 2 or 3 harvests of hay and good crops of seeds. For green fodder sugar sorghum, corn, sudan grass and soybeans should be used. The chief ensilage crops in this area should be corn, sorghum, soybeans and fodder cucurbits. The semi-sweet beets and carrots are the best fodder root plants in the area.

To the south of the region of unstable precipitation, under the influence of the nearby Caucasus mountains, the climate becomes even more mild, with a greater amount of rainfall, and we pass into the "zone of sufficient moisture", which stretches in a broad belt from the northwest to the southeast along the northern flanks of the Caucasus mountain range. Depending on its proximity to the mountains and its elevation, this zone is divided into the following regions:

XIVI (5a). The steppe of various cereal grasses of the plateau-steppe area of the zone of sufficient moisture with the thick chernozyoms along the sea of Azov. This area comprises: most of the southern part of



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the former Kuban' "okrug", most of the Adygey autonomous oblast, the northernmost steppe part of the Maikop, and the central past of the Armavir okrugs, the plateau parts of the Karachayevo-Cherkessky oblast, the Kabarda, Ossetiya, Ingushetiya, and Chechna (in the case of the last two - without their northernmost portions). This is one of the richest areas in the South of the Union for the successful cultivation of the most diversified crops. Especially favorable conditions for husbandry are created by a quite sufficient amount of precipitation (annually - 500 to 650 millimeters, from May to July 190 to 225 millimeters), a warm, but not too hot summer (July temperatures of 22 to 24 degrees), a comparatively high humidity (in June 55 to 57 percent) and a long frost-free period (from 190 to 200 days).

In view of the difficulty of choosing, the crops to be cultivated are those which are most valuable to the economy of our Union; also those whose high and steady yields can insure against the possibility of shortcomings in the production of other areas, where conditions are less favorable.

Basically, this area should produce, like the one previously described, winter wheat, corn, sunflowers and southern technical crops, with a particular increase of these last mentioned, as well as soybeans. The complete absence of the danger of freezing of winter wheat gives the possibility of an assured cultivation of the most productive, though not frost-resisting varieties, including those which are recommended here: Ukrainka, and for the eastern part also Kooperatorka. Winter wheat gives here the highest yields of all the regions of the Union, and surpasses the yield of spring wheat by 150 percent. Therefore, this area, as well as the area of forest-steppe in the right-bank region of the Ukraine, represents also a guarantee of our reserves of wheat grain against winter hardships and droughts, which might occur



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in other areas. Consequently, the predominant importance and adequate acreage of winter wheat must be maintained under all circumstances, along with technical crops. Some years, and not infrequently, there is an overabundance of humidity, and the resulting conditions, favorable to the development of fungus diseases, require the use of such kinds of wheat which are more resistant to bending and diseases (especially rust). Under the influence of these conditions, and at times of high yields, the quality of wheat grain is usually not high as regards vitreousness, characteristics, albumen and suitability for breadmaking and milling. Corn should be grown here as a second leading crop, as the conditions for its growth in this area (especially in its eastern part) can hardly be matched in the entire Union. This area, therefore, as well as the one following, can well be designated as the "cornbelt" of our Union.

The long frost-free period enables later varieties to ripen; the humid climate and the distribution of rainfall, with most of it falling during the period when it is most needed for corn and soybeans July to August 100 to 125 millimeters and over) are favorable not only to the Minnesota "13 Special" and Sterling varieties, but also to those kinds which yield more and ripen later, as Liming and Krug, which yield 20 percent more than the local varieties. The highest average obtained under conditions of an experimental station, was 40 and even 50 centners (a centner is 50 kgs.) to the hectare. Because of the requirements of factories making molasses from corn, situated in the eastern part of the area, the Sterling variety is preferable (and the local white corn is acceptable). It is quite feasible here to plant winter wheat after gathering the late crops of corn, even without plowing over the field, but only going over it with a disk harrow. The corn here, as also in the area previously described, meets competition from sunflowers and sugar beets (in the western part) and

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also from soybean.

According to our data, sunflower should be of somewhat lesser importance here than corn, and move gradually into more northern regions of the Union. This remark applies to the area under discussion even more forcefully than to the regions previously described. The variety of sunflowers are A 41 and it is permissible to use 631 Kruglika, which ripens later. Here it is possible to spread the cultivation of the soybean with more or less safety (especially in the eastern areas, where there is a better distribution of rainfall per month); however, in years when the rainfall is light (1930) there is a possibility of poor crops of this generally moisture-loving plant.

In spite of this, and taking into account the exceptional importance for the Union of the production of albumen and oil for technical uses, as fodder, and for human consumption, we believe that if the necessary measures are taken to develop technical agronomy with regard to soybeans, this crop will occupy a firm position here, even though the area given it will be secondary in comparison with the crops mentioned previously. The following varieties are recommended: Kharbin 231-a, 199, 111, Mandarin (Krushulkja 10/10 is permissible). In the 231-A variety the beans are attached more firmly than in the others.

Secondary in acreage, but nevertheless very important, is the spreading in this region of such technical crops as the castor bean, gambo hemp, kendyr [redacted], Italian hemp, peanut; also sugar beet, sugar sorghum and tobacco.

The castor bean yields good crops here, although in quality it is somewhat inferior to that grown in Central Asia. The variety recommended is the Caucasus improved Kruglika.

Gambo hemp, mainly along the floorlands of the rivers Kuban',



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Belaya, and generally in areas of sufficient humidity and near rivers. As it requires much heat, its further successful cultivation in this area and the asurance of obtaining seeds, depend largely on the dreeding of early ripening varieties. The great importance of the peanut for its very valuable nutritive oils and for technical uses, compels the intensive cultivation of this plant, which is quite possible in this region. Only the early varieties growing in bushes are recommended (White Spanish for oil - somewhat late-ripening; Valencia for eating and oil).

The cultivation of sugar beets should be continued and spread in the Maikop, Kuban', and Armavir sections of the area. The cultivation of Trapezund tobacco has to be intensified in the Krasnodar, Beloryech'ye, Maikop, and Labinsk administrative rayons. As a supplementary crop, one has to consider barley, which gives high yields here, though not as high as corn. The better varieties are the late-ripening two-row Yevropeum 353/133 and Kol'khikum 10/30. In the southern part of the area winter barley may be grown.

Of secondary importance in the area is the cultivation of spring wheat (Gordeiforme 010, Tsesium 0111, and Marquis is permissible), potatoes, watermelons, melons, and pumpkins.

In case oats are grown, the Lokhovsky variety should be used. Chinese bell flowers and sesame deserve attention as secondary technical crops; also, the ether and medicinal plants: fennel, musk sage, kazanlyk rose, and lavender.

The fodder crops are the same as in the preceding region and are just as important. It should be added that the yields are very high not only in hay, but also in seeds. Alfalfa (French) and Sudan grass often can be harvested three times, with the highest yield in the Union for non-irrigated lands. The Slavyansk district of the Kuban'

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okrug may be considered among the leading areas for the production of alfalfa seed. Of the sorghum plants, the varieties ripening later than the Rannyy Yantar, the sugar varieties and the early varieties of Kaffir sorghum, can give good results, which might interest not only the cattlemen but also the poultry farmers.

XVII (5b). The forest-steppe foothill portion of the area of sufficient rainfall with the eroded and degraded chernozyoms of the slightly raised foothills of the southern section of the former Kuban' and Armavir okrugs, the greatest part of the central area of the Maikop okrug, the southern part of the autonomous Cherkessey Rayon, the central foothills of Kabarda, Ossetiya and Chechna (also including the Stavropol' plateau). This region is a narrow strip stretching from east to west along the Caucasus range, at an altitude of from 200 to 700 meters, to the south of, and parallel to the previously described area.

In the mildness of its climate it is similar to the previously described area but, because of its location on the northern gentle slopes of the Caucasus mountains and on account of its elevation, this region has a summer not quite so hot (July temperatures between 20 and 22 degrees, depending on the altitude), and has an even greater amount of rainfall (from 600 to 800 millimeters a year, May to July from 225 to 400 millimeters), which is heaviest in the upper section, and consequently a high relative humidity (in June at 1 p.m., 58 to 63 percent). The winters, likewise, are sufficiently mild. Accordingly, the leading crops should be winter wheat, corn and southern technical crops, with a special stress on soybeans, with less importance given the sunflower, than in the preceding regions. Mild winters and humid summers are favorable not only to high and safe yields of Ukrainka winter wheat, but also the Zemka variety which is not resistant to frost. The latter quite often yields better and is less subject to leaning.



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For the same reason it is possible to grow more frost-resistant varieties of winter barley and even plant spring wheat in the late fall; the Marquis variety of spring wheat yields considerably more, and gives a better quality of grain, than the Ukrainka under the conditions of an especially mild climate of the plateau of Kabarda, according to the experiments conducted during three years on the Staroataguin experimental field. However, high humidity creates conditions which encourage rust and other fungus diseases and blights. Therefore, one cannot successfully grow spring wheat, and it is vital to breed winter varieties, which are resistant to rust and leaning.

Corn has already reached here the maximum density of sowing (reaching in some parts of Chechna from 75 to 90 percent of the total arable land); and further success of its cultivation in the area depends not on an increase in acreage, but on the introduction of better varieties, intensification and improvement of the methods of cultivation, and at the same time a slight reduction in acreage in favor of technical crops, winter wheat and soybeans.

The soybean as well as corn, finds here ideal conditions for growth with respect to humidity and sufficient length of growing period. Consequently, the crops of both plants are the highest for the European part of the Union, reaching on experimental stations in the area 55 centners per hectare on a five-year average for corn, and 19 centners on a three-year average for soybeans (Vladikavkaz).

So far as corn and soybeans are concerned, the region should be divided into two parts, depending on the altitude above sea level: up to 300 meters, and higher - from 300 to 700 meters. In the lower area of the forest-steppe foothills, which has a frost-free period of 190 days, the best yields of corn are obtained from the Liming and Krug varieties, but recommended as preferred are white-grained Sterling



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(for canning factories) and the yellow-grained Minnesota 13 (for fodder), as these varieties ripen earlier and make the same field available for other uses. Splendid soybeans which ripen with regularity and give very good crops of soybeans are obtained by using not only Kharbin 231-A and 118, but also Khabarovsk 109, Gunddzulin (Myrtanzovo, Beslan, St. Atagi) and Illini. It is desirable that this sub-area be filled to the saturation point with soybean fields.

The crops of corn and soybeans are just as good on the higher levels of the foothills (Yessentuki, Stavropol', Vladikavkaz), but, in view of the shorter growing season, faster ripening varieties are recommended, such as Brown County, Minnesota 23, and Northwestern (local may be used) of corn, and for soybeans the better yielding (but low growing) Stavropol and Minsoy, Kharbin 213-a, 118 and Illini. The Ivory King variety of corn is not suited to this humid area because of its low resistance to fungus diseases. The A-41 variety of sunflower should temporarily remain as the basic technical crop, with a gradual reduction of acreage for the reasons given above.

As supplementary crops it is advisable to develop the following: potatoes, which give splendid yields (Stavropol', Vladikavkaz, and the Mineralovodsk area), peanuts, tobacco (in the forest-steppe portions of the former Maykop and Kuban' okrugs, and the autonomous rayon of Adygeiy). In the warmer lower part of the area one could develop the cultivation of Italian (late) hemp, which is very tall and has fibres of excellent quality, and it would be expedient to plant it here for seed and furnish seeds to other areas.

Of other crops of lesser importance one should mention barley (Kolkhikum 10/30 and Yevropeum 353/133, and also winter varieties), oats - the Lokhovsky variety oil sudza, abutilon [redacted], muscatel sage, lavender, peppermint, iris, belladonna, digitalis (except on the

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Stavropol' plateau), and smoke tree. The proximity of health resorts and the favorable conditions for dairy farming call for an intensive cultivation of fodder plants, which can be done successfully; such plants are French alfalfa, Sudan grass (three crops may be had with a total yield up to 100 centners per hectare), esparsette; semi-sugar beets, and carrots. Best for use as green fodder are the following: sorghum, corn, soybean, Sudan grass, melilot; for ensilage - the above, and also Jerusalem artichoke and fodder melons. On the foothills in Chechna and Ingushetiya - vetch with oats.

The forest-steppe foothills of the Northern Caucasus present splendid opportunities for a high output of all kinds of crops; this area also is one of the best places for setting up seed nurseries for a number of plants, including some northern varieties, thereby assuring a greater speed and safety of reproduction.

XVII (5c). The upland zone, a forest area of plentiful rainfall, is situated along the northern slopes of the Caucasus mountains, in a belt above the previously described area (approximately at 700 to 1,500 meters) with mountain skeleton chernozyems and forest soils: in the former Kuban', Maykop and Armavir okrugs and autonomous regions, and also in the Chernomorsky okrug. The profusion of rainfall (800 millimeters and over per year, over 300 millimeters from May to July), relative humidity in June about 63 percent, a moderately cold climate (in July, below 20 degrees), and a short frost-free period (between 170 and 150 days, and less). In its low-lying portions, this area has all the factors necessary for the development of intensive horticulture and truck farming. In its higher portions, the excessive humidity, poor soil, lack of land suitable for farming, and untimely spring and autumn frosts restrict the development of agriculture; however, the humid climate and the availability of very good grazing (partly



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of sub-alpine type) create conditions favorable for the development of dairy farming.

Tobacco (in the western part), corn, winter wheat, potatoes, oats and fodder should be the main field crops.

One of the chief centers of culture of yellow tobacco in our Union is situated in a part of this region (Abinsky, Goriachekliuchensky, Seversk, Kieloriechensky, Maikop, Apsheronsk administrative "rayons"), and likewise in adjoining parts of contiguous areas (Sochi, Krim, Grechesky administrative "rayons" of the former Chernomorsky okrug and the Krasnogvardeiysk district of Adygeiya). A further intensification of tobacco culture and an extension eastward with the limits of this zone are imperative.

All along the uplands zone the main crop is corn, especially so in the autonomous regions, where it occupies from 50 percent to 90 percent of arable land; agriculture here is not developed and the methods are very primitive. Corn fields stretch high up into the mountains, and the grain (in mass sowings) ripens for seed at an altitude of 1,300 to 1,500 meters in Chechna, Ingushetiya, Osatiya and Dagestan; and up to 900 meters in Kabarda. Corn for fodder ripens at even higher altitudes. At lower altitudes (up to 1,000 meters) in this region the best results are obtained from local varieties (Caucasian yellow and Chechenskaya white, and the North-Dakotan, which has a somewhat higher yield.

So far there is only one variety, the low-growing Caucasus yellow which ripens sufficiently early for altitudes over 1,000 meters.

Winter wheat does not freeze because of the mildness of the climate and, in the higher regions, because of the snow covering. The best varieties apparently will prove to be Ukrainka and Zemka. At present, winter wheat prevails in the uplands area and chiefly in its



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western section (within the former Kuban', Maikop, Chernomorsky and Armavir districts). It is expedient and possible, however, to intensify its spreading to the East, into the national districts, and thus to weaken the one-crop importance of corn.

The need of horse feed in the mountain areas calls for the sowing of oats, which give good crops under natural conditions.

The humid and moderate upland climate creates favorable conditions for the cultivation of potatoes, which grow far up in the mountains, as the shortness of the frost-free period does not interfere with their growth. The crop is easily disposed of, for local consumption and in the resort towns. Rich, natural grazing grounds are found in this upland area (the upland pastures of Kabarda). The development of dairy farming, however, would require in many cases the sowing of grasses: clover, lotus, alfalfa, fodder root plants, potatoes, beets and the use of corn and sorghum for ensilage.

XVII - 6. Within the area of the former Chernomorsky region one should note, in addition to the above mentioned portions of the uplands, the belt along the Black Sea (Prichernomorskaya). The climatic conditions of this belt vary greatly between the northern end near Anapa, and the southern - at Sochi.

In the Anapa-Novorossiysk area there is a comparatively low rainfall (400 to 700 millimeters a year, most of it occurring in winter, while during May-July there is only between 90 and 140 millimeters), with an average July temperature of 23-24 degrees and plus 1 to plus 2 degrees in January.

On the other hand, the Tyapse-Sochi section belongs to the area of excessive rainfalls (1,200 to 1,400 millimeters, but only 240 to 270 millimeters during the May-July period), with an average tempera-



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ture of 23 degrees in July and plus 4 to plus 5 degrees in January, and a very long (about 300 days) frost-free period. Consequently, the Anapa-Tuapse area is available not only for fruit-growing and vineyards, but also for field cultivation (especially in the Anapa section). There should be a trend, however, towards southern technical crops and a gradual displacement of the present fields of corn, winter wheat and sunflower. The leading crops (in the Anapa area) should be cotton, tobacco, peanuts, soybeans, with some potatoes for local needs.

In the Tuapse-Sochi area, in addition to fruit-growing and truck-gardening, which lead at present, one should cultivate tobacco, peanuts, luffa, smoke tree, sweet potatoes, sumac, iris, rosemary, pelargonium, tuberose, Kazankyl rose and tannic acacia.

To supplement natural foothill hayfields, sowings are recommended of birdsfoot trefoil for hay and pasturage, and also two-crop clover, European alfalfa and winter turnips.

XVII - 7. The Priazovsky (Azov) tidelands in the Slavyansk rayon of the former Kuban' okrug, the Kuban' and Adygey tidelands, which climatically belong to the zone of insufficient rainfall and even semi-aridity, have alluvial soil and an excess of rainfall, and in most places there is need for thorough reclamation. This would make available considerable acreage for rice growing, and, in less humid sections, for the planting of winter wheat, sunflowers (Kruglik 631 and A 41), corn and soybeans. The supplementary crops which should be strengthened could be technical crops: kendyr, castor beans, kenaf, peanuts, tobacco and spring wheat; grasses - European alfalfa and Sudan grass; tuber plants - beets, carrots; for green fodder - corn, sorghum, soybeans, Sudan grass, winter rye; for ensilage - corn, sorghum, and soybeans.



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XVIII. Dagestan ASSR. Lying mostly in the mountains, its surface dissected by aretes, Dagestan, in spite of its comparatively small area, presents an exceptional variety of natural and agricultural regions, sometimes neighboring sections contrasting sharply, depending upon their altitude. For this reason, even if we divide Dagestan into a number of natural and agricultural sections, it is difficult to isolate (except the northern plateau) continuous large areas, which would fit into a more or less definite type of economy, including agriculture.

In the north, this area adjoins the arid semi-desert in Kalmyk oblast; in the east it is somewhat influenced by the softening effects of the Caspian Sea; in the south it includes the eastern section of the Caucasus land mass with its many spurs, cut by river valleys. The Dagestan ASSR may be divided into the following parts: the flatlands, which in turn include sharp contrasts from semi-desert, good only for grazing, to sections with the most intensive cultivation of cotton and southern technical crops; the foothills, differing sharply from north to south; the mountain valleys, where fruit-growing and agriculture flourish, and the uplands, which vary sharply in agricultural potential, with the possibility of land cultivation at lower altitudes and only livestock raising in the sub-alpine and alpine zones. The problems requiring immediate action in the interest of the development of field cultivation in Dagestan are: putting new lands under cultivation (and especially building irrigation systems), increasing the cultivation of cotton and technical crops in the appropriate areas, developing dairy farming, and in the arid sections, for cattle raising).

The flatlands of Dagestan include not only considerable areas of pasture lands, but other very important areas, which can be used exclusively for such valuable crops as cotton, new bast (cork), rice,

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etc., which are of exceptional value to the Soviet Union and should get special attention from the Dagestan Republic. Let us, therefore, review in more detail the peculiarities and prospects of field cultivation here, using not only the data of the VIR, but also the manuscripts on the zoning of Dagestan, which A. Weisman and P. Abolin have kindly passed on to us.

The climate of Dagestan on the whole is favorable in warmth and light, a sufficiently long frost-free period (an average of 170 to 200 days), (especially in the southern part of the flatlands), a hot summer (average July temperature 24-25 degrees), a long autumn and a mild winter. However, this climate has an important drawback in its aridity, which increases as one moves from the southwestern section, located near the foothills of the section of higher rainfalls (Khazav-Yurt gets 498 millimeters yearly, 173 millimeters during May-July) to the utmost limits in the northeas - to the minimum rainfall area of the entire European part of the Union (Chechensky Mayak - 173 millimeters per year).

However, large areas already are under irrigation, and the system may be spread to much wider areas, due to the presence of numerous sources of water - the Terek, Sulak, Aktash, and other mountain rivers. This fact cancels out the factor of insufficient rainfall, at least so far as this concerns the southwestern half of the lowlands, which lie within the basins of these rivers.

The soil of this part of the lowlands is sufficiently fertile (except for the Solonetz [redacted] and salt-marshes on the shore and other separate points). Thus, on most of the surface of the flatlands, conditions are satisfactory for a favorable development of the exacting southern crops: there is enough heat and light; and the frost-free period is long enough. There is sufficient water from irrigation (in



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the neighborhood of the foothills no irrigation is needed); and there is fertile soil.

It is natural that under these conditions, when zoning the flatlands on the basis of devoting a considerable portion thereof exclusively to the more valuable crops, we are competing for first place with truck gardening viniculture and fruit growing as well as cotton growing, the new fiber crops ([redacted] kenaf, kendyr, southern hemp and [redacted] abutilon [redacted]), and rice and fodder plants. It is necessary, therefore, to study the chief natural requirements of these various plants in order to set up the most favorable zones for their special cultivation, giving chief consideration to those which are more valuable from a national viewpoint. However, by "special cultivation" we do not mean, either here or in the rest of our plans for zoning, an exclusive cultivation of a plant, but rather as indicating the leading (and in the case of valuable crops particularly leading) significance of these crops in the respective areas, without omitting necessary rotations, and consequently with complementary crops (chiefly fodder), and their selection to fit in with the prevailing importance of the main crops.

Within the scope of field crops in Dagestan, first place (if we omit truck gardening on fields and melon fields) belongs to cotton, because of its importance. When looking for the most logical areas for its special cultivation, we have to consider three fundamental needs of the cotton plant in regard to natural conditions. First - a sufficient amount of heat, light, and frostless days. The summer temperature (reaching in July an average of 24-25 degrees) is sufficient for cultivation, since [redacted] here there is good sun radiation.

Within the range of the quick-ripening varieties available for large scale planting, under conditions prevailing in Dagestan, the cotton plant requires on an average not less than 160 days from its



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planting to the mass opening of 3-4 bolls. Taking the beginning of the period with average daytime temperature of 15 degrees as best for planting, and the end of the ripening period, with the first autumn frosts, we have, according to the data of the Kizlyar Meteorological station, exactly 160 days in the area of Kizlyar. The latitude of Kizlyar is the northern boundary for growing cotton (at least with irrigation) with the varieties available now and under present methods of cultivation. The southern limit of cotton growing in the direction of the mountains is a horizontal line in the foothills at an altitude of 300 meters above sea level.

The second need of cotton is humidity. It is a relatively drought-resistant plant, but it needs a sufficient amount of rainfall during the period of planting and budding. Excessive rainfall, however, during the period when the bolls knot up is harmful, as it delays ripening. Late rains may interfere with picking. Lastly, with respect to soil, - cotton does not like salt marshes and gives a poor yield on clay; this somewhat limits its cultivation in those parts of the Kumyk flatlands, where the soil is [redacted]Solonetz, and where there is clay with rather high subsoil water. Consequently, the chief cotton raising area in Dagestan should be the section between the southern arm of the Terek - Kordonka, including the Kumyk flatlands, Sulak lowlands to the south up to the foothills and about 5 kilometers south of the railway line, and also a narrow stretch on the seashore up to Derbent.

Within the limits of this basic cotton area, cultivation has to be chiefly with irrigation, if possible, except for the strip along the foothills, along the railroad from the stations Chervlenaya-Shelkovskaya to Shamkhal. Here, according to the data of the Khasav-Yurt station, when there is sufficient precipitation, the crops of cotton are only slightly smaller than in the irrigated sections.



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A secondary cotton raising area is found in the utmost north-western corner of the Dagestan ASSR - an area of dry farming on a dark-chestnut soil, to the west of Achikulak. The frost-free period here is sufficiently long for the growing of cotton, but only because the summer weather is hotter and more continental than in the basic cotton area, and also because the absence of irrigation shortens the growing period of this plant.

The low rainfall of this area, however, and the frequent hot winds during the period when the bolls knot, affect considerably the safety and quantity of yield. Accordingly, for the present, cotton cultivation here should remain in the form of a large-scale experiment, as this is a borderline area for the cultivation of cotton, adjoining the cotton-raising area along the Kuma.

After setting aside areas to cotton, the crop of chief importance on the flatlands, next place must be given to the new fibre crops - kenaf, kendyr, southern hemp and abutilon.

It is warm enough for them in the flatlands of Dagestan, but the production of bast fibre depends on the development of the vegetative parts. They are all humidity-loving plants, need sufficiently fertile soil, and are somewhat less allergic to salt than the cotton plant. Of them, kendyr requires lighter soil with subsoil water close by, and it is less resistant to salt. Heavier and partly saline soils suffice for kenaf, even if subsoil water is near. Finally, hemp can be grown on light soil with deep subsoil water, but with less salt, while abutilon grows on heavier saline soil. These crops all need irrigation, and their cultivation must be adjusted to their respective lands in the valley of the Terek to the north of Kizlyar, which climatically are less suited to cotton.

The third candidate for acreage on the flatlands is rice. There



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is enough heat and a sufficiently long warm period for quick-ripening varieties. It requires much water when irrigated, but is quite resistant to salt and can even grow on salt-marshes, as the flooding required for its cultivation brings fresh water, which is later drained, thus rinsing the soil. Therefore, rice growing may contribute to the elimination of salt from the soil.

For the best results in cultivation and the fight against vicious weeds (chicken millet) and for continuous (or intermittent) flooding, a flat surface with a slight gradient and a waterproof subsoil are needed; otherwise it will be necessary to use the more expensive way of periodic irrigation. In order to avoid heavy outlays for irrigation channels, sites for rice plantations should be chosen close to the sources of irrigation; i.e., river beds.

Finally, in creating large stretches of rice field, one should take every precaution to avoid the spread of malaria.

Rice is comparatively adaptable and could occupy large areas on the irrigated sections of the Terek estuary and Kumyk flatlands. However, after the best lands have been set aside for cotton and bast cultivation, the only areas open for rice are those less suitable for the above crops; i.e., saline meadows and marshlands, and salt marshes with subsoil water close to the surface, lying close to the rivers, mainly to the north of the river Novyi Teker, and outside the cotton-growing area.

The requirements of livestock raising in the Dagestan ASSR call for fodder. There is an enormous area on these flatlands - Kara-Nogay and a large part of Achikulak, which, because of its arid climate and light chestnut [redacted] Solonetz and sandy soil can be used only for grazing, with poor grass. Besides, (until large reclamation work has been done), parts of the estuary and Kumyk flatlands, closest to the sea, which



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areas are unsuited for valuable crops because of either saline soil or aridness, are definitely grazing fields.

However, one cannot rely only on these grazing areas. It is essential to assure oneself of large quantities of fodder - hay, fresh and concentrated kinds. This will be provided by the fodder crops, which will come into the crop rotations, when the area is irrigated, as supplementary crops to the valuable crops. Besides their value as fodder, these supplementary crops are essential for the reestablishment of the soil structure, tending to decrease the saline contents (alfalfa and Mellilotte), and cleaning the soil of weeds (soybeans, corn, and pumpkin). Winter wheat, sown on occupied fallowlands and yielding steady harvests of concentrated fodder in the mild winters of the flatlands, should be added to these crops. Drought-resistant fodder crops (yellow alfalfa, sweet clover, "zhitnyak", and sorghum for seeds) can be introduced on the non-irrigated (until the Terek-Kuma canal comes into existence) lands of Kara-Nogay and Achikulak, choosing the best spots as regards humidity and soil, where agriculture is possible.

Finally, it is necessary to mention the most effective way of locating vegetable gardens and melon fields on the flatlands of Dagestan ASSR.

Dagestan's valuable truck gardening should be located on the best soil with assured irrigation, if possible close to a railroad and to populated centers. It must be twofold: for canning, in most of the flatlands, and for winter-ripening (for export to the large cities and work-centers of the Union) in the flatland strip along the seashore in southern Dagestan (near Derbent), where the climate is mild and warm in winter and in the autumn. Lastly, in some parts of the flatlands, melon fields may play an important part. They require warm, sandy subsoil and sandy soil and a hot summer, but with not much rainfall.

Under the general allocation of acreage on the flatlands for



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valuable and technical crops, it will be necessary to limit the production of winter wheat to the areas less suitable for valuable crops (Achikulak) or sow it on irrigated lands as a crop secondary to the chief one in the rotation of crops. Grain will have to be imported.

We will limit our discussion to these fundamental ideas on the allocation of crops on the flatlands, and pass on their distribution in accordance with natural areas.

XVIII - 1. Cereal and mugwort ~~wormwood~~-grass-covered semi-desert steppe, with light chestnut soil, occupies the western half of the Achikular administrative rayon of the Dagestan Republic and is a direct continuation to the east of a similar (XVII-3) area (Prikumsky, Vorontsovo-Aleksandrovsk, Mozdok administrative rayons) of the North-Caucasus Kray. The sharp aridity of the climate (about 100 to 120 millimeters on the average during May-July, and about 300 millimeters a year) with a very hot summer (July 24 to 25 degrees), the location party on saline soil - all these factors do not favor reliable field cultivation in general and spring sowing in particular. It will be necessary, therefore, for the present to continue sheep raising and cattle raising, along with a trend to sowing.

Yet, there is a relatively great amount of virgin and long-unused land. This makes it possible to increase the plowed area. Considering the mildness of the winter (average January temperature - 5 degrees), it is preferable to sow, as the chief crop, a drought-resisting variety of winter wheat, which gives a vitrius type of grain, and to supplement it with spring crops: proso millet, sorghum for seeds, mustard plant, oil flax and cucurbits, and also winter barley. At the same time it is necessary to start here mass experiments in cotton growing without irrigation, which is being done in the adjacent area of Prikumye. Even greater aridity of climate, frequent hot winds in August, tending to make the



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plants shed their buds, does not at present give any encouragement to a mass movement of these plants to this area. However, the hot summer and the long frost-free period (on an average 170 to 180 days) suffices for the ripening of the early varieties under the conditions of no irrigation, which might lengthen the growing period. Moreover, the low yields (caused by the drought) of spring cereal grains (and even of corn) may make it sensible to replace them with cotton, even though its yield also is comparatively low. Only the most drought-resistant grasses, of those which can supplement the natural steppe grazing, may be sown - sorghum, Sudan grass, "zhitnyak", yellow and hybrid alfalfa.

The area needs irrigation for its fodder and grain crops.

XVIII - 2. Extremely arid ~~wormwood~~ mugwort-grass-saline semi-desert on light chestnut saline-complex soils, and in the northern part sandy soil and sandy hillocks in the former Karanogay and eastern portion of the Achikulak rayons; by its climatic and soil conditions and the impossibility of irrigation, this area is unfit for land cultivation and should be used for cattle-breeding, also for raising rough-fleeced sheep and horses.

The southwest portion, having light chestnut soil on an argillaceous and clayey subsoil, admits the possibility of growing the above drought-resisting crops, but without certainty and with low yields on an average. In case the Terek-Kuma canal is built, a part of this area will be irrigated.

XVIII - 3. Alluvial lands and irrigated parts of the valley and estuary of the river Terek with its branches in the former Kisliarsk Administrative Rayon. The characteristics of the soil and its suitability to various crops is highly variable, depending upon the alluvial deposits of the various rivers, the frequency of flooding, the effect of various



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kinds of irrigation, and also depending upon the surface. Most of the area consists of marsh-meadows, salines, light chestnut and meadow soils, salt marshes and swamp soils. In spite of the arid and continental climate (Kislyar - average rainfall during May-July only 110 millimeters, during the year 320 millimeters), the frequent droughts, and considerable areas of highly saline lands, this area is important for farming because of/immense potentialities of growing rice, ~~gumbo hemp~~ kenaf, kendyr, and other southern technical crops, as well as winter cereals. The hot summer (average July temperature 24-25 degrees) and long frost-free period (an average of 190 to 200 days) favor the cultivation of valuable crops, alongside of vineyards, orchards, gardening and melon fields. In order to fully utilize the enormous potentialities of this area for agriculture, it is essential to effect large-scale reclamation, including irrigation (and in part drainage), and to decrease and prevent salt in the soil from increasing.

The main rivals in the complex problem of allocation of acreage to the valuable technical crops, are rice, ~~gumbo hemp~~ kenaf, kendyr and cotton. In the estuary of the Terek, the meadow-marshy varieties of soil are of greatest interest for agricultural use. They are most suitable to the cultivation of humidity-loving technical crops - rice, ~~gumbo hemp~~ kenaf, and kendyr. For the ~~gumbo hemp~~ kenaf, the meadow-marshy soil in the southern part of the estuary is most suitable, as it is less salty and the subsoil water is deeper than in the northern and eastern parts.

Heavy saline contents, a high level of subsoil water, and a heavy mechanical content of the varieties of meadow-marshy soils and their complexes, situated in the last mentioned parts of the estuary, create conditions unfavorable to most crops, except rice. Rice, particularly the salt-resistant varieties, grow well and can give good yield under these conditions. The meadow-marshy saline areas (in conjunction with



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light chestnut marshy soils and solonchaks) on the level of the estuary between the Prorva and Sullu-Chubutly rivers and the south of the estuary, in the Arakum lowlands (situated between the Staryiy and Novyiy Terek rivers) are considered as areas in the first place for the establishment of large-scale rice fields. These sites have a highly saline soil and, therefore, are unsuitable for other crops.

In this are the cultivation of rice, with the required regular flooding and the necessary drainage network, may also contribute to the decrease of saline contents of the soil (in the opinion of the reclamation organizations, which made a study of this area) ("The character of the soil and conditions of reclamation in the flatlands portion of Dagestan, according to the data of the North Caucasus reclamation station", 1931).

The best way would be (on condition that the subsoil is water-resistant), to continuously flood this area, which is also valuable as one of the best methods of fighting rice weeds (chicken millet). It is possible that a system of periodic irrigation will be required in some parts where the soil has rifts. This would be a temporary measure until the rifts are silted up by a more or less lengthy period of rice cultivation with intensive irrigation.

The question of the irrigation of large areas for rice cultivation on the flatlands of the Dagestan Republic must tie up with the simultaneous adoption of the necessary preventive measures against malaria; the choice of methods for the cultivation of rice and its companions in crop rotation (soybeans?) depends upon the results of studies being conducted now and large-scale experiments in rice cultivation. Viniculture, fruit growing and growing of vegetables have to be greatly increased in the suitable parts of the estuary. The raising of cotton can be of smaller importance, by reason of the strong saline contents of



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the soil and the lack of assurance of the crops ripening here under irrigation.

The lands in the northwestern part of the estuary (from the Oroshevka station to the sea) have light chestnut salines and solonchak soil (and solonchaks in the part along the shore). They have a large content of salts, soluble in water, and are slow to assimilate, needing a good sloughing and drainage networks. The problem of how to avoid their becoming more saline even under these conditions, is still to be solved. For the present, they will have to be left as natural pastures.

The floodtide-proper and marsh areas are situated on the right bank of the estuary of the river Talovka, and on considerable areas of the right bank of the Terek from the village of Khashmat, and especially along the right bank of the arm of the Novyiy Terek from Kizlyar, widening towards Agrakhansky inlet. These are swampy areas with a large number of islands, shoals and lakes, overgrown with reeds. They require drainage, and will then be valuable for rice, ~~gumbo hemp~~ kenaf, and other crops.

Irrigated lands, not occupied by rice, new fibre crops, cotton and other valuable leading crops, may be used for winter wheat and winter barley, soybeans, alfalfa, and also as components in crop rotation, with the more valuable crops leading. On the non-irrigated lands of the estuary, one can cultivate only the most drought-resistant plants-melons, sorghum for grain, and millet.

XVIII - 4. The area of the lower reaches of the rivers Sulak and Aktasha (the so-called Kumyk flatlands between the rivers Terek and Aktash and the Sulak lowlands to the south of the river Sulak, along the line of the railroad). This area is similar to the preceding, also occupying an arid ~~wormwood~~ mugwort-saline steppe on meadow soil, saline in different degrees, marsh-meadow and solonchak meadow soil, with a large acreage,



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partly inundated by rivers, partly suitable for irrigation in the Baba-Yurt, in most of Khasac-Yurt and in the northern Makhach-Kalinsky administrative rayons. The summer is hot, and the frost-free period is even longer than in the preceding area (200 to 220 days). The southeastern part, nearest to the foothills, has comparatively adequate rainfall (Khasav-Yurt has a yearly average of 498 millimeters of which 175 millimeters come in May-July). The amount of rainfall decreases sharply in the east and northeast.

The conditions of climate and soil (in most of the area), and the possibility of irrigation, make this area the center of cotton cultivation in Dagestan, and permit the cultivation of rice, fibre and fodder plants. In this respect, the most favorable section is the one lying along the foothills and railroad tracks to the west, up to the station of Shamkhal. Better soil available for cotton within this area (dark chestnut, meadow and marsh-meadow), and sufficient precipitation, give cotton the leading position, even without irrigation.

Further to the northeast, but within the western half of the area, cotton must also be the leading crop. Here, however, under the more arid climate of this section, irrigation is a "must" in order to successfully raise alfalfa, which is needed both for crop rotation in relation to cotton, and to increase the local fodder supply. This western half, lying within the meadow saline, not too salty and with comparatively light soils, may also be favorable for an intensive cultivation of cotton, but on condition that suitable irrigation methods are used.

The sections nearer to the river valleys, and those located in the eastern part of the Kumyk flatlands and Sulak lowlands, have a higher level of subsoil water and a strong saline content of the soil and are, therefore, less favorable to cotton. These sections should be



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used for the new fibre crops, while the saline areas along the rivers, having a subsoil resistant to water and to the possibilities of constant flooding, should be under rice, especially its salt-resistant varieties.

With cotton as the chief crop in the southwestern and western parts of the area, and the new fibre crops and "uis" in the remaining sections, other crops, chiefly fodder, are also required to complete the cycle of crop rotation and obtain fodder. Those crops of greatest importance should be blue alfalfa, soybeans, (varieties: Kharbinsky 118, 111, 231 and Illini) corn: Minnesota 13 and Liming (the latter with irrigation), and peanuts. For crop rotation in conjunction with cotton it is preferable to use the following cereals: winter barley (which gives a high yield of grain) for fodder, and on the land free from cotton - Kooperatorka and Ukrainka winter wheat.

On non-irrigated lands it is advisable to plant the drought-resistant sorghum for seed (and also for ensilage), sesame, castor bean, sunflower, and melons.

The whole area requires intensive reclamation, improvement of the existing irrigation systems (Korkmassovsky, Shaburo-Vartazarovsky, Yuzbashevsky and Sunjensky, and the October Revolution Canal). It requires also that new and larger irrigation systems be built. The flood-areas of Aksay, Aktash, and the seashore solonchaks will have to continue as grazing lands. An enormous increase in the irrigated lands in this area, as well as in the areas described below under XVIII - 5 and 6, will take place if the Sulakstroy project is carried out. This should also furnish enormous resources of energy, which will also be available for the industries converting agricultural products.



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XVIII - 5. The lowlands along the Caspian sea are a stretch of arid, wormwood-saline steppe on saline-chestnut soil. In places of subsoil humidity; also meadow-marshes, on meadow-solonchaks and solonchak soils, this belt stretches along the Caspian sea within the Derbent eastern half of Kasum-Kent, southern part of Makhack-Kalinsky and Karkmas-Kalinsky rayons. This section has somewhat more precipitation (average 350-450 millimeters) than the one preceding. Most of the rains fall in autumn, and the summer is even more arid (only 70 to 110 millimeters thgough May-July) than in the other flatlands. This area, however, and especially its southern section, belongs to one of the warmest parts of Dagestan both according to its summer temperature (July 24-25 degrees), and to its winter (January average, plus 1 to minus 2 degrees), and also it has a longer frost-free period (210 to 230 days). Consequently, this area, (like the one preceding it), is especially favorable for cotton raising (with irrigation essential). In its southern part, however, one should stress fruit growing, viniculture, and raising winter vegetables.

As supplements, one must use the technical crops of gumbo hemp and castor bean. Cereals can be sown only in the areas which may be available after technical crops and grasses have been taken care of (alfalfa with irrigation, Sudan grass, and sorghum). Winter wheat (with winter barley as a supplementary crop),should be the principal grain crop. It is imperative to increase the area of land through reclamation. In the southern section of this area, there are valuable timber forests. All the flatlands of Dagestan represent its main reserve for a possible increase in husbandry and the moving of population from the foothills and mountain sections, where the area of potentially arable lands is very limited.

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The southern part of the republic occupies mountainous areas, with a highly cut-up surface (Dagestan - "The land of mountains"), and, depending on the altitude (from 600 to 4,400 meters) and the distribution of mountains, is an area of extremely diversified conditions - from warm and comparatively well-watered foothills to high snow-capped mountains, and deep, warm river valleys between the mountains. Many parts of this section of the area, however, are not suited to land cultivation, being located outside its altitude limits (high mountains), or because of stony ground (the rocky sections of the mountainous parts of Dagestan are chiefly suitable for cattle raising). The main agricultural parts of the republic are the less cut-up foothills, the river valleys, and the flatter mountain-plateaus.

Climatic conditions vary with altitude, ranging from the entirely warm zone of the foothills and southern valleys to the alpine belt, with a gradual transition to snow and an entire absence of vegetation. The amount of precipitation is basically tied to the altitude, increasing from 360 millimeters annually in the low foothills (Derbent), and being quite adequate - 400 to 450 millimeters - in the foothills proper, while reaching 850 millimeters and more in the high mountains. The deep valleys of the interior of Dagestan are arid (350-450 millimeters) having the same arid-steppe character as the foothills of the stretch along the sea. The distribution of rainfall is also related to altitude. Along the coast (Makhack-Kala, Derbent), autumn and winter rains prevail, but as one moves to the west into the mountains, the amount of winter precipitation keeps decreasing. In the foothills already most of the rainfall occurs in spring, and even more in summer. In the mountainous interior of Dagestan, this is even more pronounced. The summer months get more than half of the total precipitation, while the fall, and especially the

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winter, have no snowfall and the total amount of precipitation is small. This distribution of rainfall favors the development of natural fodder (where the conditions of soil permit) and the growth of cultivated plants.

Except for the soil base and rocky lands, which, however, occupy a substantial share of mountainous Dagestan, the remaining lands (in the central section on limestone and in the south on clayey shale), although differing according to altitude and relief, and in spite of their being over-plowed, are still able, if properly cultivated (correct fertilization and with crop rotation) to give good yields, especially of fodder and leguminous plants.

The above described conditions in mountainous Dagestan, related to the economic conditions (small quantity of good land, difficulties of transportation, etc.) require, on one hand, specialization of agriculture wherever possible, on the more valuable products - fruit-growing, viniculture (in the foothills and valleys), and, on the other hand, the raising of various kinds of livestock (especially dairy farming and sheepraising) with special attention to growing fodder (fodder grasses, corn, plants with edible roots, and ensilage).

Side by side with this, the difficulties in the importation of foodstuffs, and the sufficiently warm climate (and the possibility of irrigation of the drier parts from the mountain rivers) require, and also make possible, the development of vegetable gardening, the growing of potatoes, of cereal leguminous plants, and the sowing of cereals for local consumption on unoccupied areas.

Mountainous Dagestan can be divided into the following parts, according to altitude, terrain and natural conditions: the foothill forest-steppe and steppe character, of mountain-steppe valley character in



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the central and southern parts, the mountainous and high-altitude parts (rocky, mountain-meadow, in part wooded, and alpine).

The foothill zone is a transition from the flatlands, and fringes all of the interior mountainous Dagestan. On the north this zone borders on the Sulak-Kumyk lowlands; on the east, on the low seashore belt. It is crossed by comparatively low spurs of the main Caucasus land mass, and its surface is therefore rolling, cut up by river valleys.

The higher parts of the foothills have more moisture and are more of a forest-steppe character. The lower parts are drier, with steppe flora. The foothills of the northern and southwestern sections of mountainous Dagestan have certain differences and must, therefore, be examined separately.

XVIII -(6a). The northern foothills area is situated at an average altitude of 600 meters (and up to 1,200), with diversified flora, depending on the altitude - steppe, deciduous forests (beech and hornbeam in the more humid parts, oak as well as fruit trees and bushes in the drier parts), and sub-alpine meadows; the soil is: mountain chestnut, chernosyom, wood-clayey (under forests), often stony. The climate is moderately warm (July 23 to 23.5 degrees) with a fairly mild winter (January from minus 1 to minus 4 degrees), sufficient precipitation (about 400-500 millimeters yearly, 150-190 millimeters May through July) with the further possibility of irrigation, and a frost-free period of about 200 days. This area covers Buynak, Kazbek, and the most southern portion of the Kasav-Yurt administrative rayons.

The fruit and viniculture and cereal-growing economy of the valleys in the lower section of the area, gradually changes to vegetable gardening and cereal fodder crops as the land rises to higher altitudes. In the central part, there is also dairy farming (with a well-developed



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fodder production), and at the higher levels - vegetable and potato growing. The summer here is not hot enough for growing cotton and southern technical crops and, so far as land cultivation is concerned, farming must be limited to corn and winter wheat, with an accent on the development of fodder crops for dairy farming. Corn for grain: Brown County and Minnesota 23. Winter wheat: Ukrainka and Kooperatorka.

As supplementary crops, the lower areas of the region should grow soybeans (Klarbinskaya 118, 111, 231) and winter barley, and the upper and more humid areas - potatoes. As secondary crops the cultivation of castor beans, Italian hemp and beans should be increased.

The upper, more humid section will grow fodders: clover (one crop), vetch-oats; in the more arid steppe type sections: European alfalfa, esparsette, and Sudan grass. In the entire region, for ensilage there is corn Liming 2, sweet clover, and sunflower. The edible root plants are fodder beets and potatoes.

This area is not liable to any large increases in farmland, and its future depends rather on more intensive farming, the development of fruit-growing and dairy farming, and the growing of edible roots and fodder plants. The application of fertilizer is essential, either manure or phosphates.

XVIII (6b). The southern foothill area, at an average altitude of 600 meters (and up to 1,200) is warmer and milder than the preceding area. It has broad-leaf forests, meadows, and other types of vegetation, depending upon the altitude, on mountain chestnut and chernozyom soil. This area occupies the former Kaytag-Tabasaran, most of the western part of Kasum-Kent and part of the Korkmas-Kalinsk okrugs. The area has an unstable precipitation, which is not as dependable as in the previous zone (400-450 millimeters yearly, 130-140 millimeters May through July).



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The fields are mostly non-irrigated, but have the possibility of irrigation, which must be developed. Along the river valleys, there is fruit-raising and dairy farming. Field cultivation is chiefly of fodder-cereals, with the leading fodder crops being winter barley (which succeeds well here, especially in the sections of lower altitudes where there are mild winters), and winter wheat. The acreage under corn can be increased, and more spring wheat and oats should be planted on higher altitudes as supplementary crops.

The climate of the lower part of the area which merges into the maritime belt, and especially of the valleys, permits of increases in the cultivation of early kinds of cotton, ~~gumbo hemp~~ kenaf and Italian hemp. To supplement the existing natural meadows and pastures, it is in the interest of dairy farming to increase the acreages of grass (European alfalfa, Sudan grass, and rye with winter vetch), sweet clover for grazing; ensilages (corn, sunflower) and fodder plants: potatoes, beets, pumpkins.

This area takes second place, after the flatlands, in the size of its plowed lands, but at present uses them poorly for crops, and can increase them greatly at the expense of waste lands, fallow lands, and by eventually plowing up meadow lands. There are great possibilities for an increase in land cultivation with special attention to sowing grasses and technical crops.

The valley areas are situated in deep gorges, forming the banks of rivers in the mountain zone of central Dagestan. Where wide enough, they are being terraced for sowing and gardening. Often, however, they are only gullies, with stony banks and no vegetation. They belong to the mountain-steppe type of land.



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XVIII (7a). The central-valley area is in the valleys of the Koysu river at an elevation of 400 to 1,200 meters in the high-mountain zone of Dagestan. In the lower parts of the valleys, it is of an alluvial-gristle character. This area is a narrow strip in the valley parts of the Gunib, Khunsakh and Gumbetov administrative rayons. In its upper portions of the area, up to 1,000 meters, there is a mild, even climate, good precipitation (yearly amount 450 to 550 millimeters, most of which /over 250 millimeters/ falls in summer), a comparatively warm winter, considering the rather high altitude (from minus 3 to minus 5 degrees January temperatures), and a moderate summer (18-21 degrees in July). In its lower reaches, the mountain-steppe character of the area is more pronounced (in line with inferior precipitation). Orchards should predominate, with intensive field cultivation in places with mountain irrigation.

The surface, and especially the soil, explain the limited amount of good lands and the great difficulties of using these lands, by terracing them, picking out stones, etc. Good lands are already used up to 100 percent, including the cultivation four-tier "garden-fields", where one terrace (often with artificially filled top soil) is a fruit orchard, as well as a field for corn, kidney beans and pumpkins. On the top terrace are the crowns of pear or apricot trees, under them twist the beanstalks, and on the ground trail pumpkins. There are no great prospects of wider utilization of land.

Attention must be concentrated on a high degree of cultivation of orchards, with industrial equipment, raising vegetables for consumption, and continuing only the most intensive kinds of field cultivation with a prevalence of corn, potatoes and beans, and fields of alfalfa and esparsette to supplement natural grazing. It is essential to add fertilizer.



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XVIII (7b). Southern valley areas at altitudes of 1,000 to 2,000 meters in the valley of the Samura river in the high mountain section of Dagestan, on mountainous brown soils (in the Akhtynsky and Rutul'sky administrative rayons); lying in the valleys of the sub-alpine zone, the area has a variable vegetation, depending on elevation, with large areas of rich pasture. There is considerably less summer rainfall than in the preceding region, and this is not sufficient (May-July about 140 millimeters) to dispense with the irrigation of sowed areas. As this area is at the very southern part of the Dagestan Republic, the summer there, notwithstanding the considerable elevation, is moderately warm (19 degrees average for July) and the winter (January minus 3 degrees) permits the sowing of winter wheat. The fields are irrigated from the Samura river and its tributaries. Field cultivation, sheep-raising and some fruit growing are being developed. Farming has good potentialities for development, as there are lands which are not fully utilized, located mostly on the lower terraces of the valley where chiefly corn, potatoes, beans and vegetables are grown. On the upper terraces grow winter wheat, spring barley and fodder plants (alfalfa and esparsette).

XVIII (1c). High altitude regions of rocky-mountain type at an altitude of 1,000 to 1,700 meters on stony soil, in spots on mountain chernozyems, of the Levashinsky, parts of Gumbertovskiy, Gunibskiy and Khunzanskiy administrative rayons, surround the central valley area. Irrigation is impossible, except in valley sites, included in the XVIII (7a) area. The landscape is mostly rocky, with mountainous xerophite vegetation, being only poor pastures and sometimes meadows. The climate is mostly humid (450-550 millimeters yearly) with over-abundant summer rains (200-300 millimeters in May-July) and an extremely dry, though not very cold (from minus 3 to minus 36 degrees in January) winter.



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The area is overpopulated, is chiefly agricultural, has possibilities of fruit growing. Livestock raising can be in prospect only on condition that there is an increase in fodder crops (clover, rye, oats with vetch and sweet clover), because of the poor quality of the natural pastures. Field cultivation is needed in order to supply local food needs. In the first place, there is vegetable growing, cultivation of potatoes, and of grains. The earliest mountain varieties of corn are grown at an altitude of 1,200-1,500 meters; also, winter wheat. In the lower zone there are seedpod legumes. In the higher zone there is spring wheat, and spring barley (including the bare variety) and potatoes. It is possible to raise hemp and flax for fibre.

XVIII - 9. The high mountain area has an average altitude of 1,600 meters (from 1,100 to 2,300 meters) in its northern part, and 1,200 meters (from 700 to 1,900 meters) in the south. It has adequate rainfall (over 500 millimeters per year, including over 250 millimeters in May-July). It has a cool, too-humid summer (16-17 degrees in July), and a cold, dry winter.

There are mountain chernozyems and basic skeletal soils. The vegetation is the mountain xenophites, and mountain meadow type, especially in the southern part. This area lies in the Kakhib, part of Zumadinskiy, Charodinskiy, Lakskiy, Dakhadaevskiy and Karakhskiy administrative rayons.

The presence of good grazing lands assures the development of dairy farming and sheep raising. Field cultivation should be based on fodder crops (clover, vetch-oats, and edible roots) and cereals, with winter wheat in the lower parts of the region; and winter rye, spring wheat and barley at higher altitudes, with an increase in growing potatoes, horse beans, vetch beans, root vegetables, hemp and grasses (clover, rye with vetch). Stress should be given to introduce green fertilizers.



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XVIII - 10. The sub-alpine area at an average elevation of 1,800 meters (from 1,300 to 2,500 meters) has adequate rainfall, splendid sub-alpine mountain meadow pastures on mountain chernozyems, partly wooded. The region covers the Tlyaratinskiy, and southern parts of Tsumadinskiy, Charodinskiy, Kumukhskiy, Dakhadayevskiy, and all but the valley portion of the Rutul'skiy administrative rayons. This is a land of sheepraising. The importance of land cultivation is quite limited because of the harsh climate. Sowings of early ripening barley (including bare barley), of rye and potatoes, as well as added emphasis on growing early varieties of peas with the improvement of the local mountain vetch beans (a mixture of wild peas, vetch and lentils), and early vegetables for local consumption -- all are important in view of the difficulties of bringing outside supplies into the mountains.

## XIX. Crimea ASSR

According to the natural features of its different areas, the Crimea should be divided into three main parts: 1. steppe area, 2. mountain area, and 3. southshore area.

XIX - 1. The steppe area occupies most of the Crimea and resembles strongly the southern arid steppe of the Ukraine, with agriculture directed towards raising chiefly vitrious winter wheat, southern technical crops (including cotton) and barley.

A warm summer (23-24 degrees in July) and a very long frost-free period (180-190 days and more), create favorable conditions for southern technical crops, which are, however, hurt by the aridity (sometimes very seriously hurt) of the climate in this area. Because of these conditions and the properties of the chestnut and southern-chernozyem soil, the grain of winter wheat is of exceptional grade, both in vitriousness, in its albumen content, and milling and breadmaking qualities.



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An even milder winter (average January temperature from 0 to minus 3 degrees) though without snow-cover, almost certainly guarantees a stable crop of winter wheat, not only of the Ukrainka variety, but also of the varieties which have a better yield, and are likewise of the highest grade - Novokrymka 0204 and Novokrymka 0102, the latter of which is acceptable here (though, in spite of all its qualities it is non-resistant to smut and has a tendency to crumble), and also the Kooperatorka, which is not resistant to frost, but does not freeze in this climate.

Spring wheat suffers considerably here from drought, is subject to seizure, gives very poor crops and cannot compete, not only with winter wheat (yields are 2-2½ times lower), but even with barley. Of all the spring crops, barley yields higher and more stable crops than either oats or wheat, except in the more humid foothills, where oats can be of considerable importance. In these humid foothills, with mild winters, an important function may be that of winter barley of sufficiently frost-resisting varieties, which gives better crops and has a better quality of grain. This grain is suitable for brewing beer. This winter barley may be sown without letting the land lie fallow.

The climate of most of this steppe is not favorable to corn, in spite of the long frost-free period (insufficiency of rainfall, especially during the months which are critical to the development of corn; during July and August an average of only 50 to 75 millimeters; this, in combination with a low relative humidity and hot winds frequently causes seizures when it is in bloom). Nevertheless, corn is the stablest of all spring crops, yielding even during the years of drought (1921) 5 to 6 centners of grain, while the other crops gave no yield at all. It is imperative to increase its acreage. Likewise, it is desirable to widen the cultivation of melons, etc., which are more drought-resistant than most plants, and are a good crop to plant on used fallow lands, before



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they bring a trend of specialization in rye-potato-clover-edible roots, to this general type. Because of the poor soil, winter wheat does not prosper, in spite of the favorable winter. In more suitable sections of the area (and with fertilization), however, the acreage of winter wheat should be increased. As for spring wheat, it is affected by diseases, which is also observed in connection with barley. Rye stands up better to the sandy and sandy-clayey podzol soil, and its acreage should not be cut.

For the above reasons oats give the best crops of all the spring cereals. The permissible varieties are Leytevitsky, Lokhovsky, and Pobeda. If oat fields have to be restricted, it is only because of the need to increase the fields of potatoes and of fodder crops at their expense. These last mentioned crops also will benefit from the tilling of lands reclaimed from marshes, woods, and other less suitable tracts.

Even now this area is one of the best in the Union for the high yield of potatoes (second only to Belorussian SSR), which reacts favorably to cultivation on sandy soils in a humid climate. Also, it has here no rival among other crops, and the acreage given to it definitely must be increased, since this crop is used both as food (including exports) and as animal fodder.

Natural conditions here cause rather large areas of natural grass. They also favor the extensive spreading of fodder crops, which are indispensable for the development of plans here for dairy farming. In the first place, we must have two-crop clover, both alone and with timothy; oats and vetch, "pelyushka" (field peas)-vetch and oats mixtures; winter rye, winter vetch and serradella as green fodder. In addition to fodder-potatoes, roots, tubers and carrots, fodder beets and sugar beets are recommended. Special attention must be given here to the development of ensilage from sunflower, corn, horse beans, sweet clover, lupine, and



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putting them under winter crops. The cultivation of melons, etc., is called for to meet the needs of people at health resorts.

Of all the technical crops, cotton deserves special attention, especially in the less arid sections of the former Lenin (Kerch') and Feodosiya okrugs.

Of lesser importance is the cultivation of castor beans and the early varieties of sesame (in the western part of Crimea). Of the medicinal herbs, there is sage and Dalmatian daisy.

Fodder crops are of less significance, because of the aridity of the climate and the trend towards technical and cereal crops. The only exception is the less arid foothill section, also located nearer to the resort towns, which creates a need for dairy farming. The same fodder plants are recommended as in the southern steppe of the Ukraine; i.e., grasses: hybrid alfalfa, esparsette, Sudan grass; and as green fodder: also corn, sorghum, sweet clover, and fodder pumpkins.

Soybeans are not recommended (except in the foothills) because of the lack of rainfall. Rye may be excluded because of the dependability of the wheat crop.

According to the variations in the soil and the various degrees of aridity, which depends on its greater or lesser distance from the sea, the steppe area of Crimea should be divided into sub-sections. The foothill part is the one most favorable for crop cultivation. The yearly rainfall there is 500 millimeters or more (including 150 millimeters or more during May-July). The climate is milder than in the other sections of the Crimean steppe. On the other hand, the summer is not so hot (July - 22 degrees). The average temperature of January is only zero. Varied cereal grasses on gravel, partly glossy chernozyem-type soil of the Sevastopol'-Bakhchisaray rayon, southern portions of the Simferopol' and Karasubazar, and southwestern part of the Feodosia rayons. The lead-



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ing crops are: winter wheats Kooperatorka and Novokrymka and spring barley, and some winter barley which, however, is destroyed by frost during more severe winters. Corn will grow here, as well as in the following sub-section, better than in other parts of Crimea. The Minnesota 13 and Grushevskaya varieties also are acceptable.

Oats (Lokhovskiy and Leytevitskiy) can continue for local requirements. A certain increase of soybeans acreage is feasible here. The cultivation of fodder crops should be more intensive than in other parts of the steppe. The sub-section steppe of various grasses on chernosyem soils is also somewhat influenced by the mountains. It occupies the northern parts of the Simferopol'skiy, Karasubazarskiy and southern part of the Feodoskiy rayons. The rainfall is 400 to 500 millimeters (including 125-150 during May-July). The average January temperature is minus 1 degree. The leading crops are the same. Winter wheat: Novokrymka and Kooperatorka (the latter does better in the vicinity of the foothills). Everything said about the preceding area applies also to this subsection, which is somewhat less favorable.

The feathergrass steppe on chestnut soil on the Kerch' peninsula is more arid; with a yearly rainfall of 350-400 millimeters (May-July 100 to 125 and less). Here, the summer is hotter (July - 24 degrees). In this sub-section there are the best prospects for cotton (early varieties 182 and 1306). On the land which is not occupied by cotton and in crop rotation with cotton, the chief cereal should be winter wheat Kooperatorka and Novokrymka, and temporarily, until these spread - Krymka, which deserves special attention because of its good and dependable yields and fine quality of grain (Krymka is highly valued for export). More acreage should be given over to corn (the most drought-resistant varieties are Brown Country and Minnesota 13, with Ivory King as acceptable). The local varieties of barley, for the present, include the more



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frost-resistant kinds of winter barley. Rye, oats, spring wheat, soybeans, are not to be included with the planned crops. As supplementary crops one should broaden the melon fields and, in the second place, plant castor beans and sorghum for seed.

The selection of fodder crops has already been given here, above. Feathergrass (kovyl) steppes are on marly and light chestnut clayey soil, in the former Ievpatorskiy and western part of the Simferopol'skiy rayons. The area is arid, the annual rainfall amounting to 300-350 millimeters, (including about 100 millimeters for May-July).

Among field crops, cotton should receive special attention, though climatic conditions for it are somewhat less favorable than in the Lenin (Kerch') okrugs. The principal cereal crops are winter wheat and barley, of the varieties indicated above. Special attention should be given to corn, melons, early varieties of sesame, castor beans, sorghum for grain, and among the pod vegetables the drought-resistant chick-pea. Because of the limy soil, esparsette is preferred, among the grasses. Phosphate fertilizers are very effective for all crops.

Silvergrass (kovyl) steppe on chestnut, south-chernozyem, partly saline soils. The area is more arid, with a yearly rainfall of only 300-350 millimeters (of which 100-125 millimeters is for May-July). Winters are warm (January, minus 2 degrees), but there is no snow. This area includes the southern part of the former Dzhankoy and the northwestern part of the Feodosiya okrugs. Everything said in connection with the preceding sub-area applies also to this section, except that the prospects for cultivation of cotton are more limited.

The last area of the steppe region of the Crimea is an especially arid wormwood steppe on chestnut-saline and partly lime-gravel soils in the northern part of the former Dzhankoy and northwestern part of the former Yevpatoriya rayons. The yearly rainfall is only about 300 millimeters (May to July, 100 millimeters).



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This sub-area is least favorable for farming, both because of its soil and because of the dry climate, especially in the northern areas where salines predominate. The leading crops are winter wheat, of the varieties indicated above (on clean fallow land), and spring barley. It is desirable to increase the acreage of corn, melons, oil flax, and to introduce sorghum for seed, and chick peas. Sowings of mustard and safflower are possible.

XIX - 2. The upland area of the Crimea (Yayla) must, in the main, be left to animal raising, and, in particular, to dairy farming. The climate is comparatively humid (over 500 millimeters and up to 1,000 millimeters of rainfall). The summer is cool (average July temperature 20 to 15 degrees). These conditions are favorable to the development of natural sub-alpine grazing as well as the cultivation of fodder plants - clover (two harvests), European alfalfa, fodder beets, and also sowings of sunflower, corn, and sweet clover for ensilage.

Among technical crops, first place should go to tobacco. It is desirable to develop the cultivation of (either) volative oil and medicinal herbs: muskat sage, iris, lavender, and Kazanlyk rose (along the river valleys).

XIX - 3. The south-shore area of the Crimea has very favorable conditions for growing fruits, subtropical and valuable southern plants, and there is not much room left for field crops. Among these, tobacco is of primary importance. Peanuts can be grown (as an intermediate crop), rosemary (between cape Foros and Kastel' mountain), and other ester oil plants.



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## XX. UKRAINIAN SSR

The various sections of the Ukraine, as we will further observe, differ sharply in natural conditions. Some sections, under the decisive influence of social and economic factors, and with these conditions as a background, are bound to have different directions and specialization in field cultivation. Taken as a whole, however, the Ukraine has some basic characteristics, which determine its function in the overall agricultural economy of the Union. Of primary importance, in this regard, are the enormous possibilities of specialization in technical crops.

Because of the humidity, the mild climate and the favorable soil, the main sugar-beet growing area of the Union is located within the forest-steppe area. All means should be used to increase the acreage and intensify the cultivation of this crop. Because of the high summer temperatures and the long frost-free period, it is possible to introduce a crop new to the Ukraine - cotton. The natural conditions of the greater part of the Ukraine open up possibilities of a very large development of fodder crops, which are vital to dairy farming and hog raising, the necessity for both of which is authoritatively dictated by the needs of the working population of the largest manufacturing and industrial centers: Donbass, Krivonozh'ye, and others.

The prospect for the increase of corn crops looms especially large, as all areas of the Ukraine, except Poles'ye, are more or less suited to this. There are very good possibilities for an increase in acreage of fodder grasses and ensilage crops over most of the Ukraine (except its arid zone), and of the cultivation of edible roots (except in the more arid areas). The condition of the forest-steppe part of the Ukraine, especially in the right-bank area, are favorable to a possible increase in the cultivation of seed-pod legumes (in particular kidney-beans and soybeans). There is a sharp need for them, especially at present.

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Because of the dependability and size of winter wheat crops in the right-bank part of the Ukraine forest-steppe, this area (along with the zone of sufficient rainfall in the northern Caucaus) acts as a reserve for the entire Union. The quality of the winter wheat is so high that it has no rival in the whole world. It is necessary, therefore, not only to keep up the acreage of winter wheat, but to increase it as much as possible.

New acreage must be found for the needed and possible increases in technical crops, fodder plants, seed-pod legumes and winter wheat. The small reserves of suitable lands in the Ukraine call attention to a greater concentration of crop rotations (planted fallow-lands, where possible), reclamation of unsuitable lands (Poles'ye), and, finally, the imperative need for cutting down the acreages under crops, which are either less valuable (grey grains, and millet), or can be usefully located in other parts of the Union (a movement of spring wheat to the east, and to some extent, sunflower).

Of the plants whose acreage can be cut in the Ukraine, the main ones are oats and rye. An increase in mechanized equipment will gradually decrease the need of the country for oats (as exemplified in North America). Also, this need is taken care of by the more northern non-chernozyem areas of the Union, where its yields are satisfactory, while it meets less competition from crops of greater value. The areas it occupies in the Ukraine may be cut considerably (except in the Poles'ye), while in the steppe area (except the Donbass) it may even be completely eliminated from planned crops.

Winter rye can be cut considerably in favor of spring wheat in all the areas, except those subject to freezing (eastern steppe) or where the soil is more suited to rye (Poles'ye).

One can cut still more, and even leave out completely from among the planned crops, the fields of millet, which still occupy considerable



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acreage in the Ukraine (even in the sugar-beet area). The natural place for its growth should be the arid steppes of Kazakstan, the lower Volga and the southern part of Western Siberia.

The situation is somewhat different as regards barley. Its yields are high, as compared to other cereal fodder crops in the steppe area of the Ukraine. It is needed as a supplement to corn at a certain stage in fattening up hogs for bacon. When grown along the right bank forest-steppe area it has fairly good properties for brewing beer. Moerover, it has great potentialities as an export item. Therefore, in spite of the need to give special condideration to corn, it would be purposeless to diminsh the area under barley. Having gone over these general considerations, we will take up the characteristics of the separate areas.

XXI - 1. The right-bank Poles'ye - an area of deciduous and pine woods on podsol, sandy clayey and sandy, partly marshy, soils - former Korosten', Zhitomir, the northern part of the Shepetov and the northern right-bank section of the Kiev okrugs.

The area has adequate moisture (about 500 to 550 millimeters a year, of which over 200 millimeters falls in May-June), with a high humidity of the air (June 58-60 percent). The climate is mild, with moderate summer temperatures (only 18-19 degrees in July), but with a mild winter (average January temperature is minus 5 to minus 6 degrees), with a frost-free period of about 150-170 days. Thus, the natural conditions, limiting the selection of crops for this area, are: a sufficiently, and sometimes excessively, humid climate, a certain deficiency of heat in comparison to other sections of the Ukraine, and, especially, poor soil.

Under these conditions the most suitable crops are winter rye, potatoes, fodder crops and oats. On the whole, these crops are consistent with the general type of farming (dairy-potatoes) in this area, and



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Jerusalem artichokes.

The need of poor sandy and sandy-clayey soil for fertilizers, especially nitrogeneous, calls for all possible increases in fields of lupine, for enriching land by planting a legume crop (cideration).

In addition to the leading crops - rye and oats - one should keep (and if possible increase) the acreage under buckwheat, which gets along with poor soils and gives high yields which compare favorably with other areas of the Union. Also peas should remain.

Other secondary crops which deserve consideration are: hops, "makhorka" tobacco, hemp, winter and spring rape, opium poppy and pumpkins.

XX - 2. An area of the left bank Poles'ye, it is a zone of deciduous trees; also, it has podzol soil (but not so sandy or marshy) in the former Glukhov, and Chernigov okrug, and the northern parts of the former Konotop and Nezhin Okrug, in many respects comparable to the preceding area.

The climate is not quite so humid (about 500 millimeters a year, an average of 190 to 200 millimeters during May-July), and the winter temperatures are somewhat lower.

Everything said about the distribution and intensification of the several crops in the preceding area, applies also to this one; however, because of the somewhat better soil, hemp takes its place alongside the potato. This area, together with the adjoining sections of the TsChO and the Belorussian SSR, is one of the main centers in the Union for the cultivation of hemp. The area is one of rye-hemp-potato-oats-grass. The variety is Taraschanskaya. The fodder oats are the same varieties as before. Winter wheat as well as rape are of less importance. Attention should be given to kidney beans.



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XX - 3. The forest-steppe area on the right bank of the Dniepr, on gray forest soils, with degraded and lixiviated chernozyems. The climate is mild, the precipitation adequate. In accordance with its elevation, the area can be divided into two sub-areas with different soils.

XX - 3 (a). The more elevated section (200-300 meters and up), has mostly forest soils on degraded chernozyems, and occupies the former Proskurov, Vinnitsa, Kamenets, Mogilyev and a large part of the Tul'chinsk okrug and the northern part of the AMSSR. This is a zone of sufficient rainfall. The greater northwestern part of this sub-area has a rainfall of 500-550 millimeters (May-July 200 millimeters and more), while the southeastern part has 450-500 millimeters (May-July: 175-200 millimeters). The July temperature is 19-20.5 degrees. The relative humidity at 1 p.m. in June is about 53 to 55%. The winter is mild and warm ( the average January temperature is between minus 5 and minus 6 degrees). The frost-free period is 160 to 170 days. This area, in its mild climate, plentiful rainfall and fertile soil, is rather like the foothill section of the Northern Caucasus (the difference being that it is somewhat cooler here, and the frost-free periods are different). This area is good for many field crops and also for fruit-growing. The leading crops must be winter wheat and corn. Sugar beets, fodder cereals and soybeans are also important.

The mild climate, adequate rainfall and warm winters are the reasons that this sub-area, as well as the following, have the highest yield of winter wheat in the Union. These crops, moreover, are very stable, because even in the poorest years the crops do not freeze. Consequently, this sub-area (as well as the one following) is especially valuable for the cultivation of winter wheat as the leading crop. Just as in the zone of sufficient rainfall in the North Caucasus, these crops represent a guaranteed reserve, in case of poor crops in other areas of the Union, where winters may be severe, or the rainfall insufficient.



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Therefore, under no conditions should the winter wheat sowings be diminished. As it is desirable to increase other crops, land for them must be found not at the expense of winter wheat. The variety recommended is Ukrainka. In some years heavy rainfalls cause the spreading of fungus diseases (rust) and affect the quality of wheat grain (less vitriosity and less albumen contents than in other areas).

Of major importance is the introduction of varieties which resist rust and bending. However, the rust-resisting Zarya (Eritrospermum 2537/64), which was developed here, is not highly recommended, but only acceptable, because it is of the kind which easily drops its grain.

This sub-area is favorable for corn because of its rainfall (110-140 millimeters during July and August, which are especially important for yields). The total warmth and the length of the frost-free period, however, are insufficient for the ripening of the more productive late varieties. Nevertheless, it is one of the best locations for corn in the Union. The local experimental stations have compiled data, indicating the possibility of getting average crops up to 35-40 centners per hectare of air-dried grain (that is three times as much as at present). They place this sub-area with regard to its productivity in second place, after the zone of sufficient rainfall in the North Caucasus.

The most productive variety is Minnesota 23. For the northern section, there are the quicker ripening North Dakota, King Philip varieties. The local Chinkvantino variety also may be grown, though its yield is less. Nonetheless, because of its small grain, it is suited to poultry raising. The areas occupied by corn are large (it is an old crop here), but its importance can and must be increased. Sugar beets do not give nearly as high a yield as in the next area and on the left-bank steppe. They must remain, nonetheless, though in a minor capacity, inasmuch as already there are sugar factories here. This is in accord



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with the general direction of specialization of this sub-area in terms of a more general nature. Potatoes must be retained in the northern section of this area. Abundant rainfalls favor the cultivation of fodder plants (which are required here for hog raising and poultry farming). This has to be broadened, especially because of the absence of natural hay fields. The following grasses are recommended: Western European alfalfa, vetch-oats and pelyushka-vetch-oats mixtures; in the northern part, also two-harvest clover; in addition for green fodder: rye, winter wheat, and soybeans. For ensilage -- corn, horse beans, Jerusalem artichokes, and soybeans. Among the root vegetables, first place should go to fodder beets, potatoes, and then carrots. The area has all the possibilities for strengthening the cultivation of seed-pod legumes. In the southern section (from Kamenets, Mogilyov, and Tul'chinsk okrugs and the northern section of the AMSSR) special attention should be given to soybeans, as conditions here are more favorable for this plants, as well as corn, than in other parts of the Ukraine. However, only early varieties - Krushulya 9/2, and Kharbinskaya 199 are recommended; while Staroukrainskaya is permissible. Further north, there is not quite enough warmth for soybeans, out of the seed-pod legumes, it is preferable to increase the acreage of peas, lentils and kidney beans, and especially of spring and winter vetch for seeds.

This sub-area presents good conditions for barley, which here gives good yields (although not as good as corn in the south). In the northern part of the sub-area, it is desirable to continue growing barley, especially since here it has good brewing qualities. The varieties: Ganna Loosdorfskaya (Laya), Evropeum 353/133, and Verkhnyacheskyiy 04 are admissible.

In view of the high yields and dependability of winter wheat, one should definitely eliminate rye fields. The same should be said about



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spring wheat, which, under prevailing conditions, yields only half of the winter crop. Oat fields, too, should be considerably reduced. The varieties are Verkhnyachenskyiy 053 and Lokhovsky. Of secondary crops, it is desirable to increase the acreage of fennel, peppermint, opium poppies, hemp, squash, and watermelons. Buckwheat may be continued of poorer soils of sandy loam.

XX - 2 (b). This sub-area lies in the somewhat lower part of the forest-steppe on the right bank of the Dniepr. It has better soils - chiefly rich northern and degraded chernozyems - in the former Shepetovsk, Berdichev, and Belo-Tserkov' okrugs, in the southwest part of Kiev and the right-bank sections of Shevchenkovo and Kremenchug okrugs, in the Uman' and greater part of the Tul'chinsk okrugs. This area differs from the preceding one by having better soils, but slightly worse temperatures and somewhat less rainfall, but it is similar to it in the mildness of its climate.

The conditions of the soil are more propicious to the cultivation of sugar beets, and therefore yields here are considerably higher than in the preceding area. The same is true about corn (with the exception of the former Shepetovka and Berdichev okrugs, but we should take into account the importance of the sugar industry for the Union, and, therefore, the field economy of this sub-area should lean definitely towards sugar-beets-winter wheat crops, not omitting the importance of corn, fodder crops, potatoes and seed-pod legumes, including soybeans).

Varieties: winter wheat Ukrainka, which is high-yielding and dependable under local conditions; corn - Minnesota 23, and in the northern section, where conditions are less favorable, the earliest varieties: Burley County and North Dakota. The fodder plants are the same as in the preceding sub-area.



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right bank (from minus 7 to minus 9 degrees in January). In the southeastern section (Kharkov) there is often a danger of freezing of the varieties of wheat non-resistant to frost, on account of the fact that the snow-cover is not deep enough (about 15 centimeters at the end of winter). In terms of certain differences in soil and climate, the area can be subdivided into two parts.

XX - 4 (a). The northwest part of the area includes the western part of the former Priluki, the southern parts of the Konotop and Nezhin and part of the left-bank section of the Shevchenko okrugs. The prevailing soil is sand or sandy loam, often lixiviated and degraded chernozyem. There is more rainfall than in the other part of the area, but the summer is not quite as warm. The following crops should lead: winter rye and wheat, oats, sugar beets, fodder plants, with potatoes and makhorka tobacco being duly considered.

This area belongs to the zone of sugar-beet economy, but the crops are not as high, because the soil is inferior, as in the preceding and following areas. However, the acreage under sugar-beets should be increased, and special attention should be paid to fertilizers. It is also because of the presence of sandy loams that one has to reconcile oneself to leaving large acreage under winter rye (Taraschanskaya), while strongly increasing the acreage under winter wheat, which here, as well as in the preceding area, does not freeze, but does require fertilizer. The Ukrainka variety of winter wheat and Milturum 120 is permissible. When we consider spring cereal grains, oats (Leytevitzky with Pobyeda in the northern section, and Kharkovskiy 0596 as permissible all over the area) give better crops than barley, and especially than spring barley, which is susceptible to Swedish fly. For the present, a considerable acreage of oats should be maintained here.



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The fodder crops are the same as in XX-3 area, with due attention given to serradella and lupine (for enriching the soil by planting a legume crop). Of special significance is the development here of the cultivation of makhorka tobacco. The nation-wide center of its production lies in the Priluki-Romny area. Corn may be planted only as a supplementary crop, using the Minnesota 23, and King Philip varieties.

The planting of soybeans for grain is not recommended, both because the location is near the borderline of the area for its cultivation, and also because of the presence of sandy loam. Of the other grain crops in this region, one should keep on with the widespread growing of buckwheat, as it is not allergic to light soils. Of the seed-pod legumes, the cultivation of peas and especially of kidney beans should be stressed. As secondary crops, there should be opium poppy and pumpkins. In the northern section adjoining the Poles'ye, it is necessary to increase the cultivation of hemp.

XX - 4 (b). The greater southeastern part of forest-steppe on the left bank, lying chiefly on rich soil, and only partly on degraded and sandy-loam chernozyems, is the former Sumy, Khar'kov, Romny, Lubny and northern part of the ~~Poltava~~ Poltava okrugs. This area is especially favorable in its soil, but it is more arid (45-500 millimeters a year, 17-180 millimeters during May-July, with a relative humidity of 55-53 percent at 1 p.m. in June). There are cooler winters and there is less snow.

The field crops are of the sugar-beet-winter wheat-rye-corn-grass type, with considerable emphasis on potatoes and oats in the northern section. Because of the rich soil, sugar beets give here the highest crops of all the belt areas in the Union. Beets, therefore, should be given the place of leading importance (especially in



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the former Sumy, Priluki and Poltava okrugs). Winter wheat, which usually gives high yields, however, is found in varieties which are not sufficiently frost resistant, and in certain more rugged or relatively snowless winters, there is a certain amount of risk from freezing, particularly in the southeastern section of the area. Therefore, while the Ukrainka can be freely recommended (and the Milturum 120 is admissible) for the western section, one should concentrate on more frost-resistant varieties (Gostianum 237 with Milturum 120 permissible) for the western section, in the former Kharkov and eastern part of the Poltava okrugs. The Ukrainka, which gives high yields in good years, can be permitted only at the risk of its freezing.

It is for the same reason (and partly because of the presence of sandy loams in places), that it is necessary to keep a large percentage of rye (Nemyshlyanskaya variety). In future, however, to the extent that its replacement should be made with the frost-resistant varieties of wheat these are available.

There is a sufficient amount of rainfall (especially during July - August: 110-120 millimeters) for corn, and this, with rich soils, is the reason that the crops here are second only to the area of sufficient rainfall in the North Caucasus, which is the most favorable area for corn. It is advisable to increase here, as well as in the area XX-3a, as far as possible, the acreage under corn, especially as it is planned to develop hog-raising. However, in view of the comparative shortness of the frost-free period, only certain varieties are recommended, such as Minnesota 23, King Philip and further south, Ivory King. It is desirable also to develop aritifical means of drying corn (especially for seed). Barley does not yield as much as corn (especially for seed). Barley does not yield as much as corn (2/3 to ½ as much), and is of interest only on small areas as supple-



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mentary hog feed. The varieties for the northern section are Ganna, Loosdorfskaya (Laya). For the Khar'kov-Poltava district, it is Medikum 046. Acceptable for the whole area there is Evropeum 353/133 and Nutans 8/71.

Winter wheat gives much better harvests and, therefore, spring wheat can be omitted from any planned sowings in this area, except in the southern and southeastern section, adjoining the steppe, where the best harvests of hard wheat (Melanopus 069) are obtained, according to the data of the Ukrainian network on sufficiently clear, even though old plowed lands. Non-mechanized farms may use also Lyutestsens 062.

Along with the increase in hog raising and cattle breeding, there shouldbe as great an increase as possible in the cultivation of fodder crops, which is quite feasible under the natural conditions of this area. Alfalfa (Ukrainskaya)(Lievoberezhnaya variety) is recommended strongly, as in this area it gives good crops, second only to the Kuban area; also esparsette, vetch-oats and, "pelyushka"- vetch-oat mixture. Of the annuals, also Sudan grass is recommended. For green fodder, in addition, winter wheat and winter vetch is suggested. Corn and fodder pumpkins are desirable for ensilage. Of root-plants, there are sugar beets, mangel-wurzel (fodder beets), and potatoes. As additional crops, one should keep potatoes, and, in the northern section only, oats (Leytevitskyy, and Lokhovsky and Kharkovsky 0596 are admissible). Here, these give better yields than barley. In case soybeans are planted: Krushula 6/3, in the south Kharbinsky 199 (and Staroukrainskaya is permissible).

The secondary crops which should be increased are: kidney beans, spring vetch for seeds, pumpkins, and hemp. In view of the local specialization in the field of animal husbandry on hog raising



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and dairy farming, and the satisfactory natural conditions, the cultivation of corn and fodder plants should be especially increased.

XX - 5. Area of various cereal grasses of the semi-arid northern Ukrainian steppe on ordinary chernozyems represents, both in its nature and field husbandry, a transition from the above forest-steppe area of sufficient rainfall to the arid southern and eastern steppes of the Ukraine.

In accordance with some differences in rainfall and in winter temperatures, the northern chernozem steppes of the Ukraine should be divided into two sub-areas, the western and the eastern.

XX - 5 (a). The western sub-area has a slightly less arid climate and more favorable winter conditions. It includes the southern section of the AMSSR, the former Pervomaysk, Zinovìyev, the western section of the Krivoy Rog and the northern parts of the Odessa and Nikolayev okrugs. The yearly rainfall is 400-475 millimeters, with 16-175 millimeters in May-July (and about 50 percent relative humidity at 1 p.m. in June), which is yet quite sufficient for stable yields of spring crops and corn. The relatively mild winter (from minus 5 to minus 6.5 degrees in January) is satisfactory for a hardy variety of winter wheat.

The trend in field crops is comparable with that of the XX-3a area (distinguished only by a slightly more himid climate), i.e., winter wheat - corn, fodder Ukrainka winter wheat, (subject to the risk of freezing during the most severe winters only), has a better quality of grain than in the preceding areas. As an insurance, one may plant Gostianum 237, which is more frost-resistant, but whose quality is not as good.

In consequence of the longer frost-free period, compared with



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those areas described previously, it is possible to plant, along with Minnesota 23 corn, a later and better-yielding variety. Brown County (Ivory King) is permissible. The crops of corn are good, and its acreage may be increased considerably.

The fodder crops are the same as in XX-3a; perennials -- west European and Ukrainian alfalfa, esparsette; annual -- Sudan grass; for fresh fodder -- also corn, winter rye, sorghum; for ensilage -- corn, sorghum, fodder pumpkin, watermelon; of root plants -- beets and carrots. In the southern part of the area (in the triangle formed by Poltava-Kremenchug-Romny), where all the factors for development of hog raising are available, special consideration should be given to an increase of corn and grasses (alfalfa).

Considering other cereals - winter rye may be left out entirely, as well as spring wheat. Whole yields here are 1½ to 2 times smaller than those of winter wheat.

Barley should have some importance, as fodder for hogs in addition to corn; varieties: Nutans 8/71, Medikum, and it is permissible to plant 105/72, Grushevskyiy and Golyy 0155. The growing of soybeans for grain is possible, but the yields fluctuate sharply from year to year, and, because of the instability of returns, it is purposeless to increase its acreage. The varieties should be later ones than in the preceding area: Kharbinskyiy 199, 111, 231-a.

The cultivation of sunflowers and sugar beets is possible, but not expedient, as other areas specialize in these crops. Concerning other plants, it is expedient to increase the planting of kidney beans and plants of the melon family - watermelons, melons and pumpkins.

The increase in the cultivation of winter wheat, corn and grasses can be achieved at the expense of winter rye, oats, spring wheat, and millet. When planting oats, Leytevitskiy variety is pre-



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ferred.

XX - 5 (b). The eastern section of the northern chernozyem Ukrainian steppe has a much drier climate with less favorable winters than the preceding area. It occupies the eastern part of the former Krivoy Rog okrug, the Zaporozh'ye. Dnepropetrovsky, the northern part of Melitopol, the left bank section of Kremenchug and the southeastern section of the Poltava okrugs. The area is purely steppe in character. The yearly rainfall is only 400-450 millimeters, May-July 150-160 millimeters, with an average temperature in July 21-22, 5 degrees, and in January, minus 6 to minus 7 degrees, and often much lower. This, in combination with a scanty snowfall (the average height of the snow cover at the end of winter is 10 centimeters and less), endangers the safety of the less frost-resisting varieties of winter wheat. In connection with this combination of climatic conditions, it is desirable, when sowing wheat, to have a mutual insurance against its being killed by frost, through the sowing of spring wheat, and in case of drought, which would kill spring wheat, to have winter wheat, which is more drought-resistant.

According to statistics, both prewar and for the last few years, the average crops of spring wheat here do not differ much from the average crops of winter wheat (considering the years when the latter froze to a greater or lesser degree). Accordingly, until frost-resistant varieties (including Gostianum 237) come into general use, spring wheat should continue along with winter wheat, though the latter will gradually occupy a more and more dominant position.

However, when the Dneprostroy materializes and makes available this its electric energy and irrigation system, will have a decisive influence not only on the social and economic life of most of this area, but also on its natural conditions and on the trend of its field



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cultivation.

Under these conditions the trend of crop husbandry will be toward winter and spring wheat, corn, root plants (for dairy farming) with a large development of vegetable gardening and potato growing. Due to the introduction of the winter wheat variety Gostianum 237 and others like it, there will be a greater and greater increase of winter sowing at the expense of spring sowing, a conservation of a larger area of clean fallow lands and a greater stability of crops in case of irrigation.

The hard wheat variety (Melanopus 069) when planted on weed-free old plowed lands, gives better harvests than soft wheat (the best yielding is Lutestsens 062, but its grains fall out, and it is, therefore, only acceptable, and only for non-mechanized farms). Special consideration must be given here to the increase of acreage under corn, which might be used preceding spring grains, and also as connecting link of fallow land to winter crops. The best variety is Brown County (Grushevskaya is acceptable), in the north - Minnesota 23.

Fodder crops should be developed, especially within the Dnieprostroy area system. This includes left-bank Ukrainian alfalfa (especially with irrigation), esparsette, and Sudan grass; sweet clover for pastures; and for green fodder - in addition to the above, also sorghum and corn. Special attention should be given to ensilage of corn, sorghum, sweet clover, fodder grasses and watermelons. Of root plants - semi-sugar beets (especially under irrigation), and carrots.

Cucurbit plants (melons, watermelons, pumpkins), and potatoes will function as supplementary crops, as they are necessary for the consumption of the working population of Krivoy Rog and the industrial



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area of Dneprostroy.

Barley (varieties: Medicum 046, Nutans 8/71, and the permissible Grushevskiy) has to be continued (perhaps with some limitation on acreage) as a fodder, supplementing corn.

When the Dneprostroy irrigation system is completed, one can move into this area a technical crop - sugar beets (irrigation must be mostly used for vegetables, orchards and the cultivation of fodder crops for dairy farming).

Soybeans for grains when planted in this area with irrigation, is rather unsafe, and can only be used as a secondary crop on small areas, using the Kharbinskaya 199, 111 and 231-a varieties. Sunflower (Saratovskiy 169) may be kept until this crop is established on new acreage on the Central Volga, in Western Siberia and Kazakhstan.

The increase in the planting of wheat, corn and fodder plants has to progress at the expense of oats, millet, rye, and the cutting of acreage under barley.

In the first areas to be irrigated and electrified through the Dneprostroy system (Dnepropetrovsk and Zaporozh'ye), tending towards the industrial centers, one should give first consideration to vegetable gardening and fodder crops (alfalfa and fodder beets). Of primary importance is the reclamation work on the Dniepr flood lands (Konsky and Buzulutzk), with the required erection of banks, drainage ditches and irrigation. This will make it possible to use considerable areas for sowing not only vegetables (in the best places) and fodder crops, but probably also the earliest varieties of rice and the new fibre plants (kendyr). However, the possibilities of cultivating kendyr require solid experimental data, which so far has been quite inadequate, as experimental stations with irrigation and "abantsiya" have only recently been established in the area of the



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Dnepr floodlands.

XX - 6. The eastern (various cereal grasses) arid Ukrainian steppe on ordinary and Azov chernozyems, has many features which are general to the whole area, both in natural conditions (aridity, and unfavorable winters) and as regards the distribution of crops in accordance with the variations in temperature and soil. This area, however, should be divided into two sub-areas, separated by the Donets basin.

XX 6 (a). This sub-area is located on ordinary chernozems of the former Izium, Kupyansk, Starobel'sk and the steppe sections of Artemovo and Lugansk okrugs. The amount of precipitation is the same as in the preceding area (yearly 400 to 450 millimeters, May-July about 150-160 millimeters with a July temperature of 21-22 degrees), but the winters are colder - average January temperatures from minus 7 to minus 9 degrees, with a snow cover of an average depth of less than 10 centimeters at the end of winter.

The trend of crop husbandry is to grains: wheat-sunflower-corn-barley type. Wheat plays in general a leading part, and the frequent freezing of winter crops makes it even more important than in the preceding area to give preference to spring wheat.

Information gathered by the network of variety testing stations, by sections located in adjacent analagous climatic areas of the TsChO and Northern Caucasus, however, indicate the possibility of a transition, under certain conditions, from spring wheat to the better-yielding winter wheat, -- in order to accomplish this, it is imperative to introduce widely the frost-resisting varieties (Gostianum 237 instead of the Ukrainka, which freezes easily here), to practice snow retention and to keep a larger percentage of clear fallow lands, and earlier sowings. For the next few years it will be necessary nevertheless to



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have spring wheat occupy a larger area than winter wheat.

The hard varieties of spring wheat should definitely have a greater importance than soft varieties. The former have a more valuable grain and their yield equals that of the soft varieties even on soft soil. The best yields are given by the Melanopus 069 variety. When soft wheat is planted, it is permissible to use the best yielding Lutestsens 062, but chiefly for non-mechanized farms.

The sunflower and corn should get as much consideration as wheat. The acreage under sunflower should be increased, but one should take into account the impossibility of crowding, at least until more stable varieties are developed, because of the presence here of broomrape. The Zelenka Khar'kovskaya and Fuksinka varieties are permissible.

Corn, in this part of the Ukraine, gives on the average crops slightly inferior to those in the preceding areas (less humidity, and a shorter growing period). In the interest of animal husbandry and poultry raising, however, and also for increasing the yield of spring wheat which follows corn, cultivation of corn should be increased as much as possible. Varieties: Minnesota 23, and Brown County; Ivory King, is also permissible, where there are arrangements for drying. Barley does not lag far behind corn in yields in this area, and has to be continued among the leading crops. Varieties: Medikum 046, Medikum 105/72. Grushevskiy is a permissible variety.

Looking over the other supplementary crops, one should increase the acreage of the melon group (watermelon and pumpkin), and in the area near Khar'kov also of sugar beet; the secondary crops are potatoes and anise.

It is not advisable to plant soybeans for their beans, as the crops are low and uncertain (arid climate). It is desirable to increase the potato acreage.



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Fodder crops have less importance here than in the preceding areas, partly because the climate is less suitable, and partly because the trend forming is towards grain growing and poultry raising. However, in order to support the cattle-raising as well as to reestablish the fertility of the soil, it is necessary to increase somewhat the planting of fodder crops, with the selection as was given for the preceding area.

The increase in the acreage of wheat, corn and other leading crops in this area can partly be absorbed by growing crops, and partly be at the cost of eliminating oats and reducing sharply the acreage of winter rye, keeping it preferably only on sandy and sandy-loamy soils (in the former Kupyansk okrug).

XX - 6 (b). This sub-area is located considerably more to the south in the steppe area of the Stalinodistrict. As regards soil it is rather like the preceding area, but in climate and in the selection of crops, which should be grown here, it has much in common with the neighboring former Don okrug in the North Caucasus.

The average yearly precipitation is 400 to 450 millimeters, in May-July 130-150 millimeters (with a July temperature of 23-24.5 degrees), and a frost-free period of 170-180 days. Winter weather is also somewhat milder than in the preceding area.

This sub-area maintains on the whole the same type of wheat-corn-sunflower-barley field economy, but, because of milder winters, one could give greater preference to winter wheat as compared to spring wheat, and put more stress on corn, as compared to the Starobel'sk and Kupyansk rayons.

With the spreading of the right varieties of winter wheat, (such as the better yielding and sufficiently stable Gostianum 237 instead



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of Ukrainka, which here is in danger of freezing), this crop yields 1½ times more than spring wheat, and should, therefore, occupy the same, if not a larger, acreage, contingent on a timely early sowing as much as possible on clear (or transitional) fallow lands. Comparing spring wheat varieties, we find that the hard varieties are definitely better yielding here than the soft ones. Taking into account the higher prices they fetch and the proximity of sea ports, they should be given preference for exporting, over the soft varieties. The variety is Melanopus 069. (The soft wheat Lutestsens 062 is acceptable for non-mechanized farms).

Because of the longer frost-free period, corn gives better yields (the later varieties are: Minnesota 13, Brown County and even Sterling). It competes satisfactorily with barley (Medikum 046 and Nutans 8/71, with Grushevskiy and Rikotenze 45 as acceptable, and Medikum 026, which is the highest in yield, but unfortunately does not grow tall enough to be reaped with mechanized equipment). Together with barley, corn must serve as a basis for the development of hog raising. The acreage under corn here must be increased substantially, and that under barley should not be decreased.

The spread of sunflowers must not be forced because of the danger of a devastating form of broom-rape when there are intensive plantings. Of the row crops, corn is the best crop to force. Until more disease-resistant varieties of sunflower are bred, one can accept Saratovskiy 169.

The above general ideas hold also for other crops. It would be advisable to introduce castor beans as secondary crop.

XX - 7. Elevated steppe and forest-steppe on ordinary and degraded chernozems of the former Artemovsk, Lugansk and Stalinsk okrugs, located on the Donets mountain ridge.



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Because of its elevated terrain (reaching 360 meters in altitude) there is a slightly greater amount of precipitation (450-510 millimeters) than in the surrounding areas of the eastern steppe, a deeper snow cover, and a landscape resembling forest-steppe.

Natural traits favor carrying out the tasks which are presented by the social and economic needs of a mining-industry locality with a dense working population, which requires more vegetable gardening, fruit growing and dairy farming, relative to an increase in the growing of grasses and root plants.

Because of the above, the field economy of this area must (and, because of the natural conditions, is able to) be of a fodder-wheat-corn-sunflower-barley type (parallel with the development of vegetable gardening and fruit growing).

The area under fodder crops must be increased by all possible means, and first place among grasses should go to Ukrainian left-bank alfalfa, esparsette (especially on chalky soils) and Sudan grass. For fresh fodder, there should also be winter rye, corn and sorghum. For pastureage there should be sweet clover. For ensilage: corn, sorghum, and sweet clover. Fodder: pumpkins and watermelons. These last two are also for succulent feed. Attention should be centered on ensilage. Root plants: carrots, fodder beets and semi-sugar beets.

It is necessary for food supplies, and it is feasible, to increase the areas of ~~melon~~ cucurbit fields (melons, watermelons, and pumpkins), and to further the growing of edible potatoes, taking all precautions against diseases and so-called "degeneration", which greatly affects potato crops here.

After setting aside the greatest possible areas for the above-mentioned food and fodder crops, the remaining acreage should be allocated on the basis indicated for the preceding area. Winter



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wheat: Gostianum 237; spring wheat: Melanopus 069, which is the leading hard variety. (The soft variety Lutestsens 062, is permissible for non-mechanized farms). Barley for fodder: Medikum 046; Medikum 105-72 and Grushevskiy are permissible. Corn: Minnesota 13, Extra and Minnesota 23. Room may be left here for Lokhovsky and Leitevitskiy, the highest-yielding and drought-resistant varieties of oats- which are for feeding
/the local work horses.

XX - 8. Southern (formerly silver-grass kovyl) arid steppes with southern chernozyems and chestnut soils in the southern parts of the former Odessa and Nikolayev, okrugs, and in the whole of the Kherson' and a large section of the Melitopol' okrugs.

The arid character of the area is sharply defined. The average yearly precipitation is about 350-400 millimeters, and in the more southern sections (XX-8b) even lower, to 300 millimeters; for May-July - 120-150 millimeters (during July and August only about 75 millimeters) with frequent years of drought and poor harvests, especially among spring crops. The average July temperatures are high: 23-24 degrees, with a low relative humidity (at 1 p.m. in June about 50 percent and sometimes less). Winters, however, are relatively warm (the average January temperature is minus 5 to minus 6 degrees), though often there is no snowfall. The frost-free period here is the longest of all the areas of the Ukraine (175 to 190 days). This, in conjunction with high summer temperatures, facilitates the acclimatization of technical crops (preferably with irrigation, but with no irrigation in the case of cotton).

This area, as well as the Crimean steppes and the Prikumsky area of the North Caucasus, belongs to the zone of vitreous winter wheat, southern technical crops, and barley.



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Regarding technical crops in the Skadov, Galaya Pristan', and Tsuryupin areas, and in the southern sections of the Kakhov and Chaplin areas, first place should go to the early American variety of cotton (1306), and its acreage should be extended into the Ochakov, Nikolayev, Khetkin, Genichest, Novotroitsk, Akimov and southern part of the Odessa areas, bearing in mind the results of experiments of 1931.

This area, notwithstanding its low snowfalls, because of its warmer winters, gives a more certain harvest of winter wheat than the northern (and so much more the eastern) Ukrainian steppe. The frequency of droughts, however, makes the probability of spring wheat harvests less certain. According to prewar statistics, covering a number of years, the average winter wheat yield was only 10-20 percent higher than that of spring wheat. According to data of the crop-testing section of this area, covering the last five years (1926-1930) including the severe winters of 1927-28 and 1928-29, which had such a disastrous effect on winter crops, the difference in favor of winter wheat as compared with the best spring wheat amounts to 30-50 percent under conditions of correct cultivation of both kinds. In addition, the quality of the grain in winter wheat is very vitrious and it has the highest content of albumen of all winter crops, and excellent properties for baking. This makes this area take first place in the Union for quality of grain, and it has long been known on the international market for its first-class Krymki variety. With the development of the Ukrainka (and Kooperatorka), our winter wheats in this area occupy an unsurpassed place in the world for the quality of grain.

On the basis of all the aforesaid, we come to the conclusion that winter wheat in this area is preferable to spring wheat, and that the acreage under these crops should be increased after the leading technical crops have been taken care of. The basic variety for the



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area should be Ukrainka. In the west (nearer to the Ameer, in the western part of the Odessa district), the Kooperatorka variety may be permitted, which has little resistance to frost. In the eastern section, which is drier and has less snow (especially in the former Melitopol' district), where the high-grade Ukrainka during some years is in danger of freezing, one may use Gostianum 237, which is inferior in quality, but very stable.

With all the above in mind, one should retain considerable areas under spring wheat, though as a secondary crop. The varieties to be used chiefly are Melanopus 069, and Lutestsens 062; and also Milturum 0162 is permissible.

As shown by prewar statistics over many years, under the conditions of this area, as well as of the similar Prikumsky area, barley gave a yield of 40 percent, and up to 70 percent (in the years 1925-27), more than spring wheat. This is explained apparently by the resistance of this variety to siezures, during summer heat, and because of the low relative humidity of this area.

Barley (of the fodder variety), should be continued here as a supplementary crop, with only slight reductions in acreage, both for the reasons given above, and also because of the proximity of seaports. Varieties: Medikum 046, and Medikum 105/72, Pallidum 032 and Grushevskiy are permissible.

It is desirable to get stable yields even in years of drought and also to increase the acreage of tilled crops, which are needed in crop rotations because they improve the yield of the crops which follow them. The crop cultivation of the area, therefore, should include a considerably greater amount of corn, which on an average gives higher yields than barley, even though it is subject to seizures during its



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period of bloom. The Brown County variety, which is earlier (in spite of the greater length of the frost-free period) is not subject to seizures. The Sterling and Grushevskaya varieties are permissible.

Secondary in acreage, yet highly important is the melon group (melon, watermelon, and pumpkin), peanuts, castor beans (early varieties along the shore), and sorghum, (which can ripen for grain and is important as a drought-resisting plant).



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Because of their low yields in the arid climate of the southern steppe, the importance of fodder crops is less than in other areas. In general, however, their cultivation should be increased, especially in the vicinity of large cities. Varieties which are more drought-resistant should be chosen. Grasses: Ukrainian and Grimm's alfalfa, melilot and Sudan grass; for fresh fodder: the same, and also corn, sorghum and winter rye; for ensilage: corn, sorghum and sweet clover; for ensilage and succulent feed: fodder pumpkins and watermelons; and root vegetables: carrots. The increase in acreage of the above-mentioned crops can be effected at the expense of available waste lands (in the Melitopol' and Kherson' okrugs), by eliminating fields of rye, and oats, and by restricting somewhat barley fields; also by reclamation of bad lands (plavny). The existing large area of sands must be turned into vineyards.

It is understood that the above outline on the distribution of field crops in the Ukraine, based on an estimate of the inherent traits of its various sections, may be substantially altered under the impact of social and economic problems, and the possible effect upon its natural state, of socialized and mechanized production.

This remark refers specifically to those sections of the respective areas, where large cities and industrial centers are located (Kharkov, Odessa, Kiev). Near these, the general plan of field crops, planned for the entire area, must usually give way to vegetable crops, the production of early potatoes and an all-out increase in fodder crops, needed for the development of suburban dairy farming.





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## XXI. EAST SIBERIA KRAY

V. P. Kuz'min

The East Siberia Kray spreads over an enormous area, roadless and sparsely populated, stretching from Sayan to Taymyr and from the Yenisey to the Amur. More than any other region of the Asiatic part of the SSSR, it is dominated by the problem of "struggle against space", both in mastering its natural wealth and in keeping contact with the main centers of the Union. Over 70 percent of the most valuable forests of the region are located in the remote north. The Tungus coal basin, the largest in the world, is in an almost inaccessible desert area between the Lena, Khatanga and Yenisey rivers. The Vitim gold, the platinum of the Noril' mountains, excellent graphites along the river Kureyka and other mining as well as fishing, fur, and other riches of the yet unexplored north will be widely made use of only with the development of means of communication. The realization of the projected railway lines - Tomsk- Yeniseysk and Tayshet - Bratsk - Ust'kut, will represent a great step in this direction; and so also the development and conquest of the Northern Sea Route. It is hard to foresee the sum total of all the potentialities of this area, but, judging from the example of the south of this region, which is populated, explored, and served by transportation lines, these potentialities are inexhaustible.

The realization of the project for a [redacted]Baykal electric power network, 10 times more powerful than that of Dneprostroy, the utilization of coal, clay, iron ores in the Baykal area and "polymetallic" ores in the Transbaykal, electrification and industrialization of farming and forestry with exceptionally cheap current from the Angara, Irkutsk and other plants: all this immediately transforms this region from the savage penal colony of the Tsars into a progressive cultured



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region with an economy of world significance. A broad realization of the policy of development of national cultures among the native population of many nationalities; the many millions which will migrate into the region in connection with enormous building projects; all this will soon change the primitive farms of pastoral, nomadic, hunting and sometimes even vagrant economy into the most perfect socialistic forms, and in particular, will give strong impetus to the development of agriculture.

The climate of the East Siberian plateau has unusual features. The period of growth is short. There is a constant threat of out-of-season frosts and droughts. Winters are severe, with little snow. This, combined with an unusual mountainous terrain, is the reason why large-scale crop husbandry can exist only in the limited southern section of the region. The taking over for agriculture of the enormous reaches of the tundras and the zone of northern taiga, cut off from the world and from each other, presents tremendous difficulties. It would not be expedient to do this just in order to utilize vacant lands (such lands, easier to conquer, are available under more favorable conditions). This should be done only in places, in order to create a basis for food and fodder, which will serve the successful development of industry and crafts in the far north, and will contribute to a higher cultural level and to a fight against diseases among the cattle-raising and hunting population. In this region one must first of all consider vegetables and fodder, which cannot be easily transported, and in isolated places also cereals, leaving the remaining acreage for animal husbandry, in order to utilize the vast tundra, mountain, and forest pastures, and the rich floodlands.

The situation is different, however, in the southern forest-steppe, subtaiga and southern-taiga zone. Here, there is enough warmth



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to grow grass. The conditions of soil and climate are favorable to grain crops, including spring wheat. When the discoveries of agricultural engineering are more fully utilized and earlier varieties are developed, spring wheat and some other crops can be moved much further to the north of their present limits. The yields of cereals are in general very high in the Eastern Siberian region, but, according to experimental stations, they can be considerably increased. The point to be especially taken into account for the future is the possibility of an enormous increase, on the basis of an increase in electric energy supplies, of the cultivation of valuable crops requiring more labor, which was handicapped by lack of manpower.

To this group belong the following crops, which find perfect conditions for growth on open fields in various sections in the southern part of the region: long fibre flax, Badan hemp, potatoes, fodder root plants, and a large assortment of vegetable and berry crops.

Thus, the development of industries in the south causes an intensified development of farming, which will continue until this are can satisfy the demands of not only the more populated southern area, but also to a large extent of the Yakut and Buryat North. This will be accomplished by moving the borderline of agriculture further north, by increasing the area of fields and by raising the yield of crops.

The Polar and Sub-Polar North. - Little explored, occupying almost one-half of the area of the region, it can be divided broadly into the following sub-areas:

a) Extreme north - a zone of forest-tundra, tundra, and the islands in the Arctic Ocean. The southern frontier of this sub-area passes approximately along the Putoran mountain range (the watershed of the Khantayka and Kureyka rivers, and, on the left bank of the Yenisey, along the watershed of the Pilyatka and Turukhan rivers; i.e., beyond



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the Arctic Circle. Temperatures are very low and precipitation is small both in summer and in winter (average temperature in July ranges between 2 degrees on the seashore and 15 degrees in the south, and in January, between minus 27 degrees in the west and minus 36 degrees in the east). This, combined with permafrost and the undeveloped soil of the tundra, indicates deer raising, fishing, fur trapping, breeding of fur-bearing animals, and hunting, as the basic branches of economy. Fishing on the rivers and along the sea has far outgrown the local requirements and continues to develop rapidly. In the harbor of Ust'-Yeniseysk, a canning plant with a yearly capacity of 4.5 million cans was built and put into operation in 1931, within one polar night. This, of course, is only the start of making use of the great reserves of fish, sea beast and reindeer meat. The increased breeding of polar foxes and the development of other branches of animal husbandry will give an even greater fur crop than is obtained now. With the wider use of the North Sea Route, the development of the Noril'sk coal deposits, (where platinum also has been found). This is the third location of platinum deposits in the Union, following the Uralsk and Viluysk ones which already are being exploited, and the establishment of a harbor, the area at the mouth of the Yenisey rapidly becomes more and more industrialized.

For economic and climatic reasons the primary consideration of crop husbandry here should be the establishment of centers of vegetable gardening and fodder raising, which would guarantee the existence of dairy cattle and an increase in reindeer raising. So far, the possibilities of raising cereals and technical crops are very uncertain. Vegetable gardening, however, is possible under special conditions: in the south; in hotbeds; and the early varieties of turnips, radishes, green vegetables, and early potatoes can be grown in covered ground,



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and also in open places, artificially protected from north winds and untimely frosts. In the north, however, this is possible only in hotbeds and hothouses in industrial centers, using waste steam or electric current for heat and light. The possibilities of utilizing the enormous energies of wind for this purpose are very great here.

In populated areas, which here are the river valleys, fodder often is provided by water meadows. These, together with the vast reindeer pastures, with marshy and lakeside vegetation, must form the basis for the development of settled reindeer-raising as well as dairy herds. These areas should be reclaimed, improved and protected against snow drifts. Grazing on pastures of nomadic and transport routes should be regularized, and stocks of fodder laid up against winter shortages. These measures would stabilize the fodder supply.

For the present, one has to discount any possibility of growing perennial grasses out of the available varieties, because of severe winters, absence of snow, and presence of permafrost. However, the amount of green fodder and hay can be augmented by sowing oats and barley, or mixtures of both, with early fodder peas or winter vetch in a spring sowing.

b) Northern Taiga Region. The southern border of this area can be drawn approximately along the watersheds of the Chulyma and Ket' rivers, the Verkhnjaya (upper) Tunguska (also called Katanga or Angara), and the upper reaches of Vilyuy and Lena. South of this borderline, the climatic conditions of both summer and winter are more favorable. The soil is more developed and has more warmth, and agriculture can successfully grow to the size of an important industry. To the north, however, these potentialities decrease sharply, and, under more favorable conditions, agriculture can function only sporadically to take care of local needs in non-transportable products.



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The total warmth of the growing season here increases from 1,000 degrees in the north to 1,600 degrees in the south, but the frost-free period reaches 95 days only in the south, dropping to 70-75 days in the north. The summer is fairly hot (average July temperature is 16 degrees in the north and 17 degrees in the south), and dry, but the winter is very cold (the average January temperature in the northeast is between minus 28 and minus 36 degrees), and with comparatively little snow.

The soil of the area is mainly clayey and weakly podzolic, with peaty podsols, skeleton and mountain-tundra soils and alluvial soil along the rivers. Permafrost is found throughout the area. In the west, there are vast peat bogs.

The area of transition (Central Siberian tayga) between the west-Siberian marshy tayga and the more continental, dry eastern tayga. The forests contain many larches and pines and fewer of the less valuable cedars and firs. Moss is general, especially in the north, while to the south, the grass cover increases. Along the river are forage areas of water meadows, but these are smaller than in the western-Siberian tayga. The forests, marshes, enormous spaces, and severe climate, all have slowed down settling, and have formed a barrier between the native population and the rest of humanity. They have kept their economy and their patriarchal hunting and herd-tending mode of life on the level of long-past centuries (the Nen'tsy, Samoyeds, Ostyaks, Evenki (Tungus), and Yeniseyts still are divided into kinship tribes - "Eagle", "Little Cedar", etc.). Even now, the achievements of the social and economic reconstruction of economy and mode of life often are 2 or 3 years late in reaching here.

Reindeer raising, fishing and hunting valuable fur and meat animals in the most primitive way, which not so long ago were largely



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dependent on private capital (semi-feudal local princelings, shamans and rich kulaks) constituted the only basic branches of the economy of national minorities. Forest and mining wealth has long remained almost untouched. Vegetable gardening, feasible in this climate, developed poorly, because it drew labor away in summer from the main occupations of fishing and wood crafts. The same reasons reacted unfavorably on cattle raising, which was chiefly left to the care of nature. The area, however, is enormously wealthy in timber and mining resources. The Tungus coal basin (the largest in the world: 1,400 kilometers long by 1,300 kilometers wide), gold fields and mica beds in the Yenisey mountain range, deposits of excellent graphite along the Kureyka, Fal'yanikha and Bakhta, rivers, and newly found beds of conglomerate mineral deposits, etc.; valuable pine and deciduous forests along rivers where logs may be floated, a huge yearly accumulation of wood going to waste: all this calls for a more thorough utilization of the area with the general plan of building up the industry of the USSR, simultaneously with a more rational organization of its native occupations: reindeer raising, fishing and hunting, to be raised to the importance of industries. The severe climate and sparse population of the area calls for economy of labor in order to use it more productively in the timber and mining industries, rather than in an intensive adaptation of land to agriculture. Though the cost of freighting produce is very high (up to 700 rubles per ton delivered to the river docks on the lower reaches of the big rivers), it still is more expedient to bring in from other areas those products which can more easily be transported, using the minimum amount of labor for agriculture, and yet bearing in mind the imperative necessity of supplying vegetables and fodder to industrial areas and centers. Here, as in all sub-polar regions (see I-1, II-1, etc.), vegetables and dairy products



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are essential components of the diet. The development of vegetable gardening and of animal husbandry must precede the industrial settlement of this area.

At present, some areas and centers have already been, or are being earmarked for the spread of industries. Such are the mighty sawmills at the port of Igarka, where it is planned to bring the number of woodsawing frames up to 20, and to set up various workshops in addition to cooperage and crate making. Operations have already spread over the wild tayga land masses of Podkamennaya and Nizhnyaya (lower) Tunguska, Sim and Yeloguy. The mining of graphite plant with a huge annual capacity is being built. The prospects indicate a colossal increase of the river fleet and lively activity on the canal leading to the Ob', development of the Northern Sea Route, etc.

All this in place of the former unplanned isolated spots of haphazard and unstable crop husbandry, demands the setting up of large Sovhozes (Soviet farms) for vegetable and fodder growing; first of all on the Yenisey, and later on, along its main tributaries - the life arteries of the region.

It is already possible to cultivate here a large variety of vegetables in the open, and when forcing in hotbeds and nurseries is organized on a wide scale, this variety may be very large. Almost everywhere with few exceptions, it is possible to grow early potatoes successfully. As regards the choice of fodder, it should be first of all noted that here, as in the following areas at the same latitude, it is necessary to work out a variety of perennials, using accelerated methods of selection, of local and world varieties. Existing crops do not fulfill the requirements of this continental northern region, and at present it has to be considered as a region of annual fodder crops. For use as fresh fodder and hay, one may grow oats, barley, spring rye, either separately or mixing them with winter or spring vetch or peas. As regards edible root plants for succulent fodder, early



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potatoes may be grown everywhere, and in the south also turnips, on warm sandy loams. Natural pastures and grazing areas along the river "poyma" must be improved to be better utilized and become the foundation for breeding deer and dairy cattle.

Early barley may be grown in separate places of the area, and this crop, especially in isolated areas, where deliveries of cereals and concentrated fodder are difficult, must be given due consideration, using the extra-early varieties, developed by the Tulun'sk and other selecting stations. The earliest varieties of oats, hemp and flax for fiber can be planted in the more favorable spots of the southern half of the sub-region. In general, all these crops must be subordinated to vegetable and fodder crops. The growing of hemp, however, is of great importance for rigging freight and fishing fleets and for net-making. With the possibility of hemp field with fertilizer in the areas near cattle farms, the cultivation of hemp should increase greatly. One must remember, however, that the ripening of hemp seeds is not always certain in every location, so that these fields should be placed only in the southern part of the area, and growing for seeds moved still further south, for safety.

The southwestern section of the region, along the river Yenisey, south of the mouth of Podkamennaya Tunguska, is an exception to the general distribution of crops. Here the growing season is longer and warmer. The zone of greater summer and winter precipitation extends into this region from the west and the south, under the protection of the Yenisey ridge. Here, therefore, it is possible to grow for grain winter rye, oats, spring wheat, barley, spring rye and hemp. It is necessary to try out here on a large scale the possibilities of raising flax and clover (with timothy), drawing chiefly upon the material obtained at the Kazachin'sk experimental fields for clover sowing.



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XXI - 1. The Biryusinsk depressed south-taiga region occupies the eastern half of the central section of the former Krasnoyarsk Okrug and the central and northwestern sections of the former Kansk okrug. This is a dry coniferous taiga, which passes into the continental eastern area. The region is dominated by pine forests, in places consisting almost entirely of Rondovaya pines and mast timber. There are less larch forests. In damp, low-lying places with poor grass and a moss cover, there is the black taiga (firs, silver firs, and cedars). There are numerous burned-out spots, resulting from the struggle of the natives with the "evil of the taiga", vast meadows, and valleys and islands in the rivers.

Climatically, this area is rather favorable for the development of land cultivation and its push to the north, which so far has taken place only along the rivers and valleys, running in a latitudinal direction and therefore protected from cold north winds. The frost-free period is 100 days and more, the total warmth during the period of growth is 1,600 to 1,700 degrees. The average temperature of July is quite high: about 19.5 degrees, but in January it is between minus 21 and minus 23 degrees. The amount of summer and winter precipitation is moderate.

The prospects of this area are for very intensive exploitation of valuable timber resources, mechanically and chemically converting these into wood products. In addition to large rivers for floating logs and a canal leading to the Ob', the area will have the use of the Tomsk-Yeniseysk and Tayshet-Bratsk railroads. After the projected powerful sawmills and the paper-cellulose plant near Yeniseysk have been built, the region will have a very large local industry. The Yenisey ridge and the basin of the Biryusa and Pit rivers are gold-bearing areas, and there are also valuable alunite and bauxite deposits. Ac-



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cording to its industrial development and natural conditions, this region consists of two parts. The more industrialized western ("a") occupies the area lying on the river Yenisey itself, between the Yenisey range and the Yenisey-Ket' watershed. This section is more depressed and lies chiefly on sand and clay deposits. Since it is protected by elevations on the northeast, it has a warmer, longer and more humid summer and a somewhat milder winter than the eastern section of the region, which is more open, being located on eroded elevated plateau ("b").

Weak podsols and clayey forest soils predominate. Along the rivers there are marshy and "warmer" sandy-clayey and sandy soils. The valleys have alluvial soils. In sub-area "b", permafrost is widespread, while sub-area "a" lies to the west of its limits. As a whole, conditions in the area make possible reliable field cultivation. Attention should be devoted chiefly to fodder crops to supplement the insufficient natural fodder, also to flax and vegetables. Long fibre flax should grow well here, and yield high quality fibres. In the western sub-area, clover (with timothy) can be sown, and in both subareas, edible root tuber plants can be stressed: potatoes, turnips and rape; for hay, fresh fodder and ensilage - oats, barley, vetch and oats mixture, and winter rye. In the southern section, flax and potatoes should act as supplementary crops, while in the north, along the Yenisey, a technical crop - hemp - may be of great importance for the reasons indicated for the preceding area.

When cheap electric power is obtained from the Angora, Chulyma and other rivers, technical crops may be crowded considerably; and when transportation is improved and more food is imported, the importance of fodder crops will rise with the development of the butter-and-dairy and hog-raising branches of farming.





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Vegetables, fodder and technical crops are of greater significance in the western, more industrialized, sub-area ("a"), and this sub-area should specialize in them rather than the eastern sub-area, where cereal crops are of more importance.

Counting from east to west, but sometimes changing places, the following cereals can be grown: spring wheat, winter rye, and also oats, which are very necessary here. Under more rugged conditions, barley and spring rye may be sown as supplementary crops. In the relentless and protracted process of moving cereal crops northward, very early varieties have been segregated, and these should form the basis of crops, to the exclusion of careless introductions of untried seeds. Of special interest here are the early varieties of spring wheat: Angarka, Krasnen'kaya, Sibirka, and others. The Krasnoyarsk selection is suggested for seed in the western sub-zone. The Tulun'sk variety is suggested for the eastern sub-zone.

XXI - 2. Ilim-Verkholensk - elevated south-tayga area. Mountainous southwestern section of the Central-Siberian tayga, covering the greater northern section of the former Irkutsk okrug, the northeastern section of Kansk and southwestern section of Kirensk okrugs.

According to climate and terrain, the area is divided into two parts by the Berezov and Ilim mountain ranges. The eastern or Kirenga-Lensk part is a high upland area covered with tayga, dropping sharply to the Lena and the Kirenga, situated at the western limits of growth of the Daur Larch (sub-area "b") and the western - Ilim-Angara, elevated part of Priangarye. It is a much eroded, less wooded plateau with wider valleys and open meadows, a milder climate, and it has a more highly developed type of economy ("a"). There are larch and pine forests, more rarely "black" tayga, burned out sections, open areas, and occasional islands with the forest-steppe type of vegetation.



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The average frost-free period here is around 95-100 days. The total amount of warmth during the growing season is from 1,500 degrees in the northeast to 1,700 degrees in the south. The summer is hot and comparatively dry (average July temperature about 19-20 degrees). The winter is cold and there is little snow (January mean temperatures from minus 22 degrees in the south to minus 27 degrees in the north). The climate varies greatly, depending on the terrain (altitude, direction of slopes in relation to sun and winds) and forest growth (retention of snow, also humidity). The best climate is in protected river valleys.

The soil is weak podsol and sandy clay, sometimes marshy or semi-marshy, with widespread permafrost, especially along the watersheds. This limits field cultivation to the lighter, better drained sandy-clayey and sandy soils of the slopes of river-valleys. The valleys of the large rivers have meadow-type alluvial soils.

This area has extremely large agricultural possibilities, especially its western sub-area, where the future "Bol'shaya Angarskaya" power station will be located. Also it has enormous iron deposits (Dolonov, Kedzem'sk), and particularly some newly discovered deposits now are being surveyed; these have as much ore as the Magnitnaya mountain (in the Urals). Like the western sub-area, this section has very great possibilities and potentialities for lumber and timber industries. When the Taishet-Bratsk-Ust'kut (or Kirensk) railroad is built through this region, it will be possible not only to supply lumber and boards, but to develop the processing of valuable sawmill material and to fully utilize the enormous quantities of pulp less valuable to manufacture: messanite fiber, kraft-cellulose, building accessories, shingles, wooden pipes, box sets, barrel staves, plywood, paper cellulose, viscose, cardboard, rosin, turpentine, alcohol, acetic acid, acetone, ester pine oils, tar, coal, etc. These will be needed by the developing industry

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in the Predbaykal'ye (West Baykal), which will bring into its orbit not only this area, but also the adjoining areas, shifting industrial centers and widening the wood industry far into sparsely populated sections of the area.

Therefore, it is essential to plan the development of crop cultivation in the area so as to supply local industry, as far as possible north of its present limits; and simultaneously, to intensify the conquest of new areas from the tayga. The wealth of the area in fish and animal life demands new improved and cultivated ways of carrying on these branches of economic activity.

The tremendous significance of farming will be indicated by its having to supply the industrial population of Angastroy, Cherembass and Bodaybo. In this connection, the electrification of dairy, butter and hog farms and also vegetable farms near industrial centers, will be of great importance. Flax in sub-area "b", as well as cereal crops, may likewise acquire the position of staples. In the more remote mountain-tayga areas - the development of dairy herds, meat production and hog-raising is based on the utilization, chiefly, of improved natural pastures and hayfields. In the southern part of the western sub-section, flax can be widely grown, and, if the supply of seeds from outside is arranged, flax growing can spread far to the north.

Hemp can be grown everywhere as a secondary crop, especially with the manure of the cattle-raising areas and farms. This crop can be very important for the Baykal, Lena and Angara fleets, in supplying rigging for fishing vessels, etc.

Considering the sowing of grass, the comments made regarding the preceding area are true here; i.e., because of the harsh winter conditions and lack of suitable seeds, a selection of perennials, especially alfalfa, should be grown intensively, using local and imported seeds.



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So far, the following varieties of imported grasses are slated for use in the more favorable spots in the south of sub-area "a". American couch grass, beardless broom grass, Siberian esparsette, and in more humid places - timothy. This selection should, however, be verified by large-scale experiments. Annual sowings for hay, fresh fodder and ensilage may be composed of oats, winter and spring rye, and mixtures of oats and rye, oats and peas and vetch. Special notice should be taken of late sowings of oats (at the beginning of June) which give a good harvest of greens. The root tubers should be potatoes and turnips. White mustard may also be used for green fodder.

Notwithstanding the short growing season and the threat of frost and drought, grain crops give very good and steady yields. This is due to the hot summers and the fertile, often carbonated, soil. Spring wheat could lead among them all over the area. In the western sub-area, the Tulun(sk) Balaganka variety may be used, and later on perhaps other, more valuable varieties of the Tulun(sk) experimental station. In the eastern sub-area, there should be the Angarka, Krasnen'kaya and other local early wheats. Considering the great importance of horses during the period of building and also in development of forestry, the chief crop should be oats (in the western sub-area Tulun(sk) 86/5 may be used), and later, when hog-raising and meat-cattle breeding become more prominent, barley. In the western Tulun(sk) sub-area, Chervonets may be used. As secondary crops, there should be winter rye, and in more severe climates, spring rye. As concerns winter rye, it should be noted that it can be considered as a chief crop for the well protected western snowy places with mild winters, until the bringing of grains into the area is arranged. Further to the northeast, however, where winters are colder, the importance of winter rye should decrease in favor of spring rye. In the western section, the permissible varieties of winter rye are green Tulun(sk) and spring rye Tulun(sk). In the "a" sub-area, the



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cultivation of early peas must take root, (Tulun(sk) beta and other Tulun(sk) hybrids). In general it should be noted that the composition of cereal crops may vary greatly here, depending on geographical location, terrain, forest cover, etc. Differences in altitude are felt greatly near the northern limits of crop cultivation.

XXI - 3. The Bodaybin mountainous tayga covers the Bodaybin section of the former Irkutsk and the southeastern part of the former Kirensk okrugs. This is the mountainous area of the Eastern Siberian tayga. High uplands, cut through by large rivers, are shelters for isolated farming areas. There are forests of pine and larch, and there are open areas on the upper reaches of the mountains. This is one of the coldest places in the region, with a very short summer (less than 100 days without frost). The summer is dry and rather cold (mean temperature in July - 17.5 degrees). Winter has little precipitation, and is very cold, (average January temperature minus 31 degrees). The soils are chiefly of sandy clay, weakly podzolic. They are skeletal, peat-bog and mountain-tundra soils. Permafrost prevails.

The Bodaybo group of gold fields, the most important gold fields in the USSR, are located in this area.

The local Tungus population lives chiefly by hunting and raising reindeer. Under these climatic conditions, crop husbandry occupies small plots in the protected valleys of the Lena, Vitim, Chara and other large rivers. The possibilities for animal breeding are comparatively greater. The basic tasks of both types of activity is to supply the population of the mining and forestry centers with vegetables, milk and dairy products. Dairy farming Sovkhozes must be organized in the mining areas.

The crops should consist of the earliest varieties. Vegetables should be protected from low temperatures by hotbeds, seed frames,



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windbreaks, etc. All means should be used to speed ripening. The selection of fodder plants consists mostly of annuals: oats, oats and peas mixture, rye and oats mixture, white mustard, potatoes, and turnips. The chief grain crops could be spring wheat and oats. The local early varieties would get enough warmth if properly located. Barley and spring rye should continue as supplementary crops. In addition to potatoes, technical crops, such as white mustard and flax for fibre, may be planted, with the risk, however, that the seeds will not ripen. it should be taken into account that, in accordance with the local terrain, the importance of individual crops varies greatly in different localities.

XXI - 4. The Kansk-Krasnoyarsk forest-steppe occupies the central part of the Krasnoyarsk and the western part of the Kansk rayons. This is a zone of transition between the Altay-Sayan and the Central Siberian taygа, an area of forest-steppe islands in the open taygа, in the zone of narrow-leaved and coniferous forests.

This is the first area in the southern tier of the region which is more favorable to crop cultivation. It is more densely populated; and is a forest-steppe grain-growing region. This area is situated more to the south, yet it still has the characteristic climate of the preceding areas: threat of early frosts, of spring drought, of too little snow, and low temperatures in winter.

In this area light frosts frequently occur in August. The frost-free period is 100-110 days, longer in the west than in the east. However, the total warmth during the growing season is quite considerable and amounts to about 1,800 degrees, because of the high average temperatures of the summer months (the average July temperature is 19.5 - 20 degrees). Summer is rather dry (May-July gets about 135 millimeters of rainfall, about the same as Samara). There is little snowfall. The



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Kansk part of the area has more snow. The average January temperature is minus 21.5 degrees. The eastern part of the Kansk area lies within the zone of islands of permafrost. The soil is the chernozyem type, chiefly over loess, sandy clay, and varies from rich chernozyems (near Krasnoyarsk) to grey forest soils and podsols in the higher areas. The prevailing types, however, are lixiviated and degraded chernozyems. Natural pastures are very scarce.

Of all the region, this area has the most plowed land and the densest population, which is conducive to crop husbandry of a more intensive type. An impetus in the same direction is provided by the potentialities of industry, based on the exploitation of coal (Kansk basin of brown coal) and iron ore deposits, wood-working, and the use of locations favorable to transportation. This intensification must appear, first of all, in setting up large dairy-vegetable farms near Krasnoyarsk and Kansk. Then, it must show in the increase of flax sowings in the most favorable locations near woods and humid lowlands, and in the introduction of other technical crops (potatoes, white mustard, and makhorka).

On the whole, grain growing must be combined here with production of fodder and technical crops, though without losing its dominant importance. In contrast to other areas of the region, the climate here permits successful growing of later and larger-grained varieties of wheat. Among grains, this crop should be of basic importance (until the results of this contest are determined, the Leda variety may be used). Oats should be planted as a supplementary crop, and, in protected snowy spots, winter rye. Large-grained varieties of oats will also ripen here, such as Zolotoy Dozhd', Lel', and, under better conditions, the white-grained Pobeditel' Dippe. As regards rye, under the safest conditions Vyatka may be grown, and in other places - local kinds. According to the tests of different grains in Krasnoyarsk,



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barley can yield good brewing grain, so, in addition to being used for fodder, it can be cultivated here, in the western part of the area, for supplying the breweries of the region. The best variety for this purpose has proved to be the two-rowed Professor Viner. For fodder and in cases requiring early harvests, the early and fruitful variety Tulun(sk) Chervonets must be planted. Peas should be planted in the fields, and their cultivation increased. In view of the distance from the basic buckwheat growing regions, it is necessary to grow buckwheat here.

The selection of fodder crops may consist of the following for hay: hybrid alfalfa, American couch-grass, beardless broom grass and Siberian esparsette, and in places with more favorable winters and more humidity, also timothy and meadow fescue. For ensilage: sunflower, sweet clover, and a mixture of vetch and oats is suggested. For succulent fresh supplementary feed: winter rye, oats, a mixture of vetch and oats, and sweet clover are suggested. The edible root tubers are potatoes, turnips and rape grown in seedbeds.

XXI - 5. The Irkutsk-Nizhneudinsk belt of open tayga and forest-steppe, occupies the southeastern section of the former Kansk, and the southern part of Irkutsk okrugs, to the Sayan Mountains. Here are mixed and pure pine-and-larch forests of the open tayga, with some islands of natural forest-steppe and steppe with various grasses.

The conditions for field cultivation here are much more rugged than in the preceding area. The continentality of the climate is much more pronounced. The length of the frost-free period is about the same, 100-105 days, but the danger of untimely frosts is greater. The period of growth is somewhat less arid (160 millimeters during May-July), but not sufficiently so. The summer is colder (average July temperature 18-19 degrees; with the total heat of the growing period, about 1,600



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degrees). There is also little snow in winter, and it is colder (mean January temperature from minus 22.5 to minus 24.5 degrees). The area is situated in the zone of (islands of) permafrost. The soil consists of weak podsol sandy-clays, often lying on carbonated beds (semi-rendziny), rich with humus, sometimes passing into varieties of chernozyems. Along the rivers, there are sand deposits (especially in the east, in sub-area "b", and alluvial meadowland in the valleys.

The watershed of the left tributaries of the Angara and the right tributaries of the Oka is the approximate eastern borderline of the Angara-Cheremkhov sub-area. It is more suitable to settlement, has a slightly longer summer and a more moderate climate, influenced by the basin of the lake Baykal. The area is extremely rich in mineral deposits, has enormous sources of water power, is cut length-wise by a railroad trunk line, and represents a junction of the roads leading to adjoining republics of the Union and abroad - in Mongolia. In addition to the priceless Cheremkhov and other coal deposits, Marninsk copper, bauxites and alunites on the Belaya, Oka, Onot, and Biryusa rivers, Baykal iron ore, valuable timber, and so on, it is planned to exploit polymetals, manganese, graphite, asbestos, lumber, etc. in Yakutiya, Buryatiya and in the Zabaykal section of the area, making use of the current of the Angara. A power plant, with an output ten times as large as Dneprostroy, will strengthen and industrialize agriculture here to an unprecedented degree. At the same time, the enormous increase in the industrial population and the addition of a tremendous amount of mechanical energy will drive the farming economy to an enormous increase in land cultivation in order to guarantee a supply of food and a reserve of raw materials.

The first problem to be faced is the establishment of dairy and vegetable farms, in order to obtain and convert raw materials at the



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points of distribution and receipt of electric current. There should be an increase in technical crops, in the first place, of long fibre flax, which finds favorable conditions here, and of hemp, whose cultivation must be based on cheimical fertilizers and a more extensive use of manure. On a slightly smaller scale - potatoes, badan, makhorka, (all of which find favorable conditions here) can be grown extensively. The fodder plants for the area are: American couch grass, beardless broom grass, Siberian esparsette, yellow alfalfa, and in damp spots also timothy and meadow fescue for hay. There should be winter and spring rye, mixtures of oats and rye, oats-peas and vetch, and white mustard, for green fodder and for ensilage. The edible roots include: Potatoes, rape and turnips. Supplemented by natural hayfields and pastures, these crops should adequately supply large-scale dairy farming and hog-raising. Supplies of hay and ensilage can be added to late plantings (first half of July) of oats, which under these conditions yield large amounts of green fodder.

As the acreage of plowed fields increases, the great importance of grains remains the same. Because of hot summers, spring wheat of early varieties of spring wheat (Tulun(sk), Balaganka, and in the future f.030 or f.0178, and in sub-area "b" the larger grained Tulun(sk) varieties), should be of leading importance. Second to spring wheat, but figuring also as one of the chief crops, is winter rye (Tulun(sk) zelyonozernaya) and oats (Tulun(sk) 86/5) of which the first is to be sown mainly in protected wooded snowy places, and the second in places where horses are plentiful, as near construction projects, lumber operations and along the main lines of horse transportation. The growth of hog-raising should be ensured by a supply of barley (Chervonetz variety). The places which are not suitable for any of the above crops can be used for spring rye. The last-named two crops should not drop





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below the position of supplementary grain crops. Attention should be given to establishing the cultivation of peas. Of cereal crops, early local millet and buckwheat can be sown as secondary crops.

On the southern shore of [redacted] Lake Baykal, there are places which are protected by mountains from the winds and are affected by the moderating influence of the sea-lake on the climate. Such "warm" places should be used for orchards and berry plantations.

XXI - 6. The Chita-Sretensk forest-steppe occupies the southeastern part of the former Chita and the southern part of Sretensk okrugs. It is covered with large islands of tayga and forest-steppe with birch trees, pines and Daur larch along the mountain ranges and a mixture of diversified grass and "kovyl" steppes, mixed in with the woods in both horizontal and vertical bolts. The area is little plowed, and has many pastures and hay fields. The amount of land suitable for plowing is considerable.

Climatically, this area is very continental. The length of the frost-free period is about 100 days. The total amount of warmth during the growing season is from 1,600 degrees in the north to 2,000 degrees and up in the south. The summer is hot (average July temperature about 19.5 - 21.0 degrees) and there is not enough rainfall (May-July about 130 millimeters). The winter is very cold (average January temperature minus 27 to minus 32 degrees) and there is very little snow (average maximum depth of snow at the end of winter is under 10 centimeters). Geographically, there is continuous permafrost. The soils are very diversified, according to the relief; in steppe areas - chestnut and chernozyem-like in conjunction with solonchaks; in tayga areas - podsols; and in intermediate areas - forest sandy clays. In the valleys, the soil is sandy.

This is highly developed mining area. Here are the Olovyannoye, Smirnovsky, Zavitin and other tin deposits; also the Yakaterinensk,



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Pavlovsky, Shilkinsk, Preobrazhensk, Tayshin, Ildikan, Akatuyev, and other silver mines. There are also many other silver, gold, lead, zinc, mercury, tungsten, molibdenum, bismuth, etc. mines. Brown coal deposits are numerous.

This area, with the one following, is one of our bases of non-ferrous metals. Thus, the economy of this region is both mining and agricultural. Under the prevailing climatic conditions and because of the availability of large fodder areas, the farming here, in the future, must combine animal husbandry with the raising of grain crops. Because of hot and dry summers, the principal grain crop should be spring wheat, to a lesser degree by spring rye, and , in more humid places where horses are raised or where draught horses are kept, it should be oats. The place of supplementary and secondary crops should be reserved for grain: buckwheat and early millet.

Mining areas should be well provided with a system of dairy-vegetable farms. Natural pastures supply enough summer feed. A certain deficiency in winter fodder can be remedied with fields of: yellow alfalfa, Siberian wild rye, millet, oats and an oat-spring-wheat mixture, and also potatoes.

XXI - 7. The Borzinsk steppe area covers the extreme southwestern section of the former Chita okrug. The area consists of two parts: the western ("a") - dry varous-grasses and kovyl steppes on degraded and lixiviated chernozyems with shifting sands, and the eastern ("b"), semi-desert steppes on rich ordinary southern chernozyems and chestnut soils with spots of salines and sand masses. This area differs from the preceding by its even greater continentality and aridity, so that farming, and especially raising of vegetables, must be on irrigated land. The western sub-area "a" is more propitious for agriculture. The whole area resembles the dry Mongolian Gobi steppes. It is poorly



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suited to husbandry, and the basic branches of farming should be sheep-raising and cattle growing, which are well provided for by steppe and mountain meadows, pastures, and hay fields.

Cereal crops should be the same as in the preceding area: spring wheat, spring rye, oats, with the addition of barley, buckwheat and millet. The polymetal mines (Sherlovsk, Bukinin, Kharanor, Duldurginsk, Klichkin, and other groups) as numerous here as in the preceding area, must be supplied with enough potatoes, vegetables and milk.

XXI - 8. Mountainous Sayan tayga in the southern part of the former Kansk okrug. On the lower levels of the Sayan tayga there grow mainly cedars, with larch, firs and silver firs. On the upper levels, there are alpine meadows and tundra. The climate is the exceptionally harsh one of the continental northern uplands. The soils are of skeletal type, little developed and marshy. The population is very sparse. The Karagasses in the upper reaches of the Uda and Biryusa live by hunting and reindeer-raising. There is a complete absence of roads. The area is undoubtedly rich in minerals, but not explored. The timber is hardly used. Field cultivation is possible only in the low-lying sections of the uplands, which belongs to the XXI-5 area.

XXI - 9. The area of the Daur tayga - southwestern and northern section of the former Chita and the northern section of Sretensk okrugs. It is the Amur, Lena and Selenga watershed, cut up by large mountain ranges. Open spaces and tayga alternate. There is little plowing, which is limited by climate and relief. There are numerous pastures. This enormous area with a much cut-up surface has a great diversity of climatic conditions. On the whole they are very severe and do not favor field cultivation. The frost-free period amounts on an average to about 90 days, and the summer is rather cold (average July tem-



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perature is 15-17 degrees; the total warmth of the growing season rises to 1,600 degrees only along the northern borders). The winter has exceptionally little snow and is cold (average July temperature from minus 20.5 to minus 26.5 degrees).

The upper soil is also very diversified. Weak podsols, clayey and sandy-clayey soils predominate, on the whole. Also, there are forest-sandy soils and stretches of sands. Most places are subject to permafrost. Under these conditions and with the availability of rich pastures, farming tends to cattle-growing (large cattle, sheep and horses), rather than to field cultivation. However, by reclamation, improvement of pastures and hayfields, andan addition of winter fodder from cultivated fields, husbandry could be developed and the cattle-growing basis of farming changed into dairy and dairy-meat farming, which is essential in places.

The reserves of hay can be increased by sowing annuals: oats, oat-peas mixture, spring rye, juicy green fodder; and by the enlargement of potato fields. The usefulness of individual perennial grasses has not been determined in this area. It is necessary here, as in many preceding areas, to determine this through accelerated selection among local and world flora. Because of its harsh climate, in grain growing this is an area of "yaritsa", which can bear well all the hardships of nature in this locale. To a lesser degree, the crops of spring wheat and oats are fairly safe, though these might be more important if the earliest varieties are selected. As supplementary crops - barley, under conditions requiring the earliest ripening, and buckwheat, where conditions are more favorable. The centers of population and industry (town of Chita, Petrovsk Ironworks, Chernovsk coal mines, etc.) must be provided with near-at-hand vegetable and dairy farming.



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## XXII. YAKUT ASSR

The area of this republic is about equal to that of the European part of the USSR. The population is 280,000 persons, and the plowed area is 0.017 percent. All of its field cultivation is located in the valleys of the river Lena and its main tributaries, where 90 percent of the people live. Notwithstanding the fact that their chief occupation is farming (cattle raising and field cultivation), the local food supplies are inadequate. The consumption of vegetables is negligible even in the centers of industry. Cattle raising on natural pastures, with their low and unstable production, is handicapped, and the productive capacity of cattle is very low. Cattle raising must be based upon the intensification of field cultivation and grass growing and a system of rational exploitation of pastures, the usefulness of which is restricted by climate and the period of availability: the summer grazing period is especially short, gadflies and midges are numerous. As no winter fodder is stocked up, winter grazing is much used. The struggle against nature and the assimilation of enormous natural wealth of Yakutiya is impossible without the collectivisation of labor, supplying it with technical improvements, and the concentration of planned utilization of manpower. The sparseness of population of the republic and its great remoteness from the main centers of industry and population of the Union, make it imperative to use labor very economically, using it, first, for the development of trades and industry (gold, fur, mining, and forestry) in the necessary direction and on the scale required for the planned increase in building up industries of the Union and of the republic itself, without wasting labor on the hard struggle against nature, trying to increase the acreage of arable lands. Field cultivation has to be developed, however, to the dimensions required to



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make the population self-sufficient in basic farming produce, which can be done here. One must remember that freighting foodstuffs from outside of the republic costs very much (to the north of the republic 1,000 rubles and more per ton), and this often is quite impossible. This has to be considered especially with regard to vegetables and potatoes, which are up to 75 percent water and do not stand up well under long haulage. It has to be considered also in regard to bulky matters.

The natural development of farming, with little heat and humidity in summer and exceptionally harsh winters, has not created up to now any forms higher than animal raising on natural pastures and primitive cereal growing. Grain crops, which are the foundation of farming in Yakutiya, have to give up their place in favor of intensive crop cultivation, first of all, to fodder. Plentiful manure and sunlight promise good prospects for the development of truck gardening, which is needed here for the growing industries and also as an indispensable item in the diet of the local population, which is of low physical standards, and feeds chiefly on a monotonous diet of meat, etc.

Because of the scarcity of manpower and the short period of harvesting, the problem of mechanization of farming looms large. Large ranches must replace the numerous tiny one-man farms with a plowed area of $\frac{1}{4}$ - $\frac{1}{2}$ hectares (they amounted to 60 percent of the plowed area). The two-field system with no fertilizers should be immediately pushed several centuries ahead, omitting the intermediate stages. The numerous national minorities of the republic should be joined to the cultural way of life and be armed by it in their struggle, unequal until now, against rigors of nature. With the development of communications, they should be in contact with the outside world. Only under



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these conditions can the enormous riches of mining, forestry, fisheries and fur bearing and others, be utilized and the foundation of Yakutiyan industry be laid. At present, it is an enormous potential reserve for the national economy.

The cold and wide continental land mass of the republic is the coldest area in the world. More than one-third of the area is north of the Arctic Circle. Most of its surface consists of mountains, covered with tundra and larch tayga. Rivers with many rapids flow through narrow rocky canyons. It is only the central Lena-Vilyuy-Aldan [redacted] Depression, with its wide valleys and river terraces, that offers greater facilities for the development of agriculture. Here also are concentrated the better explored mineral resources: coal, iron, silver, lead, gold, and salt.

The air is dry, there is little cloudiness, the winter is extremely cold (in hollows the temperature falls to minus 70 degrees). There is permafrost and underground ice; in summer the temperature is high (up to 40 degrees). The sun-heat is strong. Droughts occur frequently, and there is a continual threat of frequent untimely frosts. These are the general features of the climate of Yakutiya, which is exclusively continental, not adapted to agriculture, except in the protected river valleys.

In the north, the soil is of a marshy type among tundra lands, turf-podsol clayey and sandy-clayey, and semi-marshy soils, under forest growth. Further south, on elevated spots, the soil is dark clayey, sometimes with solonchaks. Along river valleys the soil is alluvial, on mountain slopes it is the skeletal type. The permafrost on marshy soil lies at a depth of 70-80 centimeters, in the turf-podsol soils at 130-150 centimeters, varying in depth and thickness according to the type of vegetation and upper soil layers. Strange



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as it is, here permafrost is a positive factor, regulating the humidity of the soil. Simultaneously, the decrease of forest areas and plowing it up over a permafrost base tends to lower or create "gaps" in the upper soil layers and make swamps. Thus, the better agricultural lands are in the wide river valleys and on their terraces and meadowlands, as contrasted with the cold soils and poor pastures of the northern tayga, distant from the shores. These are the circumstances, at present, that create farmland congestion in the vast desert expanses which are seen at the present time.

The general tasks of agriculture in the republic are thus: the development of food production, the increase in cereal and grain crops, and the intensification of fodder crops to the extent of self-sufficiency, if possible; the establishment of a strong dairy and vegetable economy in populated areas and sites of development of mining and manufacturing, and the supply of fodder for the principal means of transportation at present - horses.

According to the significance and potentialities of agriculture, the republic is divided into the following areas:

a) the Polar and sub-polar areas, with some vegetable growing locations and, seldom, barley growing;

b) the mountain meadows in the south (XXII-1 a, b, c), with the same importance of field cultivation, and

c) the central agricultural areas along the Lena river (XXII-2(a). and XXII-2(b)).

The first area is to the north of the Vilyuy, Lena, Aldan and Maya rivers, the second to the south of them, and the third occupies the valleys of these rivers and also of the Olekhma and Chara.

Polar and sub-polar regions, tundra, forest tundra and mountain tundra. This area has outlets to the sea over navigable rivers with





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good fishing: Kolyma, Indigirka, Yana, Lena, Olenek, Onabara and Khatanga. Its potential development could be as a transit, fishing, hunting and canning area. To stimulate these branches of economy, we find here coal deposits on the lower reaches of the Lena river, along the Olenek river, between the Yana and Indigirka, and on the Novosibirsk islands; while rock salt is found on the shores of the Khatanga Bay (in the area of Anabara). This salt can be used by local fisheries, and should be used by fisheries in the Pacific Ocean region, where there is no local supply and Crimean salt is used. The prospects are for mining silver-lead ores in the Endibal'sk, Batintysk and other deposits. Coal is available on the Lyakhovskiye, Novosibirskiye and Medvyezhiye islands. In the estuaries of the Khatanga, Anabar and Lena, there are enormous accumulations of Mammoth bones /prehistoric ivory/. There is an increase in animal breeding, etc.

The task of supplying vegetables, dairy products and meat to these areas is the job of the agriculture of the region. Vegetables should be improved by full and sensible utilization of the vast tundra pastures, of water-meadows, and by supplying oat and barley green fodder obtained from cultivated fields. Experiments have shown that early vegetables and potatoes can be grown on open ground, and barley can be planted on a limited scale in isolated, better protected terrain (on the middle reaches of the Kolyma) in the eastern ("b") section of the area, isolated by the Anadyr, Kolyma, Verkhoyansk, Chersk and other mountain ranges and their spurs. In such places, the average July temperature rises to 16-18 degrees, and the total warmth of the growing period amounts to 1,000 degrees. However, the greater part of the region is a tundra-pasture land with vast areas of moss and lichen and larch-aspen-birch forest-tundra on marshy and poor podsol soils with uninterrupted permafrost.



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XXII - 1. Eastern-Siberian tayga - elevated uplands, partly covered with larch, partly barren. The area has an extremely sparse population of nomadic tribes, most of them Tungus: fishermen, hunters and reindeer raisers. In the future, this area will have most extensive lumbering (with the more valuable pulp in sub-area "c"), and there will be exploitation of the unquestionably tremendous, still unexplored mining wealth (including the Tungus coal basin, the richest in the world, which is chiefly located in sub-area "a"). Use of the wealth of this quite isolated region is impossible without a simultaneous development of farming - a development of animal raising and field cultivation. The conditions for the latter are almost as harsh as in the preceding area, and are best suited to cattle raising and horse breeding (utilizing natural pastures and hayfields and the possibility of grazing in winter because of the extremely light snowfalls).

Because this area is more to the south, is further away from the polar sea, and has a superior terrain, there are many more places where potatoes and vegetables may be grown in the open. Barley also may be planted, and in sub-area "c" - spring rye, and also spring wheat and oats. The limited natural fodder can be supplemented by sowings for hay and green fodder (and when heated silos are erected, also for ensilage) of oats, mixtures of rye and oats, and of oats and peas, and of white mustard. In populated areas, it would be expedient to plant also potatoes and turnips for fodder. The possibility of sowing perennial grasses is precluded by the absence of seeds which could equal the performance of local wild grasses. These survive the winter at very low temperatures andoften without a snow cover.

The average July temperature goes up here from 16 degrees in the northwest to 20 degrees in the southeast. The average January temperature falls to minus 25 degrees in the southwest and minus 45 degrees in the northeast. There is little snow, especially in the higher open



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spaces. The total amount of warmth in the more protected places varies from 1,000 degrees in the north to 1,500 degrees in the south. The soils of the region are on permafrost ground. They are weak podsols, clayey and sandy-clayey; in the Lena-Vilyuysk watershed - with salines; in the valleys - meadow-marshy alluvial. There are stretches of skeletal soils and peat marsh soils.

Thus, this area can be used for the development of islands of agriculture. The best natural prospects are the comparatively warmer and more snowy areas of the basin of the Olekhma river ("c"), and the more humid, though less snowy watershed of the Aldan and Zeya rivers ("b"). The presence of an enormous number of small lakes and adjoining rich hayfields and pastures fixes the type of farming, in the colder and drier sub-area "a", as that of mainly cattle raising.

XXII - 2. An agricultural region along the Lena river and its main tributaries - the valleys and geological benches of the river and the adjoining open tayga. These places are protected from cold winds; and the proximity of enormous expanses of water moderates the climate. The soil is well drained and absorbs heat well. This area accordingly, with its complex system of branches, is the best developed area of intensive field cultivation in the republic, and it is forefront through which this development moves north. There are many open areas with water, and dry hayfields and meadows; and thus, the future growth of cattle raising here is assured.

In comparison with the previously described areas of the republic, the present area presents incomparably better conditions for farming. Over most of the area, the length of the frost-free period is on an average about 100 days, the total warmth of the growing period goes up to 1,500 degrees, on an average. The summer is hot (average July temperature 19.1 - 19.4 degrees), sunny and very dry (average rainfall



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during May-July is 70-100 millimeters.) The winter is very cold (average January temperatures from minus 35.5 to minus 44.8 degrees), and there is little snow. However, the Olekhmin sub-area (XXII-2(b)) has much precipitation both in summer and in winter, has a considerably warmer winter and summer, and a longer growing period. The land consists of weak podsol clayey soils, sandy-clay and alluvial soils of various types in the large river floodlands. Semi-saline soils are in open places.

At the present time, this area is the best-explored as far as natural resources are concerned. Also, the main water arteries of communication are concentrated here, and it represents, therefore, the place for the greatest development of industry both now and in the future. The Aldan group of gold fields - the richest area in gold reserves in the Union - as well as the Vilyuy area, where not only gold, but also platinum was found. In the same region along the Lena lie iron deposits. Along the same river, there are coal deposits, also coal in the Aldan area, Iceland spar, graphite, mica of exceptional purity, Vilyuy rock salt, etc. - all these promise a development of mining in the next few years. The great quantities of fish, wild fowl, meat, lard, other fats, hides, etc., call for the erection of canning, refrigerating, candle, soap, tanning and other factories and plants. These are already being planned; so also are the indispensable brick and cement plants near Yakutsk. Simultaneously, plans are being made for the construction of a railroad, opening this area to the Trans-Asiatic trunk line and, on to the Pacific Ocean. All the above developments in this area make it a center of activity in the republic and cause the population to concentrate here.

The original way of farming in the area must give way to a system which can fully supply the changing economy of the area. The meat and



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cattle raising trend of intensive animal husbandry must, through an increase and improvement of fodder, add to itself dairy farming on a similar scale. The growing of grains must try to increase to a point where it will supply the normal needs for bread, grain and concentrated fodder. Truck gardening must be almost entirely reorganized. Technical crops must find a suitable place.

The main task of organizing a fodder reserve is to increase the natural fodder supply by the adaptation of new areas, reclamation, improvement by clearing, protection from weeds, against erosion, regulating grazing, etc. It should be increased by sowing annuals - oats, peas and oats together, rye and oats mixtures, white mustard, potatoes, and turnips. Methods should be found and put into effect for building silos, adapted to permafrost and long polar winters (the "tower" type dugouts, heated silos, or enclosures in buildings). This would provide sufficient succulent fodder for the exceptionally long winter in Yakutiya. The problem of safely keeping potatoes and root vegetables is no less important. It is essential to select perennial grasses as rapidly as possible, especially the leguminous types.

As regards cereal crops, the area should be divided into two parts in accordance with the differences in climate indicated above: the greater area at the extreme north ("a"), which requires earlier crops, and the southern area, more favorable to crops ("b").

In the "a" sub-area, only the earliest varieties of barley can be expected to ripen, and also the less demanding spring rye, while spring wheat and oats can be sown as supplementary crops. The importance of oats is especially great in the Aldan area, which uses an enormous number of horses for transportation. It should be noted that in view of the absence of railroads in the republic and the substitution



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of wagon transportation, this crop should get the attention it deserves. In addition, this crop may contribute to drawing horses further north, to replace the Yakut reindeer and the Indigir dog, which are poor helpers in heavy work, even if they are of the best local breeds. Therefore, special attention should be paid to the selection of drought-resistant and cold-resistant varieties of oats.

In the Olekhmin sub-area ("b") where the threat of untimely frosts is less, the importance of grain crops may be reversed: the basic crops - spring wheat (local "Sibirka", Teremok and others) and oats; supplementary - barley and spring rye. Of the technical crops, potatoes and white mustard should be grown all over the area; in the south - poppies, tobacco and hemp may be used. A prospective crop in the southern sub-area is flax for fibres, when the mechanical conversion of straw is arranged.

On the basis of these crops Yakutiya may build up a stable agriculture, provided that field farming is directed toward supplying the needs of animal raising, that vegetable farming and grain growing are developed, that the possibilities of mechanization are utilized, bringing innovations into the methods of field cultivation, developing the use of fertilizers, having hotbeds, and solving the problems of the struggle with the tayga and making use of the permafrost. There must be plant selection and the proper techniques for processing valuable technical crops.

## XXIII. BURYATO-MONGOL ASSR

The territory of this republic lies inside the above described regions of the Eastern Siberian "Kray" and the Yakut ASSR. Some of its separate sections are



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much like the adjoining parts of these regions in respect to their economic position, the trend of their agriculture and the type of their natural conditions.

The type of agriculture in Buryatiya was a little-differentiated mixture of animal raising, field husbandry and crafts. It conformed to the economic life of this remote, non-industrialized and formerly uncultured borderland. Its main branch of activity, cattle-raising, is based on poorly productive Mongolian cattle, and depends entirely on the type and location of the generally meager pastures. Fodder is not stocked for the long winter, not even barn fodder; and the cattle are kept grazing all through the winter. Field cultivation is with the use of two and three crop rotation, with fields lying fallow. The cultivation is not intensive and is not stabile, because of the poorly developed and primitive methods of irrigation, a very low degree of mechanization the absence of fertilizers and the slow recuperation of the productive value of the soil through rest. Such recuperation is slow because of the strictly continental day climate. Seldom, though very successfully, pastures have been improved by artificial irrigation and manure ("utugi"). The more intensive forms of animal raising (including hog raising) are so far being used only on Russian farms. Rye, the basic crop which is adapted to local conditions and to primitive farming, is only slowly beginning to give ground to wheat, in a few limited sections. It should be noted that the country did not have any experiment stations the results of whose work would have been available to the agriculture of the republic, either to show the basic direction for the organization of field cultivation, or in getting varieties of field crops adapted to the specific and unusual climate.

All this made it impossible for the agriculture of Buryato-Mongolya to raise or grow many commodities for sale, which far from





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tended to raise the cultural level of the population. [redacted] (With the exception of the Bayandayev experiment field, which serves, however only the small portion of the republic situated near the Lake Baykal). In the meantime the national and cultural development of the once pastoral and hunting population of Buryats, Evenks (Tungus) and Varagasses seeks new outlets for their work, and, as a result, there will undoubtedly be a considerable development of the republic's agriculture, based on an increase in use of electric power, mechanization, the use of chemistry, development of irrigation and the introduction of more modern systems of field cultivation, corresponding to the overall specialization of various areas of the republic: basic cattle-raising (rough and concentrated fodder) mining and forestry (vegetable gardening, fodder-supply, grain farming.).

Because of the small population of the industrial centers, the exceptionally mountanous surface and the large number of pastures, the character of farming remains chiefly meat-cattle raising and grain-growing, though in individual areas there are different combinations, in different proportions, and there are different trends. The industrial centers of the Predbaykal'ye, and in Zabaykal'ye, towns of Verkhneudinsk and Troitsko-Savsk, with their tanneries and wool-converters, (and for the future a meat canning industry), a number of lumber mill [redacted]g installations [redacted], also the cannings plants on Baykal, etc., all will have to set up their dairy, vegetable and berry-growing farms. For reasons of health, vegetables have to be an important part of the limited fare of the national minorities.

The electrification of Buryatiya, and especially the possibility of using the power of the Selenga, and in the Predbaykal'ye - of the Angara, will bring about a revolution in the field cultivation of the respective areas, especially from the angle of demand for agricultural



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raw materials (hemp, flax, "badan", and potatoes), and when animal-raising is developed, then a demand also for fodder crops. Finally, carrying out the projects for building the Verkhneudinsk-Troitsko-Savskaya and Pribaykal'staya railroads, as well as the development of highway communications, will give a strong impetus to the development and intensification of agriculture, on one hand, by providing a wide outlet for its products from the areas, previously isolated, but well suited to the establishment of farming centers and on the other hand, by creating a consumer's demand at the point where the supply originates, on the basis of the lines of communication, of new mining and forestly industrial establishments (valuable larch forests, Muyskiy, Dzidinskiy and Sayan gold fields, Udinsk area of iron deposits, graphite, manganese, mica, marble, and other mining in the Sayan, Baykal, and other mountain areas).

Though its over-all character is continental, the climate, as well as the types of soil and vegetation, varies greatly in accordance with the orography of the separate parts of the country. When dividing the country into areas, the orographic indicator is the most important after the economic indicators, such as distribution of industry, forests, mining resourses, river and overland transport network, etc.

XXIII-1). Predbaykal' strip of open tayga, forest steppe and islands of various cereal grass steppe. The lakeside area (Baykal) is of a mountain-tayga character and in its natural conditions comes close to the XXI-2b area, while the conditions of the western part do not differ from those of the industrial area XXI-5b and the south of XXI-2a. Dry valley steppes and forest-steppe islands are on the low watersheds. There are degraded chernozyems, and sometimes saline soils. The frost-free period is 100-105 days. The total warmth is about 1,600 degrees; average temperature in July - 18 degrees, in January - minus 25 degrees.



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The annual average maximum depth of snow cover is 25 centimeters. Similarly to the adjoining areas, field cultivation here should develop those crops, which would guarantee the supply of dairy and vegetable produce to industrial centers, and the supply of raw material to the industries. At the same time, the area should continue to raise grain crops (especially wheat), which are important and the conditions for which are favorable.

The mountain section of the area can utilize the natural fodder tracts and establish dairy cattle raising in the south and dairy and meat-cattle raising in the north, and must also guarantee the supply of vegetables to the manganese and iron ore mining centers on the Ol'khona river and in the Baykal range. Of all technical crops, "badan" finds the best conditions. Hemp fields may be started on well-manured lands on large cattle-raising farms (the Buryat "utugs"). The basic fodder must be supplemented by potatoes, turnips, and the annuals: oats, and a mixture of oats, rye and peas, for hay and fresh feed. In the western part of the area the same fodder crops should be used, plus additional technical crops, flax and also potatoes if machine processing is arranged. The basic crop should be spring wheat ("Balaganka" and other Tulun kinds), spring rye and oats ("Tulun 86/5"), as supplementary crops in protected wooded spots - winter rye ("Tulun zelyonozernaya"); for secondary crops - barley, chiefly for hogs ("Chervonets"), peas and early local millet, peculiar to Buryat agriculture.

XXIII-(2). Eastern Sayan (Vostochno-Sayanskiy) high altitude tayga.

Mountain tundra, salty wood plants, alpine tayga, lower level tayga, marshes in lowlands and valley sections. In agricultural conditions, this area is identical to the neighboring non-agricultural XXI-8 area. There are differences, however: first, in that the requirements of the national economy are much greater. The presence in the area of deposits



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of high grade graphite (Aliberov pits), the Il'chirsk asbestos fields, unequalled in the whole world for quantity and quality of output, a series of goldfields, and mica deposits, - all these have to be supplied by a corresponding organization of dairy and vegetable-growing farms. The second exception is the presence in this rugged mountain land of an area relatively favorable to agriculture, the Tunkin valley, which leads into Mongoliya. This valley is rather warm (average July temperature in its upper and lower parts 16-18 degrees, the total warmth of the growing period in the central part about 1,600 degrees), but it has a severe winter.

The climate in the mountains and the variegated mountain soils are not favorable to farming, and for this reason land cultivation centers chiefly in the more fertile alluvial soil of the valleys. Expansion of plowed land is restricted by the mountains and the tayga. Fodder supply can be based on natural pastures and hay fields. Grain, potatoes and vegetables should form the basis of field crops. Among grains, easily grown spring rye, oats for draft horses, and spring barley must be of paramount importance. Winter rye, barley, and peas at the mouth of the valley, should act as supplementary crops. It is possible to develop field cultivation also in the valley of the Oka river, planting the same crops, but with greateremphasis on barley, of the grain crops. The Karagas mountain nomadic tribe - (hunters and reindeer-breeders), must be drawn into the branch of agriculture which would stabilize their own activities, by using the same crops in other mountain valleys.

XXIII-3). The Pribaykal Rayon of the Daur type and northern mountain larch tayga. Forests cover over 90 percent of the area. The climate is characterized by severe winters with little snow (average January temperature below minus 27 degrees), and a hot and dry summer (average July temperature over 19 degrees). The area is much cut-up, covered



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mostly with weak podsol soil; in the valleys - alluvial soils. In all respects this area resembles the adjoining mountain-taiga section of area XXI-9, and in its northern part - the mountain-taiga areas XXI-3 and XXII-1V. Not only is agriculture possible here, but it can develop quite successfully, if it is relegated to the limited areas of the river valleys, with their alluvial soils (the valleys of the Muya, Bambuyka, Parama, Turka, Verkhnyaya Angara, and Barbuzin rivers, the lower reaches of the Selenga, etc.) At the same time, the presence of large matural pastures over the remaining area puts it into the meat-cattle growing, deer-breeding and horse raising group. With an improved fodder foundation with respect to stocks for winter, however, this area can also be a butter- or cheese-dairy area. Basically, it is a forestry-hunting and cattle-raising area. In this severe climate, agriculture can have but a part subordinate to these industries. The stocks of hay and fresh fodder must be increased through planting of oats, oat-and-rye, or oats-and-peas mixtures, and potatoes.

In the group of cereals, the basic crop should continue to be rye, which does not require much moisture in the soil, while the importance of spring wheat should be increased by using early local varieties, as also the role of oats. As secondary crops, one should plant barley, buckwheat and, in the south, early local millet. Moving to the north, into the Vitimskiy mountain area, the selection of grains changes, with a trend towards an increase in earlier varieties. Near the northern border, barley becomes the chief grain crop in the few agricultural centers. In the Pribaykal section on the "utugs" of the large cattle farms, manured fields can be successfully used for hemp. Agriculture here has the special task of setting up "[redacted]" farming, the natural conditions for which are favorable.

XXIII-(4). Selenga area: forest-steppe (mountain steppe "a"), varied



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grass-kovyl and [redacted] steppes "b". Areas similar in their general type are also located to the east in the separate Aginsk "aymak" part of the republic. "A". Open valleys alternate with tayga areas on the mountain slopes of sharply undulating elevated area. On the general background of weak podsol clayey and sandy-clayey soils, there forest clays and stretches of sandy and cartilagenous soils. It is a region of permafrost. Agriculture is located in valleys between mountains, but the acreage of plowed lands is quite considerable and can be greatly increased. The tracts of fodder plants can also be increased. The summer is hot and dry, the winter very cold and with almost no snow. "B". The landscape is of the type of the Mongolian steppes. The summer climate is hot and very arid (yearly rainfall 150 millimeters, average July temperature about 25.5 degrees). Winters are very cold (average January temperature about minus 25.5 with an almost complete absence of snow). There are degraded chernozyems, chestnut sandy-clayey and sandy soils, which are hardly usable for agriculture without irrigation. Because of the hot summers, the period of growing is long enough for the ripening of early varieties of hard wheat.

In general, in this area field cultivation and cattle raising have equal opportunities for development. In the southern steppe sub-area, however, as well as in the corresponding section of the separate Agin "aymak", the development of field cultivation is handicapped by the aridity of the climate and the considerable tracts of sandy soils. In both sub-areas, extensive cattle-raising should be changed from a meat to a dairy-meat basis, with an increase and improvement of fodder stocks. The forest-steppe sub-area ("a") is much more propitious in that respect. The following plants can be grown for hay: yellow alfalfa, Siberian wild rye, millet, oats, and oats with spring rye. It is essential to enlarge the planting of potatoes for fodder.

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Spring wheat must form the basis for grain crops. In less favorable sections, however, it can be replaced by spring rye and oats. As a safe supplemental crop, buckwheat should be sown, and as a secondary crop - millet. All the areas in Buryato-Mongoliya with the exception of the Predbaykal, are in need of irrigation, and especially so, area XXIII-(4). Many steppes have good soils and can easily be artifically irrigated. At present, they yield a fairly good crop of hay and grain only in "favorable years."

## XXIV. PACIFIC OCEAN KRAY

This extremely remote borderland of the Union has to strive, in the development of its agriculture as well as in some other branches of economy, towards self-sufficiency, especially in goods difficult to transport, as are many agricultural products. In addition, possessing natural conditions rarely equalled in other parts of the Union in respect to the possibilities of growing certain crops, this area must assume the task of supplying these crops to other areas. The Pacific Ocean Kray stretches along the ocean from the Arctic Ocean to the Sea of Japan, reaching beyond the limits for agriculture in the north, and including parts of the rice-growing zone in the south. This large variety of natural conditions indicates the possibility of raising a great number of crops. However, these crops cannot be distributed evenly over the area, because of the exceptionally diversified climatic conditions in various sections, which in turn are conditioned by the types of sea surrents and the relief of land. The climate is generally of the monsoon type, and this, in combination with the continentality of inland sections, separated from the sea by high mountain ranges, creates peculiar conditions for the whole area as well as for separate sections.

Generally, the winter weather is clear, calm and very cold. There is hardly any precipitation. It is only along the shores of the ocean and in places protected by mountains that the snow cover is more or less





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thick. The rigorous winter conditions are moderated by the influence of the sea along its shores, but this influence does not spread far beyond the Sikhota-Alin mountain range. Summer monsoons begin in the spring, bringing large quantities of rain to the continent, but this exceptional rainfall does not reach beyond the Malyiy Khingan, though the moderating effects of the monsoons are felt further west. Likewise, in summer the cooling influence of the sea does not reach far, and west of the Sikhota-Alin range, temperatures rise rapidly. Thus, the summer is warm, in places hot, and with much rainfall. However, the monsoon rainfalls begin comparatively late, and spring all over the area is distinctly arid. Among other unfavorable climatic factors, in addition to a surplus of summer rainfalls and aridity in spring, are: early frosts, over-abundance of rain during the harvesting period, low temperatures of the soil and a surface marshiness, caused by the abundance of summer and autumn rainfall.

The soil also varies greatly in character: from primary tundra soil on the Chukot peninsula, to dark, humus alluvial in the Amur basin. The considerable differentiation of agricultural possibilities suggests a division into the following basic areas:

XXIV-(1). Mountain tayga in the basin of the middle reaches of the Zeya, Selemdzha and Bureya, former Zeya Okrug and the northern part of the Amur Okrug. Mountain tayga, open along the rivers. Podsol sandy clayey soils predominate, with strips of meadowland, marshy and alluvial soils in the river valleys. The mountains have stony and peat-bog soils. There is permafrost. The frost free period is about 100 days, but the total warmth of the growing period is 1,600 - 1,800 degrees because of the hot summers (average July temperature about 20 degrees). Winter is cold, with very little snow (average January temperatures from minus 27 to minus 30 degrees). This is the moderately warm and humid section of the area.



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Vast natural pastures and hayfields may, with some improvements, guarantee fodder for dairy cattle raising. The planting of potatoes should be increased to provide succulent winter fodder. The large number of existing mines and growing lumber works in the region, likewise requires dairy farms and also vegetable gardening centers. Vegetable crops should get special attention here. Of technical crops, potatoes (and in the south, flax and tobacco) must get a solid foothold. Grain crops are also significant, and of these, basic importance should be attached to: spring wheat, spring rye and oats, indispensible because of the large number of horses in this area. As secondary crops, there should be buckwheat, chiefly for fodder, and barley, the importance of which is far greater in the remote sections than in the area as a whole.

XXIV-(2). Lowland Tayga areas on the lower reaches of the Amur and Sakhalin island. The southern part of Nikolayev Okrug. Weak podsol clayey soils, meadow, marshy and alluvial soils. An enormous reserve of fodder lands. The frost-free period is 100-110 days. The total amount of warmth in the growing period is from 1,600 in the north to 2,200 degrees in the south. The average temperature in July 18-20 degrees, in January minus 22 - minus 26 degrees. The area is moderately warm, very humid and snowy.

The prospects for this area, very rich in coal, oil, fish, timber, gold, etc., call for a large concentration of industrial population and fishermen and craftsmen. At present, there is little farming population, and this is diverted to trades, not even utilizing fully the numerous natural meadowlands. A successful development of dairy farming and hog raising can be based on the many natural hayfields and pastures. The importance of potato and vegetable growing is very great, especially on Sakhalin.



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The presence of high quality coal, oil and timber on this island and the possibilities of using these for sea transportation and for transporting them to the mainland, will shortly attract numerous industrial settlers to Sakhalin, and will call for a corresponding development of dairy and vegetable farming. The places most favorable to agriculture are in the valleys of the Tyma and Poronaya rivers, and on the southwestern shore of the Soviet part of the island, where rich alluvial lands should be widely used for fodder and vegetable growing. The same is required by goldmining, fishing and lumber works on the lower reaches of the Amur, where there are exceptionally great possibilities for raising cattle on improved natural fodder. When there is mechanization in working up dried straw and other processing, then potatoes, hemp and flax can be very important as technical crops. Grain crops can easily be delivered along the Amur and therefore their local importance would be less than that of fodder and technical crops. In this group the less demanding oats and spring rye may be considered as basic crops for the entire area, with spring wheat as supplementary, and barley and winter rye as secondary.

XXIV-(3). Mountain tayga and shoreline lowlands of the Primor'ye maritime area. Former Kamchatka and eastern mountainous parts of the Nikolaye, Khabarovsk and Vladivostok okrugs. The climatic conditions of this region, reaching from the Arctic Ocean to the Sea of Japan, are rather varied, yet, they generally exceed, with very few exceptions, the minimum requirements for field cultivation. They satisfy only the needs. In respect to heat and length of growing period, however, they satisfy only the needs of the less demanding, vegetable crops, sometimes of barley, and much less often, other crops. Practical experiments with the planting of such crops have been made with different degrees of success: along the Anadyr, in the Gizhig, Yamskiy Okhotsk and Ayan on the



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Okhotsk shore (chiefly turnips), in the valley of the Kamshatka river, in Uda, Amgun' and in the Amur estuary (more or less successfully: vegetables, barley and oats). On the whole the most reliable crops here are vegetables, which are also the most indispensible here, because of the considerable development of various enterprises in the area.

The need for development of vegetable and fodder farming is especially great in places where there are fisheries and trapping, near canning factories on Kamchatka, where the population is rapidly increasing, and in the mining areas of the mainland part of the region. By using annual fodder mixtures (oat and barley with vetch and peas), root tuber plants with their greens, cabbage leaves, and in more favorable places the sturdier perennial grasses: timothy, Kentucky blue grass, and others, in addition to natural grass, both the grazing grounds and the winter supplies of hay and ensilage may be considerably improved and strengthened. Extensive usage of methods for protecting plants against low temperatures, the use of wind power and of heat and power of the new electric power stations in industrial centers for heat and light in vegetable farming, may ensure here the ripening of a great variety of vegetable crops. By using extra early varieties and by using methods to accelerate ripening, crops of potatoes can be ensured in more favorable sites, and, sometimes, barley.

Of exceptional importance for this area is the extraction of combined concentrated fodder and fertilizers from the rich growth of seaweeds and the waste products of fisheries. The southern parts of the area: the basin of the Uda and Amgun' rivers and especially the system of the Sikhota-Alin range, with their vast and rich fodder areas, are of tremendous interest for the development of animal husbandry. Of special value in this respect is the exceptionally humid south sub-area of Yuzhno-Ussuriysk tayga - XXIV- 3b. Of basic significance among field crops here



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should be the potatoes, as human food and fodder, and barley and oats, as concentrated fodder.

XXIV-(4). Middle-Amur - the southern part of the former Amur Okrug. Meadow-steppe plain, partly open tayga (in the tayga region of the Amur - Ussuriysk type). Frost free period 115-125 days. The total sum of warmth during the growing period is about 2,200 degrees. Average temperatures in July 19.5 - 21, in January from minus 26 to minus 28 degrees. Winters are thus characterized by very low temperatures and have very little snow for such temperatures (the average height of the snow cover at the end of winter is 20-30 centimeters). Compared to other sections of the area, summer is moderately warm and humid; but in comparison with other short growing period zones in the SSSR, it appears very warm and very humid, (during May-July 225-275 millimeters), with a sufficient amount of sunlight, especially in spring. On the other hand, however, the Amur summer has some very negative features. Its main faults include the threat of late spring and early autumn frosts. This means that the ground warms up slowly and loses much of its warmth over the winter. There is a general and significant deficiency of precipitation in the second half of the summer, which is detrimental to the filling-in and ripening of the grains and interferes with harvest of grains and hay, making this period one of particular stress. The insufficient snow cover in winter makes it difficult to cultivate winter crops and perennial grasses. The area along the Amur (Priamurskiy) is much more favorable with regard to the distribution of summer temperatures.

This area lies beyond the areas of permafrost. The soils are of heavy podsol sandy clay, and silty-marshy alluvial soils of large flood-lands of various types. As a consequency of copious summer rains, the low temperatures of the other seasons, and the impermiability of the soil, there is a tendency to the formation of surface marshes. In this respect, lighter and more absorbent soils and warmer and better pro-





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tected elevations of the surface are more propitious to growing the more demanding crops. An efficient system of drawing land areas into the orbit of cultivation and the systematic working and selection of plants, reflects on the water and heat conditions of the soil and can regulate them to a considerable extent. The choice of plants is especially important in respect to storing heat in the soil and removing excessive moisture. These plants should, in their first stages of development, let the suns rays fall on the soil, let a lesser amount of sunrays go through their spreading folliage towards autumn, leave stalks or tall stubble for retaining snow in winter and drain the soil through a strong and deep network of roots.

The area is rich in large fertile meadows. Even in the past, this area, because the conditions of its soil and climate, favorable to grains, gave a surplus of grains and grain fodder, and it was considered the granary of the whole region. Farming is the basic branch of its economy. Insufficient manpower (in spite of a greater sufficiency than in other parts of the Union) and insufficient machinery, present an exceedingly serious problem for the development of the agriculture of the region, especially in view of the possibility of conquering large new lands for farming. Great changes in field cultivation should occur in connection with changes in the selection of cultivated crops, and in particular, with the greater use of intensive technical crops: soybeans, sunflowers, flax, and hemp, as well as fodder crops.

The considerable well populated area with its numerous existing or planned industrial centers (town of Blagovlschensk, the Kivdinsk and the Arkharov coal mines, numerous gold fields, the erection of butter making plants, etc.) enable the





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products of agriculture to be converted and consumed on the spot. The fact that the region is located on a center of waterways on the Zeya, Bureya and Amur Rivers, the presence of the Amur railroad trunk line, all this makes possible not only a steady flow of supplies into the region, but makes it possible to export its surplus to other regions and to the ports of the Pacific Ocean. The importance of the Amur region is especially great in that by growing wheat and oats, this area releases acreage in the south-eastern areas for more valuable crops -- rice, soybeans, etc. Because of the limited growing period and other climatic factors, which repeat here the climatic conditions of the continental Asiatic northeast, the more valuable special crops grown in the south of the region, cannot be planted here with any assurance of safety. Only the earliest varieties of soybeans (Krushulya 9/3, Yellow Amurskaya, etc.) can be grown steadily in the southern part of the area, provided fields are chosen where the soil absorbs adequate heat and the drainage is good (these crops generally would be secondary crops). The basic crops continue to be grains, and first among them is spring wheat, and next -- oats. The varieties of these crops for the region have not been definitely established. Among the competing crops, according to their various qualifications, are Lyutestsens 062, the local Amurskaya Golokoloska, and Garnet wheat. The oats include Zolotoy Dozhd and others, which cannot yet be finally accepted as varieties suited to the region.

The fodder supply may be developed by planting for hay: yellow local alfalfa, American couch-grass, Siberian wild rye, soybeans, vetch with oats, and soybeans with oats. As far as perennial grasses are concerned, one has to note the same essentiality of making an early selection, as was noted for the East-Siberia Kray, Yakutiya and



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This area is not as well adapted to soybeans as the preceding one, since the rainfall is slightly less. There are fairly good possibilities, however, for developing his crop here. Krushuly 2/3 is the variety for both the northern and southern parts of the sub-area, Kharbinskaya 199 and Staroukrainskaya are for the southern part only. Lentils, winter vetch for seeds and, in second place, kidney beans and peas should be chosen from the pod legumes to be grown here.

The spreading of the cultivation of potatoes, in the northern section especially, would be quite expedient, as they give good crops and can be used for human consumption as well as for fodder (hog raising). The acreage of rye should be cut in favor of winter wheat in general, but less so in the northern section, where the soil is, in places, of sandy loam. The variety of rye recommended here is Taraschansky. The acreage under barley should be maintained in the northwestern section, in view of the possibility of obtaining good brewing grain. Nor should the area be cut too much all over the sub-area, in the interests of hog raising (corn, potatoes, and barley). The varieties are the same as in the preceding sub-area.

Oats do not yield as well, and are less valuable than the above-mentioned crops. Their production may be decreased sharply, as well as that of spring wheat. (Varieties: Verchnyachensky 053 and Lokhovsky). Among other crops, we should mention hemp (in the northern section), peppermint and pumpkins.

XX - 4. The forest-steppe on the left bank of the Dniepr, although having less precipitation than the right-bank area, has nevertheless an adequate rainfall (yearly 450-520 millimeters, May-July 170-190 millimeters) which decreases towards the southeast. The average July temperature is 19-20 degrees. Winters are not as mild as on the



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Buryatiya. Corn, soybeans and sunflower are quite dependable for ensilage. Juicy green additional fodder can be obtained from corn, soybeans, oat club moss, foxtail millet, vetch and soybeans with oats. Fodder pumpkin can be successfully used for juicy fodder and ensilage. As regards technical crops, in addition to soybeans already mentioned above, one should grow more potatoes, and early oily sunflowers, also flax, hemp, makhorka and abutilon [redacted]. If more raw materials are needed for the sugar mills in the adjoining southeastern sections of the region, one could also plant sugar beets here under more favorable conditions. However, the four last named crops can only be considered as secondary crops.

XXIV(5) Amuro-Ussuriuskiy. The western part of the former Khabarovsk Okrug. Meadow steppes along the Amur and Ussuri, passing across open forest-steppe areas into mountain tayga of the Amur-northern Ussuri type. The Priussuriyskiy forests, which combine the vegetation of the harsh north and the humid subtropics are rich in very valuable varieties of lumber.

This area is not far from the sea and is separated from it only by a relatively low mountain range (Sighota-Alin) and, as is the following region, this one is within the area strongly influenced by the monsoon climate, much more so than the preceding area, located back of the Malyiy Khingan. This difference in locations reflects on the climate by increasing the warm period (the frost free period up to 145 days) and increasing the amount of warmth (during the growing period 2,200 to 2,500 degrees). As a consequence of northwest winds from the continent, the temperature of the winter months is very low (January average about minus 24 degrees). The cooling effect of the sea, with the opposite direction of the winds in summer,



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is not great as the summer temperatures are high (average temperature in July about 20 degrees). The character of the monsoon is felt most strongly in the quantity and distribution of precipitation. Winter precipitation, as all over our Asiatic east, is very scarce, (the average depth of the snow cover at the end of winter is 20-30 centimeters). There is not much rain in spring, but during the end of spring and through the summer there are abundant rainfalls (May-July 250-300 millimeters). So here there are repeated the unfavorable features of the climate of the region: aridity with low soil temperatures at the beginning of the growing period and excessive humidity, later. These drawbacks are compensated for by more favorable thermal conditions during the summer. However, much heat with great humidity create favorable conditions for the development of fungus diseases, which lower the yield and injure the crops (rust, "fuzarium", which causes "drunken" grain).

The top soil of the region is very varied and has a number of gradations within the limits of alluvial soils, of a silty-marsh type rich in humus, podsols, chiefly clayey soils of different cohesion and podsol soils of foothill landscape. The area is rich in well flooded meadows along the rivers and lakes, as well as in dry and marshy hayfields and pastures. This area, together with the rest of the region, is going through a period of rapid transition from being a rich colony of enterprises of former Russia to the development of its own industries and an industrialized agricultural economy.

The area has large potentialities for the development of its industries: there are great natural resources, represented by valuable forests of timber, gold fields, deposits of iron (the Malo-Khingan beds), etc. In addition, the area lies close to the ocean, especially when the projects for a Khabarovsk-Sovetskaya Gavan' railroad line, the shortest line between the sea and the Amur river, etc.) Agriculture



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has to change from being of a semi-natural-consuming type and must acquire more intensive forms. The utilization of the Amur waterway and railroad connections will tend to decrease the acreage under less valuable crops in the area, at the price of importing beadstuffs, and make this acreage available for those crops which would insure the development of a local Far-Eastern industrial base, independent of the far-away west. The favorable natural conditions must be more fully utilized for plant growing. Animal raising must be intensified. Conditions in this area are quite favorable to the cultivation of a number of valuable special far-eastern crops. Moreover, the usual western crops — wheat, oats, and rye — are not at their best in the humid and warm climate of the area, and their yields are not of high grade, either for consumption or for merchandising.

Their leading position until now was kept up because the settlers were used to them and also because of the great shortage of manpower required for the cultivation of the more intensive eastern crops which were grown almost exclusively on Chinese and Korean farms. At present, with the increase in population of the area and with the enormous strengthening of its machinery and tractor base, there should be a sharp break in this respect. Early varieties of soybeans can be grown all over the region. South of Khabarovsk rice can be safely planted. When early selected varieties are introduced, rice will undoubtedly play a prominent part among the region's crops.

Even now soybeans, and in suitable places of the southern section, also rice, must be taken into account as supplementary crops, at present, however, covering less acreage than wheat and oats. Among cereals, buckwheat can also have the role of a supplementary crop, in terms of its acreage. This is an unpretentious crop, which can be sown on newly opened land. Winter rye is not to be relied upon here, and can have only



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secondary significance, provided it is planted in more snowy places. Keeping up with mechanization, the following row planted cereals should rapidly rise from among the secondary crops: corn, foxtail millet, Japanese millet, and Japanese sorghum. Row crops are very important as forerunners of other crops, for in addition to their other positive action, they warm up and drain the cold impervious soils of the area. In addition to their industrial uses (for distilling, etc.), these crops, giving good yields, should in the future largely replace here oats and rye as fodder.

The assortment of technical crops which can be raised here, is very large. The cultivation of flax for fibers (and if necessary also for oil) should be of great importance. Long fiber flax finds very suitable conditions here. Repeated experiments have shown that when "Kudryash" is sown here, it is rapidly displaced by long fiber types. Another moisture-loving plant — the potato — also can be relied upon for good yields and should be widely used in the manufacture of starches, molasses, and alcohol. Crops of sugar beets, needed as raw material for the development of the sugar industry in the Primor'ye, grow here much better than in the preceding area. Here, in the south of the region, there are good possibilities for growing the valuable later kinds of hemp, which are of great importance for a maritime region in respect to the availability of local material for ropes; and important for the region itself, where much grain, soybeans, rice, etc. is produced. Hemp also supplies material for the manufacture of containers from the scrap of hemp. With the increase in reclamation work, the cultivation of hemp should move to the north over a broad area, especially in view of the possibility of getting from the south seeds of valuable later varieties of hemp. This area and the one following have the most favorable conditions for the cultivations of "sudza" which yields oil for



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the manufacture of the best paints and varnishes. One can also successfully raise abutilon, yellow mustard, Manchurian tobacco, and likewise belladonna, valerian and many other medicinal herbs, An increase in fodder supply may be based on sowings of oats and its leguminous mixtures (soybean, vetch, etc.), timothy, wild rye and foxtail millet, to build up the supply of hay in natural hayfields. The usual selection of perennial grasses is not to be relied on here, because of the severe winters and the peculiar combination of a dry spring and an extremely humid summer. Here also it is vitally necessary to apply every effort to the selection and creation of varieties of perennial grasses which would grow under these peculiar conditions. Corn, soybeans, sunflowers, Jerusalem artichoke, leaf cabbage, Japanese sorghum, mixtures of soybean or vetch with oats, fodder pumpkins, can be used for ensilage; for succulent feed - the same very valuable fodder pumpkin in its natural state beets, rape and potatoes; soybeans corn, vetch and soybean-oats mixtures, and foxtail millet give a plentiful and valuable material for additional fresh green fodder for fattening up cattle.

Khabarovsk, with its rapidly growing industry (agricultural machine building, building material plants, etc.), and other industrial centers must be assured of a supply of vegetables, milk, sour milk and other products, by the establishment of large dairy-vegetable farms. If we use the far-eastern, Chinese and Japanese varieties of vegetables, the varieties utilizable may be quite large.

XXIV(6) Suyfen-Ussuriy district. The western part of the former Vladisvostok Okrug. Open meadow-steppe areas, forest-steppe in places; in the foothills, forest of the southern Ussuriy type, which includes many technically very valuable kinds of trees (in addition to the usual



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cedar, fir, larch, oak, maple, hornbeam, ash, etc., there is also the "velvet" tree, the "iron" tree, the cork tree, etc. Of all the areas of the Primor'ye this is the most favorable for agriculture and is the most extensively ploughed.

The peculiarities of the monsoon climate are not only repeated here, but show up even more strongly in the summer weather. The frost-free period increases here to 145-147 days. The total heat during the growing season in the south and in the west exceeds 2,500 degrees. The average July temperature is about 21 degrees, but the average January temperature of about minus 20 degrees is characteristic of a very cold winter. There is little snow (average maximum height of the snow cover is 10-20 centimeters, and only in the seaboard and foothill areas is it more); this causes a very pronounced cooling and a deep freezing of the soil. This last fact in conjunction with an arid spring has a detrimental effect on the early stages of development of young growth. The warm summer is exceptionally rainy. In the presence of water-resistant clayey soils this causes swamping, especially in the low-lying sections.

Because of the exceptional amount and nature of rainfalls, floods are frequent, sometimes on a catastrophic scale, with crops and hayfields completely destroyed. In spite of all this, the climate of the area guarantees good yields, and is especially favorable to local Far Eastern crops. In spite of the assurance of high yields, the humidity of the climate is a drawback to farming: the deep freezing of soils in winter and the dry spring retard the growth of grass and bring the haying period close to the time of harvesting, and the exceptional humidity of this period makes it a time of great strain. This calls for special attention to the mechanizing of field work, and in particular so when crops requiring much labor and intensive cultivation are introduced. The characteristics of this climate have especially handicapped the early development here of such





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crops as soybeans, rice, beets, flax and others.

Therefore the electrification of rice plantations, which is planned in the south with the utilization of Suchan coal, undoubtedly can very strongly affect the development of this crop. A delay in harvesting leads to spoilage and losses of crops from rains and early frosts.

The soils of the region, different on the whole, can nevertheless be brought together to several types of podsols, deluvial clayey soils and structural clays, peat marshes, and crude, undeveloped soils of the mountain slopes. Large areas are available for rice cultivation even now, and a much larger acreage will be made available after some simple reclamation and irrigation work has been done in the basin of the lake Khanka.

The fact that this area belongs to the Pacific coastal region, the existence of the port of Vladivostok, the availability of large supplies of coal (the highly valuable Suchan Artemov and other mines), and of other minerals (silver, lead, iron and other ores), a fairly developed manufacturing industry (shipbuilding, brickmaking and other plants in Vladivostok) and the prospects for development along these lines, which are still great, make this area first in importance of the development of its economy not only in the Primor'ye, but on the entire Pacific coast littoral, with which it is connected by sea routes and whose needs it serves in many ways.

The agriculture of the area, utilizing the natural conditions favorable to a number of valuable crops, must not only take care of the food requirements of its industrial centers, but also provide raw materials for the development of the textile, butter, soap, beet sugar, distilling, tobacco-making and other industries, thereby providing itself with these products and not depending either on the far-away west or on imperialist-dominated Manchuria.



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As a result of the rebuilding and specialization of farming on the basis of its husbandry, many new enterprises should spring up, such as: rice refineries, paper and sack cords (from rice straw), butter making, soap making, hydrogenation, beet sugar manufacture, starch-molasses, grain, milling and others.

All this should ensure that the trend of farming in this area will be to soybeans, rice, and technical crops. In growing rice, soybeans, and some other crops, the farming of this area should be done on an all-Union scale. In its soil and climatic conditions this area has large potentialities for growing rice. In quality the rice of the Primor'ye is the equal of Japanese rice. Rice should be a leading crop.

As an inseparable companion of rice, and in non-rice growing places the leading crop, the soybean must be grown here (varieties 'Gunchzhulinskiy', 'Kharbinskiy #111, 118 and 231-a', and 'Khabarovskiy 109'). Other basic crops, which take their place in crop rotation and occupy places less suitable for rice and soybeans, are: spring wheat (the rust-resisting variety "Shtrube" is permissible) and oats ("Pobeda" variety is permissible). Buckwheat and winter rye can only be classified as supplementary crops, while the secondary row crops - - corn, kidney beans and various millets - - must have their important place among others. The planting of sugar beets is quite safe here (the seeds ripen). As in the previous area, this crop must be expanded to the point where it can satisfy the needs of the local sugar industry. The other technical crops, which were listed for the preceding area, have the same significance here, find more favorable conditions and can be grown even more successfully; this is especially true of corn, flax, valuable kinds of hemp, kanatnik, and kenaf. Also as a secondary crop, one may grow sesame (Japanese varieties). The assortment of fodder crops may be the same as in the preceding area. However, the warmer



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winters permit the sowing in addition of awnless brome grass and of red and swedish clover. The general importance of fodder crops is greater because of the necessity of introducing intensive animal raising and dairy farming into this area. Truck gardening must take care of the needs of industrial centers. Truck gardening, like the field crops, ought to draw on Chinese, Japanese and Korean varieties of plants. The area has quite suitable conditions for growing cucurbits.



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# THE CENTRAL ASIAN REPUBLICS

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## PHYSICAL AND GEOGRAPHIC CONDITIONS OF CENTRAL ASIA AND THEIR ECONOMIC SIGNIFICANCE

Central Asia is in itself not an administrative but a geographical conception. Its main components are the vast Turanskiy lowlands, which are fundamentally of a strictly desert character. Beginning at the eastern shores of the Caspian sea, these lowlands rise gradually towards the east and then fall into a series of enclosed basins, which have no outside drainage. In addition to the basin of the Caspian Sea, which occupies a comparatively small area in Central Asia, the following basins are entirely within the Central Asian area: Aral, Chu, Balkhash, Alakul'. All of them are at a very low altitude above sea level, from minus 26 meters (Caspian sea) to 360 meters (Alakul'). Because of the great dryness of the air and the concentration of summer heat, the great amounts of water which flow into these basins are totally used up in evaporation, often even without forming large open water areas (the Murgab, Zerevshau, Talas, and Chu rivers, and others).

To the southeast and to the east the Turanskiy lowlands are cut off by an unbroken chain of large mountain ranges, forming only a part of the Central Asian mountain system, the greatest in the world. The average altitude of these mountains is 4,000 meters above sea level. Many summits rise as high as 5,000 meters, and individual peaks, as for example the Lenin and Khantengri peaks, as high as 7,000 meters. All this great mountain country, lying on the Union's frontiers with China and Afganistan, consists of numerous mountain ranges and plateaus with large valleys between them. The two widest valleys, the Fergana and the Ili, divide it into three separate systems, known as the Pamiro-Alay, Tyan'-Shan' and Dzhungarskiy Alatau.

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A considerable portion of the mountain ranges of all these systems extends above the line of perpetual snow and carries numerous glaciers, which are the sources feeding mountain rivers. These tumultuous currents plunge out of the mountains onto the Turanskiy lowlands, reviving with their moisture the heat-worn desert flatlands and bringing besides water enormous masses of various alluvial matter. The largest among these rivers are the Amu-dar'ya, Syr-dar'ya, Zerevshan, Naryn, Chirchik, Chu, Ili, Karatal, and several others. However, even in the mountains some inner basins have no outside drainage, sometimes they are very large; such are the lakes Ussykkul', (altitude 1,576 meters), Chatyrkul' (3,465 meters), and Karakul' (3,780 meters)

Between the Turanskiy lowlands and the high mountain ranges, the Pamiro-Alya, Tyan'-Shan' and Dzhungarsk Alatau, is located a strip of varying wideness of the so-called foothills. These actually are either the side slopes of the main ranges, or independent small ranges and plateaus, connected in some way with the main mountain ranges. Usually the altitude of these foothills does not exceed 2,000 meters above sea level, and often is considerably less, only about 500-1000 meters. They gradually merge with the Turanskiy lowlands, as one goes farther from the mountains projecting small mountain elevations far into the lowlands. The uninterrupted stretch of hills, bordering the Turanskiy flatlands on the south and on the southwest, have the same foothill character. These hills are known as: Badkhiz, Karabil', Kopetdag, Kyurendag, Balkhan, etc. As a whole they comprise the system of the Turkmen-Khorosan Mountains, which are for the most part in Persia and Afganistan. Within the borders of the Soviet Union they reach 2700 meters only in individual places; for the most part they do not exceed 1000-2000 meters. There are no snows or glaciers on this mountain range. The rivers formed here have little water and often are of a temporary



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character, drying up during the summer drought.

On the north the Turanskiy lowlands border on the southern spure of the Ural mountains and on an interrupted chain of hills, the so-called Turanskiy-Siberian watershed. Over most of their extent these hills have an altitude of about 500-1000 meters and no rivers of any importance form there. The watershed of these hills is approximately between 48 and 49 degrees North and forms a natural northern frontier of Central Asia as a geographical unit. Thus, by Central Asia is meant a large and geographically quite separate territory, located within the borders of the Soviet Union, between 36 and 48 degrees North and 59 and 83 degrees East. [redacted] Its length from north to south is about 1300 kilometers and from west to east about 2400 kilometers. Its total area may be estimated at 300 million hectares.

The boundaries of this geographical territory encompass the entire Turkmen, Tadzhik and Uzbek Union Republics, the Karakalpak and Kirgiz Autonomous Republics and the entire southern half of the Kazakh Autonomous Republic. The administrative boundaries of these Union and Autonomous Republics are by no means bound to the natural boundaries and often are extremely capricious or even interlaced. Consequently, specialization of agriculture does not by any means correspond to the borders of the separate national republics, but is divided according to zones. Sometimes separate areas differ sharply within one republic, and sometimes the same agricultural conditions prevail not only in neighboring republics, but even in quite remote areas of different national republics.

Before starting on a description of the different areas and the disposition of their crops it is necessary to observe some general laws governing the distribution of the more important ecological factors of the growth of crops. In doing so, we will touch upon these laws as they are manifested over all the Central Asiatic area, even though the Kazakh, Kirgiz and Karakalpak Autonomous Republics have already been described in



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the section on the RSFSR. For the sake of clarity this study will be carried out according to the three geomorphological types indicated above: the Turanskiy lowlands, the foothills, and the high altitude areas.

## TURANSKIY LOWLANDS

The whole of the Turanskiy lowlands area, as already indicated, has a definitely felt desert character. Because of its location in the center of the enormous Eurasian continent, its climate is extremely continental and arid, sunshine is plentiful, there is little cloudiness, the summer is very hot and the winter very cold, though short.

Thermal Regime. Because of the intensity of its summer heat, the Turanskiy lowlands area is the hottest place in the entire Soviet Union. Some sections claim the distinction of being the hottest place in the world. The average temperature of the hottest month -- July -- varies between 24 and 32 degrees in different places; the average temperatures for the summer -- i.e., June, July and August -- range between 23 and 30 degrees. The maximum temperatures reach 46 degrees in the shade and up to 60 degrees in the sun near the ground.

On the other hand winter temperatures reach from minus 20 to minus 25 degrees below zero over all of the Turanskiy lowlands area. In its northern sections these frosts are stable and recur every year. Thus, over a number of years the average temperature of the coldest month -- January -- has been 9 - 10 degrees below zero. The further south we move, the shorter are winter frosts, and they no longer occur every year. Finally, on the southern border of the Turanskiy lowlands, the average temperature for January over a number of years has been as high as zero, and even 2 - 4 degrees above. However, does not rule out the possibility of periodic recurrences here of strong but short frosts of 15 degrees and lower.



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In the northern section of the Turanskiy lowlands the frost-free period amounts to 170-180 days, while in the south it reaches 230 days, and along the southwestern shore of the Caspian sea up to 275 days. Likewise, the total of effective temperatures, that is temperatures over 5 degrees, varies between 3700 degrees in the north and 6000 degrees in the south.

Accordingly the Turanskiy lowland area can be divided into thermal zones, each of which has quite definite thermal indexes. It seems best to distinguish three such zones:

| Order | Zone | January temperature | Summer temperature | Total temperature over 5 deg. | Length of frost-free period |
|---|---|---|---|---|---|
| 1 | Moderately hot | -5 -11 | 22 - 25 | 3,600-4,400 | 160-180 |
| 2 | Hot | -0 -5 | 25 - 28 | 4,400-5,200 | 180-210 |
| 3 | Particularly hot | -0 -4 | 28 - 31 | 5,200-6,000 | 210-250 |

The moderately hot zone is not entirely suited to the cultivation of cotton in respect to thermal conditions; only the earliest varieties, yielding a poor crop may ripen here, though not everywhere and not every year. Of other technical and special crops, these may be grown here: kenaf, kendyr', opium poppies, sugar beets, rice, sunflowers, corn, lucerne, and the new rubber-bearing plants -- tau-saghyz, kok-saghyz, and chondrilla.

This zone is situated almost entirely in southern Kazakhstan and partly in northern Kirgiziya, and does not include any part of Uzbekistan, Turkmeniya or Tadzhikistan.

The hot zone includes the main areas of cultivation of the medium-early and medium late varieties of the American cotton plant - namely: Fergana, Central Zaravshan, Golodnaya steppe, the Tashkent Chimkent and Turkestan "rayons", Chandara, the Khiva oasis, the Tashauz Rayon of Turkmeniya and



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the Karakalpak Republic, as well as most of the area of Kizylkum.

The torrid zone allows cultivation of all late varieties of cotton, including the long-fibered Egyptian. To this zone belong the lowland sections of Southern Tadjik, Shirabad, Kerki, the Bokhara oasis and the entire lowlands of Turkmenia, except the Tashauz "rayon". Because of the relatively moderate winter frosts, some places in this zone admit the cultivation of some subtropical perennials, as guayale, ramie, olive trees, eucalyptus, etc. The most favorable location in this respect would be southern Tadzhikstan, Termez, and the Atrek Rayon of Turkmenia.

Precipitation. The Turanskiy lowlands as a whole are characterized by extreme aridity, with an average yearly rainfall of 70 to 100 millimeters. It is only in the vicinity of high mountain ranges that the amount of precipitation occasionally rises to 300-400 millimeters a year. Within the northern moderately hot belt rainfalls are distributed rather evenly over the entire year, with a slight increase during the spring. On the other hand, the hot and torrid belts get their rainfall almost entirely during the winter and spring -- in the autumn there is an insignificant amount of rain, and in the summer, as a rule, none at all.

Irrigation. The amount of precipitation here is very small and rate of evaporation very large; therefore all over the Turanskiy lowland area agriculture is possible only with the aid of artificial irrigation. The exceptions are some places in river valleys, with fresh subsoil water close by, where occasionally one can come across non-irrigated crops. However, even in these conditions, irrigation is beneficial, as in spite of the proximity of subsoil water the surface of the land parches to such an extent that annual crops with a shallow root system often suffer from lack of moisture.

For irrigation, water from the mountain rivers is used; most of these rivers dry up upon reaching the Turanskiy lowlands. Irrigation,

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therefore, is mostly limited to the southern and eastern borderlands of the Turanskiy lowlands, i. e. to the neighborhood of high mountains. Only a few larger rivers carry their waters far into the Turanskiy lowlands, thereby making it possible to create irrigated oases in the very center of the desert. Such rivers are the Syr-Dar'ya, Amu and also the Chu, Ili and Karatal. In southern Turkmeniya, in addition to river water, irrigation is effected by means of subterranian waters, which are reached through galleries dug into the sloping sides of the Kopetdag; these galleries are locally called "Kyariz".



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Although the waters of the mountain rivers are, without any exception, insufficient for the irrigation of all the fields of the Turanskiy lowland, nonetheless it can be said that the irrigational possibilities of many rivers are still far from exhausted.

The Central [redacted] Asiatic republics still represent great, unutilized sources of irrigation. For example, the water supply of the Amudar River allows the possibility of irrigating 5.4 million hectares, but in 1930 the actual area irrigated in this basin amounted to 1.4 million hectares. From the Syr-darya 4.2 million hectares can be irrigated, but in 1930 only 1.4 million hectares were irrigated.

The above-mentioned figures indicate that the horizons of further irrigational construction in Central [redacted] Asia are still unlimited. Among the enormous irrigational systems being constructed anew or being designed, it is necessary to mention the Kunyadar'inskiy problem in the downstream area of the Amy-darya, the Karabekaul'skiy and Tashsakinskiy systems in Turkmeniya, the Bakhshskoye construction in Tadzhikistan, the Shirabadskiy problem in Uzbekistan, the Chirchik-Angrenskiy and Golodnostepskiy problems in Uzbekistan and Kazakstan, the Chardarinskiy and Atrarskiy problems in Kazakstan, the Chyiskoe construction in Kirgiziya and Kazakstan, the problem of Ili in Kazakstan, and so forth.

Soils.

The possibilities of extending the irrigational economy often depend not only on the lack of water, but on unfavorable soil conditions.

The soils of all of the Turansk lowlands bear all the marks of sharply defined arid conditions.



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The chief zonal type of soils of the arid zone are the so-called gray-earths, called by some scientists light-earths, white-earths, yellow-earths, or light-brown soils.

Their characteristic features are their high carbon content and their negligible content of humus particles. This explains their light -- slightly grayish, or slightly brownish coloring.

However, the present gray-earths develop only on fine-grained earths, chiefly in argillaceous layers and in places with deep ground waters. They are most typical and most widely diffused along the southern and eastern borders of the Turanskiy lowlands, where there supposedly is an influence from the neighboring mountain ranges -- both in the sense of the formation of corresponding alluvia, and in the sense of a somewhat increased quantity of rainfall.

Sands.

Almost half of all the area of the Turansk lowlands, and if we take into account only the Middle Asiatic republics, then considerably more than half of the area, is composed of sandy expanses. This is the so-called Karakum, having a total area of about 35 million hectares and occupying almost 80 percent of the area of Turkmenskiy SSR. The sands of Kizylkum, a little smaller in area -- 20 million hectares -- are situated at the junction of the Uzbekskiy, Karakalpakskiy and Kazakskiy republics. In Kazakstan, in addition to this, there still are other extremely important sandy expanses.

Notwithstanding the fact that the sands in general, and in particular the sands of the Turanskiy lowlands, are by no means unfertile, irrigation and agriculture are not practiced on them in the majority of cases. The obstacles are as follows: their easy



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erosion by the wind during plowing, the sharply defined hilly-ridged relief, which make processing and irrigation difficult, and also the great loss of water during irrigation because of the filtration from the canals and in the fields into the deep layers of the ground. True, the rich clayey mud in the irrigating water of some rivers, in particular the Amu-darya and others, rather quickly cements and stabilizes the crumbly sand. Because of this, it should not be considered absolutely impossible to have a partial expansion of irrigated crops into more level sandy spaces. For this kind of development of sands attention must be given to Turkmeniya, where the non-sandy earth is absolutely insufficient for the complete irrigational use of Amudar'inskiy waters.

Salt marshes and their development.

In addition to the sands, among the other soils within the borders of the Turanskiy lowlands the different kinds of salt marsh soils play a large role. The aridity of the climate and, as a result of that, the absence of salt erosion, which forms, in the process of weathering, matrixes for holding the salt, is the reason why almost all the soils of the Turanskiy lowlands contain a quantity of easily soluble salts, in particular gypsum, sodium chloride, Glauber's salts (sodium sulphate decahydrate), potash, soda, and others.

Especially rich in soluble salts are the soils of low-lying places with nearby ground waters. Flowing here, the surface rains and subterranean ground waters bring with them salts, washed out of the soils of higher regions and foothill areas along the southern border of the Turanskiy lowlands. Lost by evaporation from the surface soils, these waters leave in the soil all their salts, which drip year after year, forming more or less malignant salt marshes.



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Such salt marsh soils occupy a rather wide expanse along the border between the foothill strip of Kopetdag and the sands, in the downstream region of the Atrek, Amu-darya, Syr-darya, Saravshan Rivers, in the center of the Ferganskiy valley, in the valley of the Ili River, and others. Because of the high content of soluble salts, they are absolutely unsuitable in the majority of cases for growing crops and can be utilized only after basic improvement, which consists of removing the salts. These improvements are possible by means of strong rinsing with irrigating waters and simultaneous removal of ground waters by the usual drainage or by California wells. The corresponding projects have to date received only experienced investigation and not widespread application. This is due to the high cost of artificial installations for soil-development work.

The cheaper and in places the rather widely-used method of developing salt marsh lands is the cultivation of rice, and in less salty regions, to growing of alfalfa. The large irrigational rates of these crops, especially of rice, explain the partial, natural flowing off of salty ground waters, together with which the soluble salts are partly carried off. After many years of cultivating the above-mentioned crops the salt marsh soils often become so well distilled that they are suitable for the cultivation of other crops as well.

In the higher places of the Turanskiy lowlands, with deep ground waters, soluble salts are washed by rain waters into the depth of the soil. The greater the rainfall, the greater the depth to which the salts are washed. However, the maximum depth of salt layers even in the very best gray-earth soils does not exceed 1-1.5 meters; often it is considerably lower, in all 50-70 centimeters.



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At the depths indicated, the salts still have little influence on the comparatively surface-located root systems of the crops. Incorrect irrigation by increasing watering standards when the necessary faulting network is missing can, however, cause the salt layers to rise to the top, and even lead to the formation of so-called secondary salt marshes. Such an appearance on a large scale took place in the Golodniy Steppe and in some other regions. Because of this, questions as to changes in irrigation and in the definition of what constitutes proper watering standards, have an extremely essential meaning in the utilization of the Turanskiy lowlands by irrigational cultivation. In addition to this, the introduction of alfalfa into crop rotation as a soil-improving crop has much significance because it will help to prevent the secondary salting of the soil.

Physical properties of the soil.

In addition to their content of salts, which are easily soluble in water and which are quickly transportable from one layer to another by irrigation, the gray-earth soils of the Turanskiy lowlands are distinguished by other deficiencies. These are: the negligible humus content and together with this the weak structure, the easy pulverization when in a dry state and deliquescence into a dough-like mass when irrigated, with a formation of a thick smooth crust upon drying. The battle with these unfavorable physical properties of the soil can be carried on only through the aid of a revised system of processing and in particular through the introduction of crop rotation of grass fields with alfalfa and perennial cereals. The same crop rotation is very important here, as in other regions, in storing nourishing materials in the soil.



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## THE FOOTHILL REGION

Relief and alluvia at the foot of the mountain.

As it nears the high mountains, the surface of the Turanskiy lowlands begins to rise gradually. This occurs even where clear signs of orogenetic processes are not found. The cause of this occurrence lies in the systematic storage of a great quantity of powerful alluvia carried from the mountains by numerous permanent and temporary streams.

The quantity of alluvia deposited by the mountain rivers can be calculated even by such data. The Naryn River, from which stems the Syr-darya, carries in its waters in one year 14 million cubic meters of suspended material, and the Ili River about 10 million cubic meters. If all the water of each of the above-mentioned rivers were to be evenly distributed over an area of 100,000 hectares, in the course of one year a layer of alluvium 1 centimeter thick would be deposited in that area. In a hundred years the layer of the alluvium would be 1 meter thick. The above-mentioned figures do not include the coarser materials which are deposited by the rivers on the bottom in the form of sands, boulders, and waste rock. The quantity of this material in many cases is considerably greater.

The more powerful the stream the further along the lowland it carries the sandy and muddy material suspended in the water, depositing at the foot of the mountains the stone-boulder alluvia, which are coarser in composition. The smaller streams deposit their alluvia in the immediate vicinity of the mountains.

As a result of the above-mentioned processes along the foothills of all the elevations, many alluvial fans are formed which often fuse with one another and form continuous hilly trains (shleyfy)



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that barely slope towards the lowlands and are composed of alluvial -- proluvial material of various mechanic composition.

Since the processes of storing alluvial-proluvial materials continue for thousands of years, their thickness frequently reaches not only tens, but hundreds and thousands of meters. It is natural that in correspondence to this increase the surface of the locality increases in height, turning the former lowland into a raised, sloping plain. A typical picture of this is presented in Turkmeniya along the whole northern foothill of Kopedag and in Fergan, in Kazakstan and so on.

After a great depth of alluvial-proluvial material has been stored, the eroding processes which follow often break up these sloping train-like plains into numerous large and small steep slopes (uvaly), giving them the appearance of rather sharply defined low hills. In places this process of formation of low hills is increased even further because it has room to spread, and sometimes continues until it is a young, techtonic fold which forms layers of new alluvia and often gathers them into rather steep folds.

Mountain spurs.

On a line with the above-mentioned occurrence of the low hills of alluvial origin, almost all large mountain ranges are surrounded by numerous large and small mountain spurs, formed by ancient crystal or igneous rocks.

The formation of these spurs proceeded simultaneously with the formation of the mountain ranges themselves, and in some cases even preceded them. Part of them are represented by the ancient dependent mountain ranges which have been destroyed and eroded as a result of the prolonged weathering which followed.



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The foothill system.

Whatever the origin of the separate low hills may be, all of them together form either a wide or a comparatively narrow strip of the so-called foothills, situated between the Turanskiy lowlands and the high mountain ranges.

Along the large river valleys and lake funnels intersecting the mountain ranges, the system of foothills frequently cuts deeply into the region of high mountains in separate branches, dividing it into individual ranges.

On the other hand, by the same chain-like elevations it often cuts deeply into the borders of the Turanskiy lowlands, forming either whole chains, or more or less isolated hills, sometimes from rather broad foothills.

As stated in the beginning, the height of these foothills fluctuates between 400-500 to 1,500-2,000 meters above sea level. Their relief is more or less broken, although in places there may be seen rather broad almost plain-like or barely sloping surfaces which are completely suitable for agricultural use.

The climate of the foothills. Warm.

Climatically, the foothill region of Middle Asia is rather essentially distinguished from the Turanskiy lowlands, although separate regions in this respect are far from similar among themselves.

As concerns the summer heat, it is necessary to note here its regular decrease according to the height of the place above sea level. This regularity is expressed by a definite height of temperature gradient, exactly 0.6 degrees for every 100 meters in height.



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Therefore, if in the more northern regions of the foothill strip we have an initial temperature in the summer for the Turanskiy lowlands of say 24.8 degrees (Iliyskaya Station 452 meters in height), then at a height of 1,500 meters the average temperature in the summer will be around 18.5 degrees, and at a height of 2,000 meters in all only 15.5 degrees.

At the same time, on the southernmost border of Middle Asia, at an initial temperature of 30.7 degrees in the Turanskiy lowlands for the summer, (Termez, 310 meters in height), the temperature in the summer at a height of 1,500 meters is 23.5 degrees and at 2,000 meters is 20.5 degrees.

Together with the decrease in force of the summer's heat, the length of the growing season also decreases according to the altitude of the place. The magnitude of the winter coldness constitutes the exception, since some parts of the foothills have higher temperatures than the neighboring lowlands in the winter months. This is explained by the inflow of cold masses of air along the lowland plain from the more northern latitudes, while on the higher foothills the action of these cold masses of air is not diffused because of their extreme heaviness.

The height of the extent of cultivated plants.

Along with the change of the warm cycle of the foothills goes the change of the makeup in the cultivated plants that are possible in each locality. Extremely detailed observations with respect to the extent of different crops are available for Southern Tadzhikistan. For an example we shall take the following data by Darvaz.



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(1) Pomegranate can be cultivated . . at an elevation up to 1,500 meters

(2) (Injhir) fig can be cultivated . " " " " " 1,700 meters

(3) Cotton, castor plant, sesame, safflower, beans (phaseolus mungo), tomatoes, grapes, plums, cherries, peaches . . . . . " " " " " 1,900 meters

(4) Millet, "kunak", "lobiya", lentils, watermelon, honeydew melon, onion, pepper, mulberry, [redacted] walnut [redacted], apricots, cherries, plums (Prunus divaricata) . . . . . " " " " " 2,300 meters

(5) Wheat, barley, peas, vetchling, chick-pea, stringbeans, flax, alfalfa, squash, potatoes, beets, poppy, sunflower, apples, pears . " " " " " 2,500 meters

In the more northernly situated Fergana and in the Tashkent region the limit for the cultivation of cotton can be calculated at 900-1,000 meters, instead of the 1,900 meters south of Tadzhikistan, and the limit in general for all crops at 2,000 meters. In the still more northernly Auliyeatinskiy, Frunzenskiy and Almaatinskiy regions even the earliest-ripening kinds of cotton can not grow above 500-700 meters, and the upper limit of agriculture lies at the height of 1,700-1,800 meters.

Precipitation in the foothills.

In respect to humidity the foothill strip of Middle Asia, in general, is characterized by a greater amount of atmospheric precipitation than the Turanskiy lowlands. If we take such comparatively low-situated points, like Ashkhabad (218 meters),



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Mirza-Chyl' (273 meters), Dzhizak (392 meters), Tashkent (473 meters), Chimkent (503 meters), the Krasnyy waterfall (603 meters -- even here the yearly quantity of water increases 200 millimeters over the maximum norm for the wastelands of the Turanskiy lowlands, and in some cases reaches even 400-500 millimeters (Dzhizak, Chimkent). This refers not so much to the altitude of the place itself, as to the influence of the neighboring high mountains, which intercept the route of the humid air currents.

Not always, however, does a place have such a coincidence of altitude and increased quantity of rainfall. Depending on the various local peculiarities, in particular on the direction of the slope in relation to the moisture-bearing winds, on the nearness or distance of the high snow-covered peaks, on the location of the neighboring mountain chains, etc., the separate parts of the foothills can be very strongly moistened by rains or be distinguished by great aridness. This situation can be illustrated by the following table, based on the observations of more than 100 stations situated over the whole of Middle Asia.

| Height above sea level in meters | Annual Precipitation in millimeters |
|---|---|
| 0 -- 260 | 78 -- 230 |
| 260 -- 650 | 112 -- 483 |
| 650 -- 1,100 | 184 -- 765 |
| 1,100 -- 2,000 | 213 -- 995 |
| 2,000 -- 3,000 | 164 -- 1,482 |
| 3,000 -- 4,000 | 59 -- 1,012 |



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From these data, it is evident that within the borders of the Turansk lowlands to a height of 260 meters the maximum amount of yearly rainfall is 230 millimeters. In the region of the low foothills the annual rainfall reaches 483 millimeters, in the region of the middle foothills 765 millimeters, in the region of the high foothills, even to 995 millimters. In the mountains higher than 2,000 meters above sea level, the amount of rainfall is often even greater and reaches 1,482 millimeters (Almaatinskoye Lake).

On a line with this, at all altitudes there are places where the yearly amount of rainfall does not exceed the limits of the usual arid norm which is characteristic of the Turanskiy lowlands, i.e. -- 100-250 millimeters. As in the Turanskiy lowlands, so here artificial irrigation seems to be the only sure condition under which such wastelands of the foothills can be utilized for agriculture.

Non-irrigated agriculture.

Those parts of the foothills which receive rainfall amounting to more than 250 millimeters in a year, can be utilized for non-irrigated or so-called "bogara" agriculture. Places with 250-400 millimeter rainfall are considered to have an inadequate water supply; places with a precipitation of more than 400 millimeters have an adequate water supply.

In determining the composition of crops for non-irrigated regions of foothills, it is necessary to keep in mind one extremely essential detail, namely, the amount of rainfall according to the seasons of the year. All foothills situated south of Chimkent and Tashkent, receive rainfall almost exclusively in the winter and spring months, just as the corresponding parts of the Turansk lowlands do. The summer and the first half of the autumn are almost absolutely without rain.



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Corresponding to the extent of rainfall, only such winter or early spring crops as mature and are gathered from the fields towards the onset of prolonged and steady droughts, i.e., towards June, prosper more or less well in the non-irrigated strip of this part of Middle Asia. This refers to the cereal grasses -- wheat, barley, sometimes millet, then safflower, olive flax, peas, chick-peas, and to a lesser degree sunflower, corn, sesame. Alfalfa usually gives only one spring harvest. It is interesting to test crops of early-ripening vegetables like cabbage, turnip, and carrots in non-irrigated lands.

As for the late-ripening crops with a long growing season, to which cotton belongs, they fall under the action of a prolonged and steady drought on the non-irrigated land, as a result of which, such crops are rather ineffectual.

The soils of the foothills.

In respect to soil conditions the foothill strip likewise presents great variations. It is true that the sands and salt marshes so characteristic of the Turansk lowlands are almost completely lacking here. Depending on the amount of rainfall the predominant soils are either the wasteland-steppe gray-earths, or the so-called dark-earths and chestnut soils, and less frequently the black-earths. The last are found only in the higher foothills, and chiefly on the northern and western slopes.

Because of their physical properties, all these soil types are more favorable for crops than the wasteland gray-earths of the Turansk lowlands. They are more structural, do not fall apart and do not form crusts even when irrigated. This refers in particular to the chestnut soils and to the black-earths. One can also discount



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the danger of secondary salting during irrigation, for it does not occur. In places, however, a heavy rubble occurs, which makes processing of the fields difficult and lowers the fertility of the soil. The properties of the geographic relief also often sharply curtail the possibilities of processing. Because of this, great areas of foothills can be utilized only for grazing animals and for haying. Where there is broken terrain, the cultivation of fruit orchards and vineyards can be very important.

## THE HIGH-MOUNTAIN REGION

The high-mountain region of Middle Asia is concentrated chiefly within the borders of Tadzhikistan and Kirgiziya, occupying about 2/3 of the area of these republics. It is considerably less in Kazakstan and Uzbekistan, and almost non-existent in Turkmeniya.

Heat.

Situated within the limits of heights of 2,000 to 5,000 meters, with individual peaks reaching even 7,000 meters, the high-mountain region is distinguished by a comparatively cool and brief growing season and an extremely prolonged and rather severe winter. If we apply the scale of temperature change of 0.6 degrees for each 100 meters of elevation, used above for the foothill region, it can be shown that the summertime temperatures for the southern part of the region fluctuate according to elevation, from 20 degrees to 0 degrees, and for the northern part -- from 15 degrees to 0 degrees.

With an average summertime temperature of 5 degrees snow patches remain throughout the summer. At higher altitudes, these become snow fields and glaciers. The lowest boundary of continuous



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snow is calculated at a height of 4,500 meters in the south and 3,500 meters in the northern mountain region.

Precipitation.

The amount of atmospheric precipitation fluctuates within very wide limits, as in the foothill region. While there are places which receive 1,000 millimeters and more of rainfall in a year, we have places in this same region such as Pamirskiy Station, with its record low rainfall of 59 millimeters a year -- a record low not only for the whole Soviet Union itself, but for the world.

Vegetation.

Because of great variation in warmth during the growing season and also on account of unstable atmospheric precipitation, the normal growth of natural vegetation in the high-mountain region of Middle Asia also is extremely variable. The so-called Alpine or subalpine meadows predominate here, making excellent summer grazing lands for all kinds of domesticated animals. The grazing period extends over not more than 2-4 months, after which it is necessary to drive the cattle to the warm regions of the foothills and even to the Turansk lowlands.

In places where the mountain slopes are well watered by rainfall, more or less broad thickets of trees and underbrush are found. In the north, within the borders of Kazakstan and Kirgiziya the "tyan'shan'skaya" evergreen plays an important role. In the south, in Uzbekistan and Tadzhikistan, the mountain juniper or "archa" predominates. In addition, there are also leafy trees: birch, aspen, maple, ash, and also walnut and all kinds of fruit trees. However, these last varieties are more indigenous to the foothill zone, rather than to the mountain zone.



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Agriculture.

The whole high-mountain region is almost completely unsuitable for agriculture. Only in the very lowest parts do such early-ripening crops, as barley, flax, and Eruca sativa (an annual mustard plant), ripen.

In some places it is possible to consider cultivating garden vegetables which are less demanding of warmth and can endure the first autumnal frosts -- cabbage, carrots, turnips and onions. However, the properties of the very broken mountain relief so hinder the processing of the soil that it is almost impossible to consider the widespread cultivation of these crops.

## THE CROPS OF CENTRAL [redacted] ASIA AND THE BASIC PRINCIPLES OF THEIR DISTRIBUTION

Directives of Gosplan.

Taking into account the character of the natural resources of Middle Asia and keeping in mind the general needs of the whole socialistic national economy of the Soviet Union, the Gosplan of the USSR lists the following directives for the Middle Asia republics in drawing up the national economy plan for the second Five-Year Plan:

(a) Central [redacted] Asia keeps its leading role in the production of cotton, as a result of which, the initial cotton processing industry must be widely developed; also, a large cotton industry must be established.

(b) The source of power in this territory must be set up anew by exploiting coal and petroleum resources, and in particular by operating electric stations on water and coal. The utilization of water resources must be more ramified.



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(c) The development of non-ferrous metals must be provided for (brass, zinc, lead, and others).

(d) The extraction of minerals must be organized (sulphur, calcium, mercury, asbestos, radium, barium, and molybdenum).

(e) The production of fertilizers, in particular nitrogen, must be organized.

(f) Special attention must be given to developing the proper balance between the production of fuel and fodder in this territory.

(g) The above-mentioned general directives are particularized in a further listing of special instructions for the individual republics which constitute the economic union of Central [redacted] Asia. These instructions are drawn up in the following manner.

Uzbek SSR. -- The chief cotton area of the USSR. The greatest amount of copper mining, production of nitrogen. Textile and foodstuff industry. Machine building. Output of petroleum and anthracite.

Turkmen SSR. -- Together with cotton raising and cattle breeding, chemistry is one of the chief branches of national economy. The chemical area is the wealth of Kara-Bugaz and Guurdak. The petroleum (Chelken) and fish industries are developing considerably.

Tadzhik SSR. -- The area for Egyptian cotton and one of the chief regions of the USSR for the output of non-ferrous metals. Along with this, cattle breeding, horticulture and the textile industry are being developed considerably.

Kirgiz ASSR. -- Cattle breeding, specialized horse breeding. Processing of fuel resources, and rare metals. Cultivation of new bast crops and cotton. Sugar industry.

Kara-Kalpak ASSR. -- Cotton raising and cattle breeding. The industry reprocessing agricultural raw material. Fish industry.



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In this manner, Central Asia "keeps its leading role in cotton raising" and at the same time "must give special attention to the proper set up of its fodder balance."

Both these agricultural problems can and must be resolved by the successful combination and proper apportionment of suitable crops.

Irrigation as a basis for cotton raising and other technical crops.

The problem of cotton raising in Middle Asia is resolved, chiefly, only with the help of irrigation.

Due to the fact that in the hot belts suitable for the cultivation of cotton the rains fall only in the cold half of the year, and a prolonged and very steady drought sets in in the middle of May, -- this crop is either absolutely unsuccessful or results in small, unstable harvests unless irrigation is used. When irrigation is applied, the prolonged and hot growing season guarantees such large and stable harvests that all expenditures for irrigation are completely profitable and justify themselves in a comparatively short time.

At the present time Central Asia has about 3 million hectares of irrigated lands, of which 1.5 million hectares are devoted to cotton raising. According to the calculations of Comrade Yanishevskiy, the potential area (if irrigation is used) and the yearly area devoted to cotton raising comprise about 5 million hectares, excluding the basins of the Chu and the Balkhash, and, if the flow of water is regulated, they comprise 7.5 million hectares. If the basins of the Chu and the Balkhash are included, the figures become, respectively, 6 and 9.5 million hectares. The total irrigated area in Central Asia can be estimated on the order of 10 million hectares.



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If complete use of the above-mentioned areas were made, theoretically the possibility of setting aside a part of them for other than cotton and technical crops is feasible, since the needs of the Soviet Union for these crops could be completely satisfied. However, in the forthcoming Five-Year Plan to which our specialization is adapted chiefly, the anywhere nearly complete use of the above-mentioned lands is impossible. "The directives for the establishment of a second Five-Year Plan for the agriculture of the USSR", published by the People's Commissariat of Agriculture USSR, in the edition "Irrigation and Reclamation" foresees the increase of the irrigated area of the Middle Asia republics to only 550-570 thousand hectares. In reference to quality, the largest objectives mentioned are Vakhsh--- 65,000 hectares, Fergan -- 100,000 hectares, Chirchik-Angren -- 80,000 hectares. From this it follows that in the near future the utilization of irrigated lands ought to produce the maximum advantage for cotton and some other valuable technical crops.

As a result of the above-mentioned division of the Turansk lowlands into three heat belts with varying intensities of heat and varying lengths of growing season, there are three chief belts of irrigation (the boundaries of which are shown on the corresponding map) for the irrigated part of Central Asia.

The southern belt consists of dry subtropical plants with the leading late-maturing and medium-late-maturing kinds of cotton, of which Egyptian cotton is one. This belt encompasses the southern-most part of the irrigated lands, chiefly in Turkmeniya and Tadzhikistan, where climatic conditions permit the long-fibered kinds of cotton to mature without the application of artificial measures.



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Together with the leading crop of cotton, other subtropical crops, perennial and annual, will be allocated to this region, but they will be crops with long growing seasons. In the interest of increasing the harvest of the leading crop which is cotton, and considering also the needs of cattle breeding, fodder bean crops ought to be introduced into crop rotation, in particular alfalfa. On soils that are insufficiently supplied with water, the leading crops are cereals.

The second, or middle, belt, adjoining the first from the north and occupying the chief part of the irrigated lands of Central Asia, has the middle-early-ripening and middle-late-ripening varieties of cotton as the principal crops. The late-ripening kinds can be grown only by transplanting. The role of fodder and cereal crops in this belt is analogous to their role in the first belt.

The third belt occupies the northernmost part of the irrigated lands and has the least favorable climatic conditions in comparison with the other two. This belt is used especially for raising cotton of the extra-early-ripening and early-ripening varieties, and also for other technical crops, chiefly new basts, and sometimes for sugarbeet (Kirgiziya). The role of cereal crops and grass is approximately the same as it is in the first two belts.

Non-irrigated lands and the problem of grain balance.

In speaking of the specialization of non-irrigated lands, we divide them into two basic types: those with an adequate water supply and those with an inadequate water supply. To the first kind belong non-irrigated lands which have a precipitation of more than 400 millimeters of water a year, down to those which have the



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smallest amount annually. The location of these lands which chiefly occupy mountain slopes, is not like that of a compact mass, but rather represents a system of scattered small areas. In this connection, areas which lie close to one another can vary sharply in their precipitation depending on the height at which they lie, and on what slope of the mountains they are situated. Therefore, it is possible to speak only of the types of non-irrigated lands, but one cannot give their exact geographical location.

On the non-irrigated lands with an adequate water supply and also in those dry farming regions which have a better than average rainfall, the leading crops ought to be cereal grasses, primarily wheat. On the non-irrigated lands with an inadequate water supply the regions which especially suffer from a lack of rainfall ought to be sown with grass of the drought-proof fodder grasses; and those areas should be used as natural pastures.

On the non-irrigated land with an adequate water supply, grass sowing, especially of beans, ought to be included in crop rotation, and some regions ought also to be used for a non-irrigated cotton crop. We consider it possible to limit the role of such a cotton crop on non-irrigated lands by having lands available in parcels which are large enough to make extensive use of mechanized farming methods. About 200 thousand hectares indicates how much land is available in such areas.

The effectiveness of non-irrigated cotton raising under the conditions of [redacted] Central Asia is extremely small, in view of the great output of labor the crop requires when wide-scale mechanization is not used. The second big reason for limiting non-irrigated cotton raising in Middle Asia is the need to make maximum use of such



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non-irrigated lands for raising grain and for the animal husbandry of this territory.

Above we said that the directive instructions for Middle Asia under the second Five-Year Plan present the country with the problem of cereal-fodder balance. Let us see how this has been worked out in recent times for Central Asia. Unfortunately, full, published data on this question are to be had only for the years 1926-1927 and 1927-1928.

For the first year, we have physical quantities, while the second year, the data is expressed in prices. The actual net shipment of cereal grains into Middle Asia in 1926-1927 by the individual republics was as follows: Uzbekistan (with Khodzhent) received 403,440 tons, of which wheat comprised 110,160 tons; Turkmeniya received 160,240 tons, of which wheat comprised 110,160 tons; only Tadzhikistan had a negligible delivery of 570 tons.

In 1927-1928, the delivery of grain products into Uzbekistan amounted to 42,636,000 rubles, and in Turkmenistan to 9,200,000 rubles.

With the increase of cotton production and forcing cereal crops and rice from irrigated lands, the deficit of grain products in 1931 in Middle Asia was carefully determined by the Representative of the People's Commissariat of Supply as equal to about 60 million poods (2 billion, 400 million pounds). The actual deficit was more.

If we take into account the growing need for concentrated fodders, and also the planned increase in consumption with a continual emphasis on economic specialization in Central Asia on industrial crops, then it becomes clear that the needs of the territory for grain products will be over 100 million poods during the Second Five-Year Plan.



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If we consider the extreme bottleneck which transportation is in the Soviet Union and the necessity in the second Five-Year Plan in Central Asia of delivering an enormous amount of construction materials (primarily, forest products), machines and other manufactured products for a country that is becoming industrialized -- it becomes necessary to take all measures to produce a maximum of cereal crops on the local non-irrigated lands. This is necessary also in the interests of the defense of the nation.

The needs of animal husbandry.

We pointed out above the growing need for concentrated and nourishing fodder, for animal husbandry in Central Asia. Despite vast pasturing resources, the balance of livestock products in the Central Asian republics was unfavorable. In 1929-1930 the delivery of meat and fat into Central Asia came to 29,376 tons and large and small rawhides equalled 950,500 pieces. The only exception in the otherwise negative balance was the shipping out of hides -- astrakhan and lambskin.

The explanation of this situation with livestock products must be looked for in the unwise use of available fodder. The presence of pasture feeds, in Central Asia when used wisely can guarantee sustenance for 70 million head of livestock, providing a change-over is made to rams. In this connection, in 1929, the livestock in Central Asia, in a change-over to rams, equalled 10 million head.

The scourge of Central Asian cattle production seems to be jute, i.e. -- cattle dying because of lack of forage in winter. The extremely extensive forms of cattle raising in the chief cattle raising regions of Central Asia, the pasture-like characteristics of



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the area and the resulting shortage of bulk fodder for the winter, together with the deficit of grain and concentrated fodders throughout Central [redacted] Asia -- such are the reasons for the presence of jute. The struggle against jute ought to progress, on one hand, along the line of a socialistic reorientation of animal husbandry throughout the territory, and on the other hand, with the rectification of the fodder balance. Meanwhile, the use of cottonseed cakes for fertilizing the fields rather than for fodder, further accentuates the already strained balance with concentrated feeds.

Taking an extremely rough count, the deficit in concentrated feeds (taking the requirement as 100) shows the following pairs of variables for the individual republics: Uzbekistan -- $\frac{8}{58}$, Turkmenistan -- $\frac{15}{53}$, Tadzhikistan -- $\frac{32}{55}$, Kirgiziya -- $\frac{57}{62}$, for all of Middle Asia -- $\frac{29}{59}$. The numerator indicates the deficit of concentrated feeds when cottonseed cakes are used, and the denominator indicates the deficit when cottonseed cakes are not used for feed.

The above-mentioned figures show the need for the speediest possible solution of the problem of the feed balance in Central [redacted] Asia. It is necessary to remember that cattle breeding has great importance in the agricultural economy of the country, comprising 47.9 percent of the economy in 1927-1928.

If the problem of bulk fodder can chiefly be solved by wise use of pasture lands, by haying and the use of waste from fields, and also by irrigation, then the solution of the question of concentrated feed requires certain changes in the very makeup of the crops in the non-irrigated lands chiefly, but sometimes in the irrigated lands. Of necessity, we spoke above of the all-out increase of the grain-growing area in the non-irrigated lands and in the regions of the



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irrigated lands which are not sufficiently supplied with water. Together with this comes the question of setting up special irrigated lands for fodder crops for the animal husbandry State farms. The area of these lands as part of the total area of all irrigated lands will, of course, be small, but it is necessary all the same to provide for their organization.

In those regions where animal husbandry plays a significant role as the basic occupation of the population, or where it is needed to supply the demands of nearby industrial centers provision must be made for the increased role of fodder crops in crop rotation, and for the inclusion of "dzhugara" (a kind of sorghum -- Andropogon Sorghum var. cernuus), beans (Phaseolus mungo), etc. The decrease in the area devoted to raising cotton will be compensated for to a large extent by the increase in yield which will result from this system of rotating crops of field grasses.

The needs of animal husbandry ought to be taken into consideration also in the irrigated regions which adjoin Kara-kum and Kizyl-kum and the winter pasturing territories of Kirgiziya and Tadzhikistan.

In the regions adjoining industrial centers, field cultivation as a rule is not a leading occupation. Gardening, melon growing, and truck farming ought to be developed here. However, the question of setting up these branches of agriculture, which in general play a very large role in Central Asia, is out of the realm of the topic we are now covering, and will be taken up separately.

The needs of agrotechnology.

In addition to national-economic demands, when we consider the question of an intelligent crop distribution, we ought not to exclude



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agrotechnological considerations. We have already taken up the division of Central Asia into non-irrigated foothill lands and the irrigated lands of the Turkmenskiy lowlands, dividing the latter of these into three belts -- a division explained by the agrotechnological needs of individual crops and species. Questions of crop rotation were partially touched upon above, and to some extent will be examined further on, in a survey of fodder crops, where we will see that as a result of the introduction of crop rotation of field grasses an increase of 30 percent or more in cotton harvests can be expected. To the agrotechnological problems of this sort, there should be added the matter of the capacity of irrigation canals to let water pass through and in general that of the guarantee of water systems to supply water. So, for example, when an irrigation system does not guarantee a sufficient water supply, the sowing of cotton crops is usually concentrated in the upper parts of the system, while crops like grain, and other forage crops which require less water are planted in the lower parts.

Salty soils and soils with nearby ground waters, which are widely used in places, as we have seen, are hardly suitable for cotton crops and can be used for all kinds of other valuable technical and special crops, in particular rice, hemp (Hibiscus cannabinus), Indian hemp (Apocinum cannabinum), melons, alfalfa, etc.

The properties of the relief and the physical composition of the soil also cause the kinds of crops grown to vary, depending on their soil needs and the means available for cultivating the fields.

In some of the arid regions of the Turanskiy lowlands which are little suited to wide-scale irrigation because of soil and water conditions, there arises the problem of cultivating fodder and food



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supply crops in order to set up a reliable basis for cattle raising. In addition to selecting crops for their economic value, they ought to be chosen for their ability to resist drought and salt, and for their ability to hold down the sands, etc.

Finally, the soil and climatic conditions which are peculiar to Central Asia and do not occur elsewhere in the USSR, present the problem of experimentation, and in case of successful experimentation, the problem of the mass cultivation of many such plants which are useful for our economy, and whose cultivation is not possible in other regions. This refers to such crops as guayule, ramie, various olive oils and volatile oils, vegetable sponges, certain cucurbits, etc.

Keeping in mind all the above-mentioned considerations, the proposed makeup of useful crops for Central Asia given below is extremely varied. This variety, however, is not to be looked upon as being at odds with the demands of specialization. Each region ought to have its leading crops, which, for the majority of regions, is cotton. All other crops are considered secondary or experimental.

Cotton.

Central Asia, which is the chief cotton area of the USSR, ought to devote itself wholeheartedly to the development of this one crop, as long as it remains highly deficient in terms of the national demand. The maximum of irrigated lands ought to be set aside for cotton, and chiefly the most favorable land.

In view of the conditions of Central Asia the best soils for the cultivation of cotton are the sandy loam type (soil containing 60 to 80 percent sand) and argillaceous type of serozems, both of which are well supplied with water. The heavy clayey types of serozems are difficult to cultivate, are not easily permeated by water, become



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pulverized when irrigated, and upon drying, form a thick and very smooth crust. In places where it is easily feasible technically, such heavy soils ought to be subjected to treatment with sand.

Salty soils and soils with nearby ground waters are suitable for cotton only after certain preliminary processing, in particular drainage and irrigation.

If each irrigation covers 1,000 cubic meters, then the cultivation of cotton on irrigated lands needs 3-6 irrigations during the growing season, depending on the soil.

In the case of non-irrigated cultivation of cotton in Central [redacted] Asia, according to the data of the Turkestan Selective Station the harvest of such cotton is 2 centners per hectare when the minimum amount of rainfall is 251 millimeters per year, as a result of which the growing season ends 16 days earlier than that for cotton grown on irrigated lands.

When the rainfall is more abundant -- 600 millimeters per year -- we can count on receiving 2-6 centners of cotton wool per hectare.

Because of the considerable fluctuation in the amount of rain which falls from year to year, the non-irrigated cultivation of cotton in Central [redacted] Asia is, undoubtedly, risky. Therefore, the questions of agrotechnics in the struggle to accumulate moisture in the soil and to make the maximum use of it, ought to play a decisive role here.

As to climate, cotton requires a long period of no frost until it begins to ripen -- from 90 to 150 days, and a large sum total of heat for the growing period -- from 3,500 to 6,000 degrees, depending on the variety of cotton. As a basis for determining the kinds of cotton, we have used the agroclimatic data of the Agro-Meteorological Institute, calculating the total heat of the growing period in terms of those



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average daily temperatures which are at least 10 degrees. The division of different varieties into groups is given below:

| | |
|---|---|
| early-ripening . . . . . | 3,500 -- 4,000 |
| medium-early-ripening. . . . . | 4,000 -- 4,500 |
| medium-late-ripening . . . . . | 4,500 -- 5,000 |
| late-ripening and Egyptian . . . | over 5,000 |

The division of the kinds of cotton into groups (according to NIKhI) is done in the following manner:

| Group I<br>Early-ripening and extra-early-ripening | Group II<br>Medium-early-ripening | Group III<br>Medium-late-ripening |
|---|---|---|
| 10193) Turkestan Selective<br>10196) Station (Turkestanskaya Selektsionnaya Stantsiya) | 10002) Turkestan Selective Station (Turkestanskaya Selektsionnaya Stantsiya) | 508 "Batyr"<br>1876) Turkestan<br>2034) Selective Station (Turkestanskaya Selektsionnaya Stantsiya) |
| Bolgarskaya mixture | 182 "Ak-Dzhura" | Navrotskiy |
| Kashgarskaya mixture | 169 "Dekhkan" | Navrotskiy "bis" |
| Middle-Asian mixture | 2017) Turkestan Selective Station (Turkestanskaya Selektsionnaya Stantsiya) | Cook |
| 1306 "Shredera" | 750) | Triumf-Navrotskiy |
| | 1838) | Wilson type |
| | 2005) | Akala |
| | | Stanvel' |
| | | 8000 Turkestan Selective Station (Turkestanskaya Selektsionnaya Stantsiya) |



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| Group IV | Group V |
|---|---|
| Late-ripening | Egyptian |
| Del'to type) Sea Island | Ashmuni |
| Cleveland ) | Zagora |
| Snowflake ) | Sekeleryadis |
| Columbia | Pima |
| Delphos | Afifa |
| Triumf Navrotskiy | Bosos |
| | Yuma |
| | Bol'tos |
| | Nubari |

On the basis of this experimentation with the numerous varieties it is entirely reasonable to concentrate upon one or two of them in each group. This will make it possible to keep weeds out of the seed stock, which is what happens in Middle Asia. On the basis of conferences on the production of cotton seeds which took place in the autumn of 1931, the second Five-Year Plan envisages increased sowings of varieties No. "8000" and No. "2017", while reducing the area sown to "1838". Emphasis on the "Cook" variety is to remain the same,

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"1306 Shreder" (Schroeder) transferred to new regions. The varieties Triumf-Navrotskiy, Navrotskiy, 508, and 182 will be rereduced, and by the end of the Five Year Plan will be replaced by the more productive varieties indicated above.

In the northern regions of the Khivinsk oasis it is necessary to set up a seed center to produce seed of the earlier varieties of cotton for the new cotton regions (Ukraine and North Caucasus). In the southern part of the Amu-Dar'ya, southward of Chardzhuye, it would be desirable to cultivate the Si-Alendov variety, which has a good fiber length and gives a higher yield than the Egyptian varieties.

The expansion of cotton seedling transplantation will to some extent obliterate the clear-cut zones of dissemination of the individual varieties, making the northward advance of the Egyptian varieties possible and thus assuring higher yields of the transplanted crops as against those grown by direct ground seedlings. The location of the regions of transplanted culture should be linked with the electrification of agriculture, considering the possibility of heating the seedbeds by electricity.

KENDYR In addition to the expansion of cotton, establishing cultivation of the new bast fibers is very essential; but they should be rationally allocated so as not to damage the development of cotton culture. Kendyr is among the most important of these new bast fiber crops. It is a perennial which can for the most part be cultivated along shore terraces of rivers and on the most varied types of soils, requiring from 7 to 15 waterings. Since it has a relatively short growing season, it can be advanced relatively far into the north. Therefore, introducing kendyr on a large scale in the cotton regions would of course be inexpedient. The principal regions for its distribution are Ka-

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zakstan and Kirgizstan, where the area of its natural habitat is located along the valleys of the Syr-Dar'ya, Amu-Dar'ya, Chu and Ili rivers.

On the other hand, inasmuch as kendyr grows along the flood-plains of rivers and in waterlogged places, it cannot compete with cotton, which does not thrive on marshy or even lightly saline soils with a ground water level near the surface. For this reason we envisage a certain expansion of kendyr on the tugay lands along the valleys of the Chirchik, Syr-Dar'ya and Amu-Dar'ya rivers, as a local crop on filled-in areas, not interfering with the expansion of cotton cultivation.

KENAF Inasmuch as kenaf is called upon to replace imported jute in the manufacture of heavy burlap, the question of its cultivation in Central Asia is very important. Although this crop may also be grown under the conditions of North Caucasus, its cultivation in Central Asia would make it possible to obtain higher yields of fiber and better seed, since irrigation is available and climatic conditions are better than in the north Caucasus. Moreover, kenaf can be grown on the most varied soils as well as in sites where the ground water level is close to the surface, whereas in similar conditions cotton yields are low because of the strong development of the monopodial stems at the expense of the sympodial stems, with late opening of the bolls. The area for the distribution of kenaf is in the northern regions of Central Asia, and coincides with the proposed Kendyr area.

ABUTILON This crop needs two waterings less than kenaf and has a shorter growing season. It does not require a total temperature during the growing season higher than 2500 degrees. It may there-



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fore be located in the area of the systems with scanty flow in the northern parts of this natural province, on medium and heavy argillaceous-loamy soils, with the ground water level not less than one meter below the surface. The area of cultivation embraces Kazakstan and Kirgizstan.

LONG-FIBER FLAX In cultivating this crop on the irrigated lands of the Turkestan Selection Station, two crops were obtained in a single growing season, with three waterings in all for both crops. This crop thrives best of all on land newly brought under cultivation, while with kendyr and kenaf the reverse is true. So we may recommend for the first year the use of virgin land for flax, and after the first year for kendyr and kenaf.

RAMIE Ramie is the most valuable perennial of the bast fiber plants, and its cultivation should be widespread throughout Central Asia, where the temperature conditions are most suitable to it. It is a native of the humid subtropical regions, and definitely demands such an environment. In arid regions, it requires above all abundant watering every 15 days, with 1500 cubic meters of water to each watering; it also needs deep ground water (not less than 2 meters from the surface), and good soils, without marshy flooded localities. Ramie cannot endure winter freezes below minus 15 to minus 20 degrees Centigrade, and demands high temperatures during the summer months.

The lack of reliable data on the behavior of this crop not only under the conditions of Central Asia, but also under those of the USSR as a whole, makes it difficult to delimit the area for its distribution. With a certain amount of caution it could apparently be grown in the subtropical southern regions of Turkmenia and Tadzhikstan as a preliminary semi-experimental project, more or less



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on pilot-plant scale. It is possible that it might also occupy a few regions of the central cotton belt, provided there were winter covering to guard against freezes.

FIBER EXOTICS With respect to the other fiber plants with more or less likelihood of growing under Central Asian conditions, it is necessary to point out a number of such crops, like jute, okra, "rozeliya," etc. Cultivation of these crops, in view of their serious technical defects as compared to kenaf, cannot at present be of much importance.

Jute under our conditions gives lower yields than kenaf.

Okra also has a number of disadvantages as compared to kenaf. Its major disadvantages are that it is highly exigent as regards soil conditions and water, and that its spinnable varieties mature late and give a low yield, inferior both quantitatively and qualitatively to kenaf. Rozeliya cannot be cultivated in Central Asia because its growing season is too long.

Exotic fiber plants of the leguminous plant family will be mentioned in the leguminosae section.

For semi-experimental projects in the subtropical part of Central Asia such other fiber crops as agave, New Zealand flax, yucca, and esparto grass may be recommended.

ESSENTIAL OIL CROPS The location of the essential oil crops in Central Asia, where their wide distribution is under all conditions desirable, is a matter of some difficulty. Experimental cultivation of these plants and meteorological indexes of the growing seasons of the local wild fragrant flora, which exist in extraordinary variety, conclusively demonstrate the possibility of a large-scale development of these crops in Central Asia. This development should proceed in two directions:



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The first is the study and utilization of wild vegetation, in relation to which some work has already been done. The expedition of the Central Asian Botanical Garden in the central part of the Gissar range (Tadzhikstan) observed 62 species of plants yielding essential oils, of which a considerable proportion were of commercial value. Similar results were obtained by the Turkmenian section of the VIR. Wild marjoram, Muscatel sage, tarragon, hyssop, Persian [redacted] mugwort, lakhnofilyum, and a number of wild Umbilliferae deserve special attention.

The second direction is the widespread cultivation of aromatic plants yielding essential oil of high value. Such cultivation may be done on both irrigated land and bogara land. The experiments of the Turkmenian section of the VIR and of the Central Asian Botanical Garden in Chigman, Khodzhent and Tashkent yielded good results.

Among the cultivated plants, lavender, geranium, lemon sorghum, catnip, lipiya /linden flower?/, basil and a few others deserve special attention. Lavender survived the winter of 1931, when the temperature in Khodzhent dropped to minus 29 degrees Centigrade.

Interesting results have been obtained with catnip, the oil of which may be used in place of the costly lemon sorghum oil.

Muscatel sage and the herb Trachyspermum copticum develop well under bogara cultivation.

Essential oil crops may be divided by regions as follows:

Irrigated land: geranium, lemon sorghum, rosemary (in the subtropics), tuberose, Kazanlyk rose, iris, catnip, basil, lavender (in the mountains).

Bogara land: muscatel sage, the herb trachyspermum copticum, lavender (on more sheltered sites), fennel, anise.



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Cultivation techniques and the properties of the essential oil crops in Central Asia have been very slightly investigated, and the question of the volume of the industrial demand for them is still largely unresolved, so that it is still not possible to classify them into primary and secondary crops.

It can, however, be roughly calculated that Trachyspermum copticum, Kazanlyk rose (which yields an extremely costly attar of roses), and geranium belong among the primary crops.

As regards the geographic allocation of all these crops, we may point first to the valleys of the Zeravshan and Chirchik rivers, and to Fergana, Turkmenia and Southern Tadzhikistan. The Kazanlyk rose can be grown only further to the south, while lavender, on the other hand, belongs at high altitudes, if its winter-resistability is taken into account.

Scientific research institutions will carry out further experiment on the cultivation of essential oil crops, making it possible to determine with greater precision those crops which may be used and to which regions they should be allocated.

RUBBER-YIELDING PLANTS Among this group of plants, guayule, khondrilla and tau-sagiz are now in the stage of semi-experimental, pilot-plant studies, as well as kendyr, referred to above, which belongs to the bast fiber group.

Guayule is a perennial originating in the mountains of Northern Mexico, where it may be cultivated as high as 2200 meters above sea-level. The climatic conditions in its native habitat are characterized by scanty precipitation, from 200 to 500 millimeters annually, with winter temperatures dropping to minus 10 and minus 15 degrees Centigrade.

Guayule thrives best on stony soils with abundant lime. Ex-



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cess soil moisture is harmful to it.

On the basis of this short description of the natural conditions for guayule, the best place for its propagation would appear to be the subtropic region of Central Asia, with bogara agriculture.

Khondrilla in the wild state is found in the northern Kizyl-Kum region on hilly and partly shifting sands. Inasmuch as sands occupy immense areas in Central Asia, its cultivation under these conditions could become very widespread. However, neither the conditions for cultivation nor the properties of the plant itself have been investigated to any great extent as yet.

Tau-sagyz is a perennial growing wild in the mountains of Kara-Tau. Studies have shown that it contains more rubber than any other rubber-bearing plant. It can be grown both on irrigated and bogara lands. The conditions of its cultivation and the regions for its propagation have not yet been established. It will be necessary to lay out tau-sagyz plantations within its present growing area and in other regions with analogous conditions. The same may be said of the related kok-sagyz.

SUBTROPICAL TECHNICAL CROPS For the region of the subtropics of Turkmenia and Tadzhikistan we consider it possible to recommend experimental cultivation of eucalyptus, acacia (for tanneries), sumac, cork oak, olive tree, yucca, New Zealand flax, agave, esparto grass, etc.

OIL-BEARING CROPS Certain oil-bearing crops are rather widely disseminated in Central Asia: safflower, [redacted] sesame and curly seed flax. They are grown on irrigated land and also on unirrigated (bogara) lands. The greater part of the Oriental sesame on irrigated land is grown as a second crop following the winter grain crops.

In addition, we cannot omit cotton from the list of oil crops,



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for since its oil content is relatively high (34.6 percent) it is used not only for spinning fiber, but also for oil. The possibility of obtaining large amounts of cottonseed oil and cottonseed cake, as by-products of textile production, points to the inexpedience of giving over great tracts of irrigated land to specialized oil crops. Only on bogara lands, where cotton cultivation is not very successful, should the oil-bearing crops mentioned above be more or less extensively distributed.

[redacted] Sesame may also be grown on irrigated land as a second crop after the winter grain crops, where there are any.

As regards the climatic and soil conditions required by the oil crops, the following factors must be noted:

[redacted] Sesame needs a growing season of 110 to 140 days, depending upon the variety, and fertile, weed-free soils. On irrigated land, 2-3 waterings must be provided, on the scheme 1 - 2 - 0, or one watering before blooming and two during the blooming period.

Seed flax needs a longer growing season than [redacted] sesame. The best soils for flax are arenaceous-loamy soils or light argillaceous-loamy soils.

Safflower has a growing season of 120-130 days and is distinguished by better drought-resistant qualities, which makes it possible to grow it extensively on bogara land. It needs mellow soils.

According to oil content, these plants fall in this order: [redacted] sesame, 55 percent; seed flax, 34.4 percent; safflower, 25 percent. [redacted] Sesame yields the best oil, of a highly nutritive quality, recalling in taste the best sunflower butter. Besides oil, safflower also yields carthamine, a dyestuff with some importance in the manufacture of aniline dyes.

In some regions of Central Asia, the castor plant is culti-



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vated in addition to the above-mentioned oil crops. In view of the relatively limited demand for castor oil and the possibility of growing this crop in North Caucasus as well, the castor plant will not be widely propagated in Central Asia.

The peanut, or ground nut, is the best of all the other oil crops. The oil content of its nut ranges from 31 to 84 percent, according to variety. It may be pointed out for comparison that the soybean has 18 percent, [redacted] sesame 55 percent, and the castor-bean 50 percent. Peanut oil is a high grade edible oil, second in quality only to the best olive oils. Peanut cake is of higher quality than cotton, flaxseed, or soybean cakes, and is used extensively in confectionery, while its inferior grades make excellent concentrated livestock fodder.

The peanut gives high yields, up to 30 centners. Its hay is only slightly inferior to that of alfalfa and clover.

It demands a long frost-free period -- 5 to 6 months -- with high temperatures and intense sunlight. It is not exigent with respect to soils, but gives best results on mellow arenaceous loamy and arenaceous soils, with good subsoil drainage. It thrives on lime, which, as is well known, is abundant in the soils of Turkestan. Even slightly saline or heavy stony soils are not suitable for peanut growing.

The great disadvantages of this crop are its great requirements for labor and the slight degree to which it enriches the soil with organic matter, since the entire plant is removed from the ground at harvesting time.

THE GRAIN CROPS Winter barley and wheat, which in places still play a role on the irrigated lands of the cotton regions, should be relegated to bogara lands except in occasional individual cases. The



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question is only as to the time when this shift should be made. If we still sow winter grain crops on irrigated land, it is only because this is done in the autumn, when the irrigation water is not needed by cotton.

One or two autumn waterings are sufficient for the grains, and sometimes they get along without any autumn irrigation at all. In any case they give normal yields without consuming great amounts of water, or require irrigation only after cotton sowing has been completed, or before it starts.

Of course, this is not at all to contend that there is no competition between the grains and cotton, since they do take acreage which could otherwise be used for cotton. The whole question of shifting them to bogara lands depends upon the water supply. The construction of reservoirs on systems where water is scarce will make it possible to increase the volume of water available and thus expand the sowings of cotton by displacing the grains.

If we are thus compelled to continue sowing winter grain crops in some regions, it is only a temporary measure until adequate water supplies are available.

The displacement of a number of food crops from the irrigated lands, especially the grains, gives priority to the task of maximum expansion of bogara acreage for winter crops, in order to alleviate the grain deficit of the Central Asiatic Republics.

Among the grain crops on bogara lands are winter and spring wheat and barley. The spring crops predominate, however, and there is only a small acreage in winter crops. Reasons for this are the small quantity and the lateness of autumn precipitation, as well as the growth of weeds among the winter crops.

Experimental stations and practical experience confirm the



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higher yields from winter crops, and show that weeds can be successfully controlled by crop rotation and good tillage.

The shifting of grain sowings to the autumn will relieve the peak load of spring work and render possible a substantial expansion of acreage of both grain and cotton, provided there is extensive mechanization of agricultural production. All this definitely indicates the need for giving the most attentive consideration to the development of winter crops.

With reference to the varieties of wheat and barley, it may be said that according to the results on selecting plots locally improved varieties give the best results. Locally selected varieties and varieties of mass selection hold first place among them.

SECOND CROPS It is entirely possible in a large number of Central Asian regions, under favorable climatic conditions, to obtain two crops a year from the same field by sowing a second crop after the harvesting of the winter grain crops - wheat and barley.

The population uses proso millet, kunak, the bean Phaseolus mungo, lobelia, corn, sorghum, sesame, rice (arpa-shaly), forage sorghum and cotton for these second crops.

The experimental stations have obtained entirely satisfactory results from the second crops. The following yields are reported by them:

| Name of Crop | Yield in Centners per Hectare |
|---|---|
| Corn | 15 |
| Sunflower | 7-8 |
| Bean Phaseolus mungo | 5-6 |
| Lobelia | 7-8 |
| Cotton | 7-8 |
| Cotton in Kashka Dar'ya area | 15-17 |
| Soya | 3-4 |



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The nitrogenous improvement of the soil effected by sowing lobelia, Phaseolus mungo, and soya for green fertilizer after the winter grains warrants particular attention. According to the experiment stations, this procedure increases the yield of the following cotton crop by 50 percent.

The above considerations unquestionably argue for the development by every means of the practice of sowing second crops. Where winter grains are grown on irrigated lands, the sowing of second crops may be widely practiced, to some extent also for the purpose of improving the nitrogen content of the soil. The following crop rotation should be used: winter grains; a second crop for green fertilizer; then, in the following year, cotton.

RICE The culture of rice is an extremely necessary component in the balance of food supply and demands corresponding attention and expansion of sowings. At the same time, however, it requires the expenditures of exceedingly large amounts of water for irrigation -- ten times as much as cotton requires. In view of this, rice cultivation in many cases slows down the development of cotton. In all such cases it should be shifted away from the cotton regions. Rice is usually grown on strongly waterlogged soils with high water table of heavy clayey consistency, so that it is impossible to introduce cotton on rice-fields without corresponding land reclamation melioration, since under such conditions the growth of cotton proceeds by development of monopodial instead of sumpodial stems. The delay in the opening of the bolls and the large-scale depradations of the cotton aphid (pautinoviy kleshchik) in consequence, cuts the yield of cotton.

For this reason, waterlogged land, well supplied with water, should first of all be assigned to rice. There are large tracts of



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finitely must be replaced.

The Samarkand and Fergana regions of the Uzbek SSR and Tadzhikistan ought to be designated for seed growing for local consumption.

As regards the reestablishment of soil structure by alfalfa, this process must be strengthened by growing a few other grasses in mixtures with alfalfa. Eragrostis abyssinica and zhitnyak (triticum cristatum) may be recommended on an experimental scale for this purpose. As a second type of mixture, shabdar clover (trifolium resupinatum) with alfalfa may be recommended. This has the advantage that when so mixed, the local varieties of alfalfa give a normal harvest already in the first year, a fact which is very important in view of alfalfa's short life of usefulness.

SHABDAR CLOVER (Trifolium resupinatum) The cultivation of shabdar (Persian clover) by itself has the following characteristics:

1. The first year crop is higher than that of local alfalfa, but falls off sharply in the second year of sowings.
2. It holds its own against weeds, whereas alfalfa only develops weakly during its first year and lacks this advantage.
3. Cattle eat it willingly.
4. It forms a very considerable number of nodules.
5. It thrives on sites with ground water level close to the surface (50 - 70 centimeters).

Shabdar also has the following disadvantages:

1. Its water content is high -- as much as 85 percent -- and therefore it does not dry out easily.
2. During drying for hay, the pith of the stalks dries out, leaving them hollow.
3. Its demand for moisture is great.



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To sum up, it may be said that shabdar as an independent secondary crop be given a certain amount of distribution in the southern parts of Central Asia, particularly in places with the ground water level near the surface. Secondly, shabdar may be mixed with alfalfa to obtain a good crop even in the first year and to combat weeds.

Alexandrian clover deserves attention alongside of shabdar. In the first year it yields up to 50 centners of hay, but its growing season is long. Its water content is less than that of shabdar.

THE SEED-POD LEGUMES AND THEIR ROLE IN NITROGENOUS SOIL IMPROVEMENT

The seed-pod legumes, which give better results under Central Asian conditions, are peas, chick peas, peanuts, the bean Phaseolus mungo, soybean, lobelia, etc. All of them may be used for food (the seed) and also for cattle fodder, whether green, or in the form of hay, straw after threshing, or the seed itself, etc. But their main importance is that they restore soil fertility by their quality of gathering nitrogen and replenishing the soil with it.

The following particulars may be noted about individual crops of this order. Depending upon the variety, the pea needs 70 - 150 days for its growing cycle, with total temperature during that period of 1800 - 2800 degrees Centigrade. It needs medium to light argillaceous-loamy soils containing lime. Winter peas, which give a large green mass, have recently been propagated in Central Asia; and the Badakhshan and Austrion varieties of these may be recommended, being distinguished by very early maturity and good winter-resistibility at temperatures as low as minus 30 degrees Centigrade. Sowings of these winter peas may be made in autumn between the rows of cotton, even before it is harvested. A second method is sowing after the final cotton harvest. In this case it is possible that growing will not



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begin during autumn but in the spring - in early spring for the most part. In both cases it is possible to obtain masses of green vegetation for plowing under for nitrogen soil enrichment before the next sowings of cotton are due. Winter vetch, fenugreck, trigonella, etc. may be handled similarly. It would be desirable to experiment along similar lines with a number of annual winter legumes from the local wild flora: esparsette, astragal, trigonella, vetch, vetchling, and so forth. They often grow in great profusion on the virgin bogara lands and on fallows, and give a good volume of green vegetation up to the end of April.

Among spring legumes, the bean Phaseolus mungo, lobelia, vetchling and chick pea may be recommended as nitrogenous soiling crops; and it is entirely practicable to sow them between the rows of cotton and plow them under during the blooming period of cotton. These crops may also be recommended as second crops after the winter grains, in the following crop rotation: winter grain; second crop (legumes); and cotton in the following year.

The significance of nitrogenous soil improvement by leguminous crops for cotton is evident from the following 1912 data of the Ashkhabad Experimental Field. The yield of cotton in these experiments varied. It is given in centners per hectare.

| | |
|---|---|
| After Phaseolus mungo, used for green fertilizer | 13.07 |
| After Phaseolus mungo, grown to seed | 9.61 |
| After chickpea | 10.97 |
| After black fallow | 9.84 |
| After lentils | 9.24 |
| After sesame | 8.56 |
| After corn | 8.34 |
| After sunflower | 7.81 |
| After cotton | 7.51 |
| After dzhugar | 7.36 |



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The results of the Golodnosteppe Experiment Station have been given earlier in this section. According to them cotton yield was increased by 50 percent after the bean Phaseolus mungo had been grown to seed, and by 160 percent and higher after that crop had been used as a soiling crop.

According to this data, Phaseolus mungo and chickpea should be singled out as soiling crops for nitrogenous soil improvement. The insufficiency of available data, however, prevents our making any final conclusions on this point, and the question must be left for the scientific research organizations of Central Asia.

FIBER LEGUMES (FOR SPINNING) The following group of fiber legumes deserves attention in the cotton crop rotation, as sources of textile fiber and also as nitrogen-fixing crops.

San is worthy of attention first of all among this group. The experiments in raising san in Central Asia at the Turkestan Selection Station have shown the great merits of its fiber and the slight sensitivity of this plant to low temperatures. Disadvantages of san are the very late maturity of its productive varieties, the very low productivity of its early varieties, and its tendency to excessive ramification when grown as a row crop.

Montana is undoubtedly superior to san. Its yield is good and its fiber contents very considerable. The quality of its fiber is only slightly inferior to that of san.

Of the other plants in this group, we may assume that kayanus and Spanish broom can be cultivated.

It would, however, be premature to recommend all of these enumerated plants for extensive cultivation in Central Asia. The disadvantages of san have already been mentioned. On the other hand it would be inexpedient to reject entirely these extremely interesting plants. But their propagation will depend upon the work of selection

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agencies in developing varieties with good yield and sufficiently high fiber content, under the conditions of the short growing season. In view of the lack of sufficient data on montana, kayanus and Spanish broom, serious study of these plants is desirable in any case.

FODDER ROOT CROPS AND TUBERS. The development of the beef and dairy cattle breeding industry to supply the cities and great industrial centers demands the organization of the corresponding fodder bases and, in particular, the cultivation of the fodder root crops and tubers. Among them, potatoes merit our attention in the northern parts and sweet potatoes in the southern parts of Central Asia. The latter give higher yields than potatoes. In addition, mangel-wurzels, carrots and rutabagas may also be grown.

These crops will be widely distributed in the dairy and market-garden zone around the cities and manufacturing centers. In regions unrelated to this zone their cultivation is limited, on land outside the zone of contiguous fields.

CUCURBIT CROPS of these, the muskmelon is extensively consumed by the population and deserves special attention. It can be canned and distributed not only within the USSR, but exported as well. Taking into account its colossal yield of 300 centners per hectare, muskmelon propagation cultivation in Central Asia appears entirely expedient, mainly on the land outside the contiguous field areas. Muskmelon can also be grown in the river valleys on soils with ground water level near the surface, and even in somewhat saline sections, where cotton growing would not be efficient without reclamation.

BOGARA FODDER CROPS. The development of cattle breeding and the necessity for assuring winter supplies of fodder for the cattle demand the maximum development on unirrigated bogara land not only of grain



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crops (wheat and barley) but a number of drought-resistant fodder plants.

The extreme dearth of data, in the published reports, concerning the bogara fodder crops of Central Asia makes it very difficult to decide how these crops should be made up in the future. But taking into account the fact that crop losses occur in both winter and spring, and that there are very prolonged summer droughts as well, a number of crops may be recommended, with a certain degree of caution, and mainly for semi-experimental trial on a pilot plant scale.

The rather successful experiments of the Krasniy Vodopad Experiment Station on bogara cultivation of alfalfa gives us the right to recommend that crop for the better parts of the bogara lands. The hybrid yellow-flowered and blue varieties are the best. Other fodder crops that can be recommended are Sudan grass, mogar, sorghum, particularly the black sorghum or Pennisetum typhoideum, which gives a higher yield and is more drought-resistant than ordinary sorghum. Seed peas and fodder peas are desirable, especially the winter crop on a semi-ecperimental scale. Other legumes here are kidney beans, tepari beans, lentils and vetchlings. In experimental work on safe gardening sites we may recommend potatoes or Jerusalem artichokes, and also squash, forage watermelons, horse beans, and sunflower for silage. Fodder watermelon is drought resistant and can also grow in less sheltered parts of the bogara lands. The propagation of mangelwurzels, carrots, and turnips (Brassica napus rapifera and Brassica campestris rapifera) is not impossible on the parts of the bogara land which are better provided with precipitation.

Chickpea, sweetclover, mountain spinach (lebeda), Astragalus retamocarpus and Brassica armoracioides may be recommended for semi-experimental work on bogara sites with poor precipitation. Besides



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such land on the Chirchik river and a few other places, which could be utilized for rice growing if large scale rice sovkhozes were organized. Southern Kazakstan should be considered the basic rice region.

THE LEGUMINOUS CROPS AND THEIR ROLE IN CROP ROTATION

The introduction of grassland rotations into the cotton regions should be considered one of the basic measures of the Second Five Year Plan. An increase of productivity ranging up to 30 percent may be expected in consequence.

The climatic and soil conditions of Central Asia favor the rapid disintegration of organic matter in the soil. For this reason the cultivation of row crops (cotton) without grassland rotation leads to destruction of the structure and cohesion of the soil, and thus to the lowering of biologic activity and nitrification of the soil; and the yield of cotton falls off rapidly. The following data may serve to illustrate this point. It is taken from the materials of the 1932 Cotton Conference in Moscow.

WEIGHT OF STRUCTURAL AGGREGATES IN 100 GRAMS OF SOIL

| Sequence of Crop Rotations | Over 1 millimeter | 1-0.25 millimeter | 0.25-0.1 millimeter | Under 0.1 millimeter |
|---|---|---|---|---|
| Cotton 1 year | 2.75 | 14.72 | 25.76 | 56.77 |
| Cotton 3 years | 1.00 | 7.92 | 20.55 | 70.53 |
| Cotton 5-6 years | 1.11 | 3.18 | 13.80 | 81.90 |
| Cotton with full mineral fertilizer: 2 years | 1.36 | 4.08 | 12.06 | 82.50 |
| 5 years | 0.77 | 1.48 | 11.36 | 86.39 |
| Cotton with cottonseed cake fertilizer and manure: | | | | |
| 2 years | 1.40 | 4.24 | 19.82 | 74.54 |
| 5 years | 2.20 | 10.25 | 25.57 | 61.68 |



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| | | | | |
|---|---|---|---|---|
| After the introduction of clover: 1 year | 4.42 | 18.37 | 33.10 | 44.11 |
| 3 years | 12.97 | 21.72 | 24.52 | 40.79 |
| Alfalfa | 10.27 | 20.04 | 30.68 | 39.48 |

Thus the introduction of organic material into the soil as a result of grass sowings sharply improves the cohesion of the soil, while the continuous cultivation of cotton, even with mineral fertilizer, lowers it.

The following table gives the characteristics of the dynamics of organic matter, as shown by the experiments of the Ak-Kavak experiment station, under different systems of cultivation. Taking the original quantity of organic matter in the soil as 100, this value changes as follows after cultivation:

| | |
|---|---|
| After introduction of fallow | 36 |
| After cultivation of cotton for 1 year | 88 |
| After cultivation of cotton for 2 years | 78 |
| After cultivation of cotton for 3 years | 60 |
| After cultivation of alfalfa for 2 years | 115 |
| After cultivation of alfalfa for 3 years | 125 |
| After cultivation of alfalfa for 4 years | 152 |

To illustrate the changes in productivity after different predecessor crops, we may give the following table showing the results of eight years of experiments by the Golodnosteppe Experimental Station:

| | |
|---|---|
| Original cotton crop on virgin land | 16.4 centners per hectare |
| After continuous cropping of cotton for 8 years | 8.2 |
| Cotton after proso millet | 9.0 |



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| | |
|---|---|
| Cotton after sesame | 9.0 |
| Cotton after sorghum | 10.3 |
| Cotton after bean Phaseolus mungo grown to seed | 12.3 |
| Cotton after winter wheat | 13.1 |
| Cotton after a green fertilizer (Phaseolus mungo), plowed under during the blooming period | 21.3 |

The role of grassland crop rotation in cotton growing thus becomes entirely clear. Without giving a large amount of other data on raising cotton productivity by this method, we pass now to the other crops of this group which are worthy of attention under the conditions of Central Asia.

ALFALFA According to data of the Pakhta-Aral Sovkhoz, the yield of cotton after alfalfa was increased as follows over the yield on virgin land:

| | 1929 Centners | Per cent | 1930 Centners | Per cent |
|---|---|---|---|---|
| On virgin land | 12.7 | 100 | 10.0 | 100 |
| After 1 year of alfalfa | 18.5 | 146 | 14.5 | 145 |
| After 2 years of alfalfa | 28.7 | 226 | 18.2 | 181 |
| After 3 years of alfalfa | 30.8 | 243 | 20.8 | 208 |

If we also consider that alfalfa holds its own very well against salinification of the soil and gives large hay harvests with high protein content, the advisability of introducing it into crop rotation with cotton becomes obvious. Moreover it is a perennial which may give harvests from a single sowing for as long as ten years. The ordinary local varieties of alfalfa grow poorly during the first year and the sites become overgrown with weeds. It is therefore ne-

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cessary first of all to choose suitable shorter-lived (2-3 years) varieties for rotation with cotton, but with good growing power already in the first year.

Turning to the experimental data, the Arabian varieties of alfalfa may be indicated. These gave the best results in productivity, early maturation, foliation, number of stalks, and rate of spring growth; they also displayed relative winter-resistibility. These experiments are still insufficient and should be extended, the more so since these Arabian varieties, along with their good qualities, are somewhat inferior in winter-resistibility and other factors to our own alfalfas. This forces us to emphasize the necessity of energetic selection work to develop the most productive short-lived varieties of alfalfa. Entomological work is also necessary to develop rational control measures against the phytomyces which cause colossal losses to the first alfalfa mowing. /Phytomonas ?/

A. I. Belov recommends the following varieties of alfalfa under Central Asian conditions: for Fergana, Golodnaya Steppe, and the Samarkand and Bukhara regions: French alfalfa (of Provence); for Turkmenia: Arabian alfalfa; in the Khiva oasis: Grimm's alfalfa, which is higher yielding and more winter-resistant than the Khivinsk varieties.

With respect to seed alfalfa, the author of this work also advises stopping the distribution of the Khiva variety throughout Central Asia and substituting more productive varieties, and points out that the various groups of European varieties have given better results than those of Central Asia.

The Khiva oasis should remain a region growing seed for shipment to other parts of the USSR, but the current local variety de-

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this, we also recommend gathering the wild alhagi, which is excellent as a concentrated fodder when ground into flour at the mill, and may also be used for silage. The wide distribution of this plant even under the most extreme unprotected bogara conditions, and the discovery of species without spines, brings up the question of cultivating it as well as using it in its wild state.

On the sandy desert regions of Central Asia, used only for cattle grazing, the cultivation of drought-resistant and alkali-resistant grasses is a major problem, for they are needed to anchor the sands and cover the takyry, and in addition they yield satisfactory masses of nutritious forage. This question is still entirely unstudied. For semi-experimental work we may recommend Siberian zhitnyak, sand barley, sand oat, sand brittle rye, and, for the takyry, chiy grass (Lasiagrostis), sedge, sweetclover, alhagi and lebeda, etc.

## XXV. THE UZBEK SSR

The total area of the Uzbek SSR is 17,600,000 hectares. Within the administrative boundaries of this republic we have chiefly lowland plain, valley and foothill sections, with elevations ranging from 100 to 700 meters above sea level. It is true that almost all of these sections are related in origin to the high mountains surrounding them. These are, however, located within the administrative boundaries of the neighboring Central Asian Republics -- the Tadzhik SSR, the Kirgiz SSR and part of the Kazak SSR. Only at the extreme southern border of Uzbekistan do the western spurs of the Gissar and Zeravshan ranges enter its territory, and, to the east of Tashkent, also the western spurs of the T'ien Shan Mountains. The highest points of these spurs are not over 3500 meters, while the mountains of the adjoining Republics reach elevations of 4500 meters and higher.



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The link between the plain and valley tracts of Uzbekistan and the adjoining mountains is seen, in the first place, in the origin of their alluvial deposits. These consist almost entirely of material transported from the mountains by numerous permanent or intermittent streams.

The nature of the deposits on the Uzbekistan plains varies greatly, depending upon the distance of the mountains and the character of the streams. We encounter all stages from the very coarse stony rain-transported deposits down to the fine dusty loam loess formations. In many of the great river valleys there are extensive alluvial deposits of variegated character. The variety of these deposits is increased still more by the fact that not infrequently there is marked development of tertiary and tertiary-cretaceous saliferous clays and argillaceous loams in the belt of low foothills surrounding the great valleys, and that these clays and loams are readily washed down by rain currents, which occasionally transport them substantial distances from their places of original deposition.

The connection between the plain and valley sections of Uzbekistan and the surrounding mountains of the neighboring republics is further seen in the fact that a very substantial portion of these lowland areas is fed by water formed as a result of condensation by these mountains. To some extent this is apparent in the higher amount of precipitation in some foothill areas, as compared with that in localities more remote from the mountains. But a far more substantial contribution to the water balance of Uzbekistan is made by the direct flow of water from the adjoining mountains. This flow often is subterranean, through strata which gradually filter off some of the transported material. These ground waters then emerge to the surface in the lowlands, determining the formation of very



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considerable areas of meadow, swamp or lightly saline lands. Frequently, too, they form small lakes or spring-fed rivulets. But the greater part of the water irrigating the fields of Uzbekistan descends in rivers and streams on the surface from the neighboring mountains.

Almost all the territory of Uzbekistan is located in two zones, a desert zone and a desert-steppe (semi-desert) zone. Only the higher parts of the mountain slopes are outside thelimits of these two zones.

The more low-lying parts of the plains and great valleys of Uzbekistan, more remote from the high mountains, belong to the desert zone, which includes the whole western part of the Republic from Shirabad and Karshidown to Bukhara and Khorezm, together with the larger part of the Golodnaya Steppe and Inner Fergana.

According to temperature conditions during the growing season, these parts of the Uzbek Republic belong in part to the torrid belt of Shirabad, Karshi, and Bukhara, and in part to the hot belt of Khorezm, Golodnaya Steppe, and Fergana. Mean summer temperatures in the torrid belt are 28-30 degrees, and 25-28 degrees in the hot belt. In the torrid belt it is possible to grow the late varieties of cotton, including even Egyptian cotton. In the hot belt the medium-late varieties of cotton are grown, together with a number of other valuable industrial and food crops.

The annual precipitation throughout the desert belt does not exceed 200-250 millimeters. Since evaporation is very intense, this completely excludes any possibility of unirrigated agriculture, except for isolated instances of cultivation on swamp-meadow soils with fresh ground waters close to the surface.



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The soils of the desert belt of Uzbekistan are very varied, depending upon the character of the depositions and on the dynamics of the ground waters. On the one hand, desert serozems [gray-earth soils] in a number of different forms are widespread. These are shown on the soil map as light serozems underlain by loess-type rock, gravelly serozems, saline and gypseous serozems, principally composed of pebbles and gravel, and sandy serozems, as well as the compact silty soils of the takyry, in various stages of salinification. All these soils are characterized by the great depth of the underlying ground water, and for the most part are suitable for cultivation under irrigation. On the pebbly-gravelly soil types, however, cultivation is often made difficult or even impossible by the difficulty of tilling the soil and the rapid loss of irrigation water by filtration, and in a few cases by the impossibility of irrigation owing to topographic considerations. Because of the great tendency to salinification shown by certain types of desert serozems, the rate of irrigation must be strictly regulated and the proper outlet channels provided for the discharge of used waters.

The second category of soils in the desert zone is found in localities with ground water near the surface. These are widely distributed in many regions of Uzbekistan, particularly along the valley of the Syr-Dar'ya river and its tributaries, also along the Zeravshan and Kashka-Dar'ya rivers, and to a somewhat lesser extent along the Amu-Dar'ya River. They are shown on the soil map as salinified deposits and meadow soils on the river floodplains, meadow carbonaceous and salinified soils, and solonchaks. In many of these cases these are sections that could be used only for growing rice, since their assimilation for other crops, particularly cotton, would

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involve extensive reclamation work in drainage and river control. Cultivation is, moreover, often seriously hampered by the strong salinification of the soil by easily soluble salts. This is particularly true of the solonckaks, but we also encounter it not infrequently in the meadow soils of the first two classes.

The task of reclaiming the solonchaks for agricultural purposes is of course not an absolutely hopeless matter. The removal of the salts can be accomplished with the aid of rice cultivation combined with the abundant watering of the soil which this crop requires. On the other hand, special flushing of the soil is also possible with the aid of artificial drainage by pipes or California drains. However, there are still a good many unclarified questions regarding both the nature of the processes which take place during these soil changes and the technical engineering aspects of the work.

We should note, in conclusion, that there are large tracts of sand spread over this desert zone of Uzbekistan, and that these sands are in most cases completely unsuitable for agriculture.

The desert-steppe zone occupies a considerably smaller part of Uzbekistan. To it belong the higher parts of some valleys and plains immediately adjoining the high mountains, together with a belt of low foothills. The latter takes in the higher border areas of the Fergana valley, the foothills of the Turkestan and Gissar mountain ranges, the foothills of the Western T'ien Shan, etc. Temperature conditions during the growing season show a moderately hot belt with average summer temperatures around 20 - 25 degrees. This provides to some extent for cultivation of early varieties of cotton and also of rice, corn, alfalfa, grapes, apricots, etc.

Precipitation in the desert-steppe belt is 250 to 400 millimeters. This is enough to assure the possibility of growing a few



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crops without artificial irrigation, although irrigation in all cases results in still higher efficiency. Grains -- wheat and barley -- should be the most important of unirrigated bogara crops. In some cases safflower, corn, sunflower, alfalfa and a few other crops may also be grown as bogara crops. The matter of bogara cultivation of cotton in this zone still awaits clarification of the technical possibility and economic expedience.

The soils of this zone are predominantly typical serozems. In view of the insufficiently clear distinction between the desert varieties of serozems and typical serozems, it is necessary to include in this zone a few localities designated on the soil map as having soil varieties which we have classified as belonging to the preceding desert zone -- for example, the high border areas of the southern part of the Fergana valley, Dzhizak and its environs, the localities to the south of the city Samarkand, the higher parts of the Karshi steppe, and so forth.

The salinification of the soil in the desert-steppe zone is already of no particular importance. But the character of the topography and the amount of stone and coarse gravel in the soil are factors of the most vital importance here, and ought to be studied for sections with irrigation as well as in estimating the possibilities of bogara cultivation.

In some river valleys of the desert-steppe zone, meadow-bog soils with ground water near the surface play an important part. In contrast to the meadow and bog soils of the same valleys in the desert zone, these soils contain almost no easily-soluble salts and are entirely suitable for growing rice or other crops.

The mountain slopes located above the upper boundaries of the



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desert-steppe zones belong partly to the steppe zone and partly to the subalpine or even alpine zones. In the first of these zones, chestnut soils predominate, with chernozems less common. With favorable topographic conditions and no large amounts of gravel, these soils may be used for cultivation of wheat and barley. In the subalpine and alpine zones, agricultural cultivation is already impossible. In these areas only summer grazing of cattle may be carried on.

In view of the small extent of these zones within Uzbekistan, we shall not stay long on them. They will be characterized in greater detail when we describe the land resources of the neighboring mountain republics, principally the Tadzhik SSR.

The natural conditions we have indicated above determine that the specialization of field agriculture in Uzbekistan will proceed along two main lines. On irrigated lands, the leading crop in all districts is cotton, from the moderately early to the late varieties, including the Egyptian. Egyptian cotton in ordinary field cultivation can ripen to the south of Bukhara, but in the more northern and eastern regions this is only possible by using transplantation and with preliminary preparation, putting the seedlings in a hotbed. With the maximum cotton sowing 60-70 percent of the irrigated land, cotton should be rotated with grasses, chiefly with alfalfa.

The secondary crops on the irrigated land will be rice, kenaf and kendyr -- on the river floodplains with ground water level near the surface -- and to some extent the essential oil crops, peanuts, and corn. In the southern regions ramie, guayule and other subtropical crops are in the stage of experimental development.

On the bogara parts of the low and intermediate foothills the



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primary crops are the grains -- wheat and barley; supplementary crops are the oil crops -- curly flax, safflower and [redacted] sesame -- and also the essential oil crops, and, to some extent, cotton, corn and fodder plants.

We pass now to the consideration of crops by individual districts.

XXV (I) Fergana Rayon embraces all sections within the former Fergana and Andizhan Okrugs. It represents in topography a closed-off valley, surrounded by mountains on the north, east and south.

The soils of the region are diverse. Meadow carbonaceous and salinified soils, with sands in places, occupy the center of the valley along the Syr-Dar'ya river and its tributaries. To the north and south of this central section, which is the lowest section, the soils are arranged in belts. The first belt is one of [redacted] solonetz gypseous serozems for the most part rubbly and pebbly-gravelly. The next belt is one of typical serozems. Finally, in the foothills and the mountainous parts of the valley, chestnut soils, mountain solonchak soils and chernozems are found.

Between Kokand and Andizhan, and to their north, is a wide sandy belt surrounded by solonchaks.

The following data characterize the climate of the region. The total temperature above 10 degrees for the growing season is 4300-4725 degrees, with a frost-free period of 210-226 days and annual precipitation 170-210 millimeters.

Namangan is distinguished to a certain extent by higher temperatures and a higher total temperature during the growing season -- these due to the fact that the growing season is longer.

The region may be considered relatively well supplied with water.



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Favorable climatic, soil and water conditions make the Fergana valley a leading cotton growing region. Cotton has already gained the position of the primary crop here. The crops to be assigned to the irrigated lands in this region will be as follows:

Industrial crops: basic-- cotton; the group of medium-late varieties of the Navrotskiy type.

Nitrogenous soil-enriching crops: winter peas, winter hairy vetches, and spring fenugreek (experimentally).

The grains should be entirely shifted to bogara land.

Forage crops: alfalfa basic, Alexandrian clover and shabdar (Persian clover) supplementary.

On the land outside the contiguous field areas: kitchen gardening, cucurbit, and mulberry bush plantations.

The bogara area of the region is insignificant, inasmuch as the bogara belt that rings the Fergana valley belongs to the Kirgiz ASSR. Of industrial crops, safflower for bogara land; of grain crops, spring wheat and barley.

XXV (2) Zeravshan region includes the following parts of the former Samarkand Okrug: the southern parts of the Mitanskiy, Pay-aryksiy and Akdar'inskiy Rayons, the northern parts of the Ikramovskiy, the Yukary-Dargomskiy Rayon and Urgutskiy Rayons, and the southwestern part of the Bulungurskiy Rayon; and these parts of the former Zeravshan Okrug: the Kermenskiy Rayon, the southern part of the Khatyrchinskiy Rayon, the Narpayskiy, Karadar'inskiy and Katta-kurganskiy Rayons; and all the Rayons of the former Bukhara Okrug.

Along the floodplain of the Zeravshan river are found salinified depositions and meadow soils, beginning from the place where the river divides into two branches and extending almost to the end of the floodplain.



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Solonetz and gypsiferous serozems, for the most part rubbly or pebbly-gravelly, extend south of the Zeravshan.

To the north of Bukhara sandy serozems are widespread; to the south of Bukhara, on the side of the Kashka-Dar'ya River, the silty salinified, compact soils of the takyry.

With respect to its agriculturally significant climatic elements the region is divided into two subregions: (a) Bukhara, including all the regions of the former Bukhara Ijrug as far as Katta-Kurgan; (b) Samarkand, including all the remaining regions above Katta-Kurgan.

The total temperature during the growing season is 4160 degrees in the Samarkand subregion, with a frost-free period of 170-200 days and annual precipitation of 280-300 millimeters.

The total temperature during the growing season is about 5000 degrees in the Bukhara subregion, with a frost-fr ee period of 230 days and annual precipitation of 135 millimeters.

So we see that the Bukhara subregion is hotter, with a longer growing season and very limited precipitation. Because of this it is more favorable for irrigated cotton cultivation than the Samarkand subregion.

XXV (2a) The Samarkand subregion on its irrigated lands is in a cotton growing region, with the exception of the vineyard, orchard and kitchen-garden zones around Samarkand (the Yukary-Dargomskiy and Urgutskiy Rayons), and the Katta-Kurgunskiy Rayon, a sheepraising and bogara grain area.

The basic crop in the Samarkand subregion is medium-early cotton of the type of the "182" varieties and of the medium-late Navrotskiy type.

Supplementary crops: essential oil crops: tuberose, lipiya



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[redacted], iris, catnip, basil, and Turkish tobacco.

The grain crops should be displaced from irrigated land and industrial crops substituted, with an increase in water supply. Rice may remain for the time being in the northern parts on soils where other crops are impossible or inefficient.

Secondary crops: alfalfa for seed.

Soil-enriching crops: peas and winter hairy vetch.

Fodder crops: alfalfa, supplemented for pilot plant experimental work by Alexandrian clover and shabdar.

On the land outside the contiguous field areas: cucurbit, kitchen-gardening, and mulberry bush plantations, leguminous oil crops and dzhugar.

XXV (2b) Bukhara subregion, which, as has already been indicated, is climatically more favorable for cotton, but has an inferior water supply.

The basic crop is cotton of varieties of the medium-late Navrotskiy type and Upper Egyptian varieties.

Soil-enriching crops: winter peas, winter hairy vetch, fenugreek (on an experimental scale), and Trigonella Foenum graecum from Yemen, which matures in 60 days.

Grain crops should be entirely displaced.

Fodder crops: alfalfa basic; Alexandrian clover and shabdar secondary.

On land outside the areas of contiguous fields: cucurbit, kitchen gardening, legumes, oil crop, and mulberry bush plantations, dzhugar.

XXV (3) Kashka-Dar'ya region, including the Kassanskiy, Bashkentskiy, Chirakchinskiy and Guzarskiy Rayons, and the western parts of Shakhriziyabskiy and Yakobakskiy Rayons.



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Its soil conditions are characterized by salinified alluvial deposits and meadow soils in the floodplain of the Kashka-Dar'ya River. Silty-salinified and compact soils of the takyry predominate along the railroad from the N. Bukhara station on the northeast as far as Karshi and Guzar. The Karnay-Chul steppe is occupied by sandy serozems. The region of Shakhrizyabsa and Kitab to the south west of Guzar represents serozems becoming gypseous, gravelly serozem varieties in the foothills of the Gisar range.

It is a region of bogara cultivation of poor moisture supply with some irrigated cultivation along the Kashka-Dar'ya and Guzar rivers. The irrigated agriculture is poorly supplied with water. Cotton is therefore the main crop in the upper reaches of these river systems, while winter grains predominate in the downstream sections. A great expansion of cotton sowings in this region, replacing grains, would be made possible by construction of reservoirs in the upper reaches of the Kashka-Dar'ya.

The basic crop is cotton of the group of medium-late varieties of the Navrotskiy type and of the Upper Egyptian variety.

Soil-enriching crops: winter peas, winter hairy vetches, and spring fenugreek (experimentally).

Fodder crops: alfalfa; secondary crops -- shabdar and Alexandrian clover.

On land outside the areas of contiguous fields: cucurbit, kitchen gardening, and mulberry bush plantations.

XXV (4) Tashkent region, includes all rayons of the former Tashkent Okrug.

Meadow carbonaceous unsalinified soils are widely distributed along the Chirchika River from Tashkent to the Syr-Dar'ya River, and on the right side of the Syr-Dar'ya in the Angren downstream areas.



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On the left side of the Syr-Dar'ya in the Mirzachul' region and in the north serozems, frequently salinified, are predominant. The foothills and mountains of the Pskent and Chatkal' ranges are chestnut soil and chernozem areas.

The Tashkent region may be divided into two climatic subregions: (a) the Tashkent subregion, with the total temperature of over 10 degrees during the growing season 4100-4400 degrees, the frost-free period 180-205 days, and annual precipitation about 350 millimeters; (b) the Mirzachul' subregion, with total temperature of the growing season 4528 degrees, the frost-free period 200 days and annual precipitation 230 millimeters.

The whole of the region is a cotton-growing area, except for the zone of orchard, vineyard and market-gardening around Tashkent city.

Of the medium late cottons, Navrotskiy is the basic variety for this region; topography and the ground water level must always be taken into account.

The medium-late varieties may be recommended for early sowings on dry, warm soils.

With the ground water level near the surface and in the more northerly parts of the region, "169" or "182" are preferable.

The allocation of crops on the irrigated lands of the region is as follows:

Industrial crops: Basic-- cotton, medium-late Navrotskiy type; the medium-early type "182" for the northern sections. Supplementary crops: kendyr and kenaf on the floodplain of the Chirchik with sufficient water supply.

Essential oil crops: tuberose, lipiya, iris, lavender (in the mountains) basil, catnip. Turkish tobacco in the Tashkent region.



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Soil-enriching crops: peas and winter hairy vetch.

Grain crops should be replaced by cotton and entirely shifted to the bogara lands, except for rice, which will continue to be grown along the Chirchik River, where there is an abundance of water and of water-logged heavy clay soils on which cotton growing would not be sufficiently profitable without extensive reclamation work.

Fodder crops: Alfalfa, supplemented by Alexandrian clover.

For land outside the contiguous field sections: cucurbits, kitchen gardening, oil plant, leguminous plant, mulberry bush plantations.

The bogara part of the region occupies an area of 430,000 hectares, of which 60,000 are well provided with moisture and 370,000 poorly. The distribution of bogara crops is as follows:

Cotton in the upper part of the bogara area (^) moderately well provided with moisture in the belt approximately between 1500 and 3000 feet above sea level. Navrotskiy variety.

Legumes: chickpeas and peas in the belt of the bogara well provided with moisture.

Oil crops: sesame on both the well and poorly watered bogara; sowings at higher elevations are desirable in view of its early maturity. Seed flax on well watered bogara, safflower on poorly watered bogara, Muscatel, sage and lavender in the mountains.

Grain crops: winter and spring wheat, winter and spring barley, with an expansion of winter sowing.

Fodder crops: alfalfa on well watered bogara, and also, on a semi-experimental scale, all of the crops indicated for Outer Pamir-Alay (see below).



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XXV (5) Khorezm Region, including all the rayons of the Khorezm Okrug. It represents an oasis in the lower reaches of the Amu-Dar'ya river, and is bounded on the west by the sands of the Kzyl-Kum, and on the south and east by the sands of the Kara-Kum.

Solonetz and solonchak serozems predominate, underlain by the alluvial deposits of the Amu-Dar'ya and often being of silty-saline and compact takyry character.

Cultivation is exclusively under irrigation, and the unregulated water inflow into the heads of the canals frequently results in water shortage.

The total temperature during the drowing season is 4380 degress, with a frost-free period of 200 days and very insignificant precipitation, less than 100 millimeters per year.

Cotton is the basic crop of the region, with the medium-late varieties being grown. However, in view of the difficulties of transportation, cultivation of the food crops will to some extent also be continued.

Industrial crops: basic - medium-late, Navrotskiy type varieties of cotton, with "169" for the northern sections; supplementary - alfalfa for seed, and Indian hemp and kenaf on the floodplain of the Amu-Dar'ya.

Soil-enriching crops: peas and winter hairy vetch; in crop rotation with grains, as second-crops: Phaseolus mungo beans, lobelia and vetchling.

Grain crops should be displaced, but cultivation of winter barley and wheat may be continued in view of the difficulty of importing cereals from outside.

Forage crops: alfalfa.

On land outside the contiguous field sections: kitchen garden-



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ing, cucurbits, leguminous and oil plants; dzhugar; mulberry bush plantations.

XXV (6) Outer Pamir-Alay region, located on the west of the Istarevshan vilayet of the Tadzhik SSR. It embraces the following rayons of the former Samarkand Okrug: Zaaminskiy, Dzhizakskiy, Yangi-Kurganskiy, Pay-Arykskiy (northern part), Mitanskiy (northern part), Nuratinskiy, Khatyrchinskiy (northern part).

The agriculture of the region is mostly bogara, while irrigated cultivation is found along the valleys of the scantily flowing rivers and brooks. The irrigated lands also include some intermittently watered lands, on the small valleys and in the "say" with intermittent flow. These rivulets dry up completely during the summer or dwindle to a mere trickle which no longer represents a source of irrigation water. Under such conditions, the possible crops are mainly winter grains, alfalfa and sesame. Cotton is seldom encountered and is liable to dry out during the blooming and bearing periods.

The soils of the region change as the altitude increases. In the lower sections, typical serozems predominate. In the more elevated parts there are desert-steppe serozems, chestnut soils and chernozems, with stony locations prevalent in the mountains. Along the mountain ridges to the southeast of Nur-Ata the surface is stony and extremely gravelly soils of various types predominate, while further south of Nur-Ata the prevailing soils are saline and gypsiferous serozems, for the most part pebbly-gravelly, becoming sandy serozems towards the north.

As regards climate and agriculture, the region must be divided into two subregions: (a) a lower subregion around Dzhizak; and (b) a higher subregion in the foothills. In the lower subregion the total temperature during the growing season is 4700 degrees, with a



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frost-free period of 220 days and annual precipitation 430 millimeters. In the higher subregion (the remaining districts) the climate is characterized by lower temperatures and a shorter growing season as compared with those at Dzhizak, with an annual precipitation of 400-450 millimeters, rising in some parts of the mountains to as much as 600 millimeters.

The climate of the lower subregion is thus more favorable for cotton than that of the Samarkand subregion, but somewhat inferior to that of Bukhara. The medium-late Navrotskiy type varieties of cotton therefore give good yields in the Dzhizak region, while the medium early varieties of the "182" type may find a place in the higher subregion, while the early type 1306 may be grown on the intermittently watered lands.

But before giving the regional distribution and specialization of crops and varieties, we must pause to dwell on the water supply of the region, which exercises a decisive influence on the distribution of crops.

The Dzhizakskiy and Yangi-Kurganskiy Rayons are irrigated with the waters of the Sanzat River and the Iski-Tyuya Tartara, which empties into the Sanzar. The Dzhizakskiy Rayon is located at the end of the Sanzar system, while the Yangi-Kurganskiy Rayon lies at its head. To reach Dzhizak, the waters of the Sanzar must flow through so long a course that large amounts of water are wasted in evaporation, and hardly half of the original volume finally arrives at Dzhizak.

The development of cotton cultivation [redacted] in the Dzhizak Rayon is thus impeded by the insufficiency of the water supply, though climatic conditions are good for this crop. The expansion of cotton sowings in the Yangi-Kurganskiy Rayon, by supplanting the grain crops even more, greatly hinders the expansion of cotton growing in Dzhizak.



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Therefore the allocation of crops to these two Rayons depends on the degree to which their water supplies are assured.

Simultaneous expansion of cotton sowings in both Rayons would be entirely possible if water supply in the whole river system were assured. But pending solution of the question of increasing the water supply throughout the Sanzar system, we give the preference for cotton growing to the Dzhizak Tayon, due to its better natural conditions. The agriculture of the Rayon will therefore move generally towards cotton growing, while the remaining regions will grow grains, with cotton to a greater or lesser degree as a subsidiary crop on the irrigated lands, with the following rotation of crops: winter grain; second-crop for nitrification; and cotton in the following year.

The allocation of crops to the irrigated part of the Dzhizak subregion will be as follows:

Industrial crops(with a better water supply) - cotton of medium-late Navritskiy type.

Grains - should be supplanted by other crops as the water supply is improved.

Fodder crops: basic crop, alfalfa; secondary crops, shabdar and Alexandrian clover.

Nitrifying crops: winter peas and winter hairy vetches.

In the upper sections along the Sanzar River:

Industrial crops - cotton of the type 182 medium-early varieties.

Grain crops: winter barley and winter wheat (until an entirely adequate water supply is assured).

Forage crop: alfalfa.

Nitrifying crops: the bean, Phaseolus mungo, lobelia, vetchling, etc.



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On the land outside the sections of contiguous fields: kitchen gardening, cucurbit, and mulberry bush plantation.

The bogara part of Outer Pamir-Alay Rayon occupies a very considerable area. It includes a continuous area of 174,000 hectares of well-watered bogara, and 561,000 hectares of poorly watered bogara. Precipitation here is the highest in all of Uzbekistan. The average annual precipitation in Dzhizak over a 10 year period was 430 millimeters, with precipitation in individual years as high as 657 millimeters. Not only grains but a number of industrial crops, bogara cotton being the most important, can be successfully grown here.

Thus while maintaining the basic grain orientation of bogara cultivation, so that the cotton regions may be partially supplied with cereals, cotton and the oil crops may be given a secondary role here. In sum, the list of crop allocations to bogara lands will be as follows:

Industrial crops: Basic - cotton, to occupy the upper part of the moderately well-watered bogara and the lower part of the well-watered bogara, or roughly in the 1500-3000 foot altitude zone. Navrotskiy variety,

Oil crops - sesame on well watered and poorly watered bogara; seed flax, chickpeas and safflower on poorly watered bogara. The latter is one of the most drought-resistant plants under Central Asian conditions.

Finally, tau-sagyz and muscatel sage may also be grown on poorly watered bogara.

Grain crops - the basic grain crops are winter wheat and barley, and spring wheat and barley. Sowing in spring is customary; but efforts should be made to expand winter sowings. This will assure better harvests and make it possible to relieve the spring sowing period of some of the field work by transferring it to the autumn.

As regards the varieties of wheat and barley, the results of 2-3 year experiments showed that the European varieties were not suitable. The local varieties proved superior to the latter under all test conditions, and among the local varieties those developed by the Katta-Kurgan Experimental Station and those resulting from mass selections from the local wheats and barleys gave the best results.

Fodder crops: alfalfa on the well-watered areas of the bogara.

The following may



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be grown on a semi-experimental basis in the moisture-provided bogar: vetchling, pea, Sudan grass, mogar, sorghum or Penisetum typhoideum, kidney bean - tepari, lentil, vetch, proso millet, potato or Jerusalem artichoke, squash, water melon, cactus, Brassica armoracioides, Astragalus retamocarpus, sweetclover, mountain spinach.

XXV7 The Southern Pamir-Alay region, located west of the line Pendzhikent-Sangardak. It includes the southern parts of the Urgutskiy and former Dargomskiy Rayons in the former Samarkand Okrug; the eastern parts of Shakhriziabskiy and Yakobagskiy rayons, and Tengi-Kharamskiy Rayon, in Kashka-dar'ya Okrug; and Baysunskiy Rayon and the northern part of Sary-Asiyskiy Rayon in Surkhan-dar'ya Okrug. These are mostly the foothill sections of these rayons.

The soils of the sections adjoining the mountains are serozems, chestnut soils, chernozens and mountain solonchaks. Solonetz and gypsiferous serozems, for the most part detrital or pebble-gravelly, predominate in Southern Baysun, Yurchi and Sary-Asiya, with light serozems in the region of Shakhriziabas and Kitab.

The climate of the region has not been studied, but it apparently resembles that of the elevated part of Outer Pamir-Alay, except that it has higher temperatures.

In allocating crops and varieties, on the whole, the same distribution may serve here as for the preceding region ( Outer Pamir Alay ) with the addition of type 182 of medium-early-maturing cotton for the irrigated part. Shakhriziabskiy Rayon is distinguished as an area of orchard and vineyard. The bogar lands are included in the non-moisture-provided belt, and thus cotton growing is more limited. Of the other crops, all those noted for the non-moisture-provided bogar of Outer Pamir-Alay may also be grown here.

Southern Pamir-Alay passes over on the south into the so-called





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Bukhara Pyatirech'ye (Five River Zone), which represents a special region of the dry subtropics to which the valleys of Surkhan and Shirabad, in Uzbekistan, belong. In view of the fact that the greater part of the Pyatirech'ye is included in the Tadzhik SSR, the description of this region will be deferred until later in this work (see XXVII$_1$).

XXV8 Kenimekhskiy Rayon, which is located to the northwest of Kermina station. It is a sheep-raising region, but has about 7000 hectares of irrigated land, used mainly for growing grain and cotton.

The soils are serozems, frequently saline and passing over into the compact soils of the takyr, and also into sands.

The Rayon is scantily supplied with water, and it would be entirely correct to regard it as a region for forage crops to supply the sheepraising industry (astrakhan) (caracul).

The principal crops are alfalfa, clover (Trifolium resupinatum), Alexandrian clover. The secondary crops are grains.

## XXVI. THE TURKMEN SSR.

The total estimated area of Turkmen SSR is 49,100,000 hectares. Almost all of this territory is situated within the Turanian lowlands and has an elevation not greater than 200 meters above sea level. Isolated sections of the lowlands are even considerably below sea level. Thus, for instance, the coastal region along the shores of the Caspian Sea is as low as 26 meters below sea level. In the interior of the country there are even more remarkable land-locked waterless depressions. Such is the Saryka-mysh depression at an elevation of minus 39 meters, the depression on the Ishek-Ankren Plateau, at an elevation of minus 50 meters, and so on.

Only along the southern border of Turkmenia does the Turkmeno-Khorosan mountain system stretch from northwest to southeast, and even





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these mountains are located for the most part in Persia. The highest points of these mountains within the confines of the Turkmenian Kopetdag do not exceed an altitude of 2000-2300 meters, while on the Persian side of the frontier they reach 3000 meters. On the extreme southeast, within the boundaries of Turkmenia, are the low Karabil' and Badkhyz highlands, which form the foothills of the Afghan Paropamiz. The altitude of these highlands is not over 950 meters.

By virtue of its geographical location and its low altitude above sea level, the greater part of Turkmenia lies within the desert zone. In the summer months it is one of the hottest areas in our whole Union. The average July temperature is 28-32 degrees, while the maxima during the same month not infrequently reach 46 degrees in the shade, and even 50-60 degrees in the sun. The aggregate temperature during the growing season (from the times that the temperature reaches 10 degrees) is 5000-5300 degrees. The growing period is of outstanding length. The number of days with an average diurnal temperature over 20 degrees ranges from 130 to 160, while there are about 200 days with an average diurnal temperature over 14 degrees. The frost-free period is 206-240 days. Winter is relatively mild, though temperatures down to minus 20 degrees and even as low as minus 26 degrees are sometimes reached.

These temperature conditions which prevail over most of Turkmenia exclude the possibility of cultivating the subtropical perennials, which cannot withstand the winter cold. Only in the Atrekskiy Rayon and in some parts around Kerkov is the winter milder, especially in the former case, under the moderating influence of the Caspian Sea. But the long, hot growing period everywhere in the Republic allows the cultivation of the most valuable subtropical annuals, and particularly of the high-yield late-maturing cottons, up to and including the Egyptian long-fiber varieties.

In no part of the whole desert zone of Turkmenia does the annual





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precipitation exceed 230 millimeters, and in most cases it ranges between 100 and 150 millimeters. Precipitation falls exclusively in the cold half of the year. This makes agriculture possible only under artificial irrigation. The sources of water at the disposal of Turkmenia for the irrigation of its lands would be sufficient to supply several million hectares. Its principal source is the Amu-Dar'ya river, which takes its source far from the boundaries of Turkmenia in the snowy mountains of the Pamir and the Hindu Kush.

The utilization of the waters of the Amu-Dar'ya for irrigation is hampered by the circumstance that the course of this river inside Turkmenia runs through the wide sandy desert of Kara Kum, where the soils are little suited or entirely unsuited for agriculture because of their extremely loose texture, and very great permeability to water. Only a narrow shore belt, one kilometer to a few kilometers wide, shows the presence of spongy, compact, salted alluvial deposits from the river. These deposits are covered by meadow or meadow-solonchak soils; (takyr and takyr-type) serozems (gray earths); the greater part of which are suitable for irrigation and cotton growing. There have been recent attempts to discharge a portion of the Amu-Dar'ya waters onto the sands to convert them into silt and irrigate extensive reaches of the depressions in southeastern Karakum along the so-called Kelif (Caliph) Uzboy. The problem of a Trans-Karakum canal to carry Amu-Dar'ya waters into the Murgab, Tedzhen and Ashkhabad regions is very complex and difficult to solve, in the sense of accomplishing such a project.

On the lower reaches of the Amu-Dar'ya there are considerable tracts of land which would be suitable for irrigation by its waters. The extensive ancient delta of this river is made up of stratified alluvial deposits, which are covered by primitive-takyr-type serozems and meadow solonchaks. However, the greater part of the Amu-Dar'ya delta is situated within Uzbekistan and the Karakalpak Republic. Nevertheless,



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a considerable area of irrigable lands in this region still falls to the share of Turkmenistan. Great perspectives are opened up by the project now being worked out for the Kunya-Dar'ya irrigation works, the realization of which could result in providing up to a million hectares of new irrigated lands.

Besides the Amu-Dar'ya, there are two other less important rivers which cut their final path through the sandy wastes of Kara-Kum; the Murgab and Tedzhen, both of which rise outside the borders of Turkmenia, in the mountains of Persia and Afghanistan. The alluvial deposits of these rivers among the sands have formed extensive delta plains, covered by carbonate meadow soils, primitive takyr-type serozems and solonchaks. The area of lands suitable for irrigation along the Murgab river reaches 840,000 hectares. But the Murgab river itself can only irrigate 70,000 to 100,000 hectares. In the Tedzhen oasis the shortage of water is even more extreme. The area of land suitable for cultivation here is estimated at hundreds of thousands of hectares, while the volume of river water for irrigation would only be enough for some tens of thousands. The most critical situation develops during the period of the second and third irrigations. Therefore the construction of reservoirs on these two rivers to store up the winter and spring waters that unproductively pour away is a pressing current problem.

All the rest of the Kara Kum desert, which occupies at least nine-tenths of all Turkmenia, is a waterless waste, with soils unsuitable for irrigation. Nevertheless it is not a completely dead territory. The sands are covered with rich and variegated shrub and grass vegetation and are used as pasture grounds for sheep and camels, Astrakhan (Caracul). Sheep-raising, which is well supplied with native forages, is greatly developed, particularly in the southeastern parts of the Kara Kum and on the adjoining highlands of Karabil' and Badkhyz.





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Between the northern slope of the Kopetdag mountains and the sandy desert of the Karakum, there is an uninterrupted belt of mountain-base plain tilting to the north. The width of this plain is 20-30 kilometers, and it is built up of proluvial deposits, that is, of deposits washed down by the rains and transported from the mountains by intermittent streams of water. Nearer to the mountains these deposits consist of pebbles, interbedded with fine powdery soil (melkozem). Further away from the mountains, argillaceous loamy and argillaceous deposits predominate. The mountain-base plain is dissected by small valleys, through which run rivulets or intermittent streams.

The belt of plain below the railroad is occupied by desert serozems alternating with primitive spongy, compact, salty (takyr-type) soils; solonchaks and sands. Above the railroad, unsalinified desert-steppe serozems predominate. The greater part of all these soils could be used for irrigated agriculture, but the mountain streams carry too little water, and even that, for the most part, only in the spring. Because of this we can only speak here of irrigation in patches, on small areas, for which water is not infrequently obtained by running so-called kyagrizy or subterranean galleries to collect the ground waters and lead them to the surface. The construction of reservoirs on the mountain streams and the improvement of the building of kyagrizy could considerably increase the present area of irrigated lands.

The slopes of the Kopetdag are steep and stony. On the softer portions desert-steppe serozems and chestnut soils are spread, which may be used for unirrigated grain sowings. There are a few highland plateaus which are more favorable in this respect, having fairly soft chestnut soils, but their number is relatively small.

The highest peaks of the Kopetdag are already in the zone of chernozem meadow steppes, but in the majority of cases steep stony slopes and naked cliffs predominate.





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In the westernmost part of the Kopetdag, where this range enters the confines of Turkmenia with its southern slops also, a few minor rivers run from these slopes down to the lowlands of the Caspian Sea, forming the basin of the Atrek River. Inside Turkmenia the Atrek flows at first through a deep channel, bordered by narrow terraces. The banks are steep, almost vertical, 30 meters high. As the sea is approached, the height of the banks diminishes. In the lower reaches the level of the water in the river is almost as high as the surrounding steppe, as a result of which the slightest excess of water causes the river to overflow its banks and inundate extensive areas. The so-called Lower Atrek oasis is situated here, and consists partly of waterlogged stretches and partly of extensive solonchak tracts, of little use for cultivation.

The entire Atrek region is distinguished by the mildest winters in all Central Asia, for the absolute minimum here does not drop below minus 10 degrees. For this reason it attracts interest as the most hopeful location for growing the subtropical perennials, in particular the rubber-yielding guayule, ramie and the like, which are usually killed by temperatures under minus 10 degrees. Unfortunately, the water supplies of the Atrek river are extremely limited. Thus the greater part of the area of Turkmenia will be specialized toward livestock raising, primarily pastoral. Unirrigated bogara agriculture has relatively limited prospects in the foothills of Kopetdag. Irrigated lands will, on the whole, be used for the late-maturing varieties of cotton, including the Egyptian. On the systems with light flow, assuring irrigation only in spring, the winter grain crops will still continue to be grown to some extent, until suitable reservoirs are built to regulate the flow. New subtropical crops will be introduced in the Atrek region.

When the Kun'-Dar'ya irrigation project is finally realized, the Tashauz Rayon should become one of the basic cotton areas of Turkmenia. However, in view of its more northerly location, only the medium-early-maturing and medium-late-maturing varieties of cotton can be grown.



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XXVIII) The Atrek region includes the following administrative regions: the southern part of Atrekskiy Rayon and all of Kara-kalinskiy Rayon.

The soils of the belt adjoining the Caspian Sea are solonchaks. The next belt that follows it on the east is occupied by desert variants of the serozems and stretches to the railroad on the north and to the Persian border on the south. There are typical serozems in the south-eastern part of the region, and along the Atrek river there are saline deposits and meadow soils on the floodplains (tugay).

The climate may be defined by the data of the Chikishlyar Meteorological Station, which stands on the southernmost point of the region on the shore of the Caspian Sea. The annual temperature is 16.1 degrees, and that of January, the coldest month, is 4.5 degrees. The aggregate temperature during the growing season is 5037 degrees, with a frost-free period of 243 days. Annual precipitation is 176 millimeters. In Kyzyl-Arbat the aggregate temperature during the growing season is 5291 degrees, with a frost free period of 243 days. Temperatures as low as minus 0.5 degrees have been recorded for January.

This is a cotton region, growing the Egyptian varieties and also other industrial crops. In general, the allocation of crops is as follows:

Industrial crops: Primary - - cotton, Lower Egyptian varieties. In individual parts of the region, mainly along the foothills, guayule may be grown on unirrigated bogara and also under irrigation.

Forage crops: alfafa, supplemented by Alexandrian clover.

Nitrifying crops: winter peas, hairy winter vetches, spring fenugreek.

In semi-experimental study: annual eucalyptus, tannery acacia, sumac, cork oak, olive tree, yucca, New Zealand flax, agave and esparto grass.



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XXVI(2) Prikopetdag region includes the administrative zones of the southern parts of Bakhardenskiy, Geoktepinskiy, and Ashkhabadskiy rayons and all of Ginsburgskiy Rayon.

This region embraces the mountain-base plains and the foothills of Kopetdag. Its soils are represented by a belt with a predominant distribution of serozems, passing over in the north to the silty, saline, compacts soils of the takyr. On Kopetdag itself, mountain light-chestnut and dark-chestnut soils and widespread.

In its low-lying parts, the aggregate temperature during the growing season is about 5200 degrees with a frost-free period of 225 days and an annual precipitation of 200 millimeters. In the mountain parts, the aggregate temperature is lower, while the precipitation is somewhat higher.

The region is poorly supplied with water. Irrigation is partly from temporary spring freshets and partly from kyagriz. In view of this, together with the growing of the industrial crops, the agriculture of a few localities will grow grain crops until the water supplies are increased, because grains can mature with only one or two spring irrigations. The group of crops is planned as follows:

Industrial crops: cotton, Lower Egyptian and medium late-maturing Navrotskiy type.

Forage crops: alfalfa, Alexandrian clover, shabdar.

Nitrifying crops: winter peas, winter hairy vetches, spring fenugreek; crops sown after winter grains: bean, Phaseolus mungo lobelia, vetchling.

In the land outside the contiguous cultivated fields: melon, gourd and market-garden crops.

Around the city of Ashkhabad there is an orchard and vineyard zone.

XXVI(3) The Murgab Rayon together with Tedzhen embraces the following



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administrative regions: Tedzhenskiy and Iollotanskiy rayons, the northern part of Serakhskiy Rayon, the southern part of Mervskiy Rayon, and the southwestern part of Bayram-Aliyskiy Rayon.

Soil conditions are characterized by the predominance of meadow carbonate and saline soils along the Tedzhen and Murgab rivers. To the west of Tedzhen the silty, saline, compact soils of the takyr are widespread.

The aggregate temperature during the growing season is 5040-5300 degrees, with a frost-free period of 206-223 days and annual precipitation of 120-134 millimeters.

This is a region of irrigated agriculture and of cotton growing.

The industrial crops are as follows: cotton, principally the Lower Egyptian varieties.

The grain crops are subject to displacement.



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Feed crops: lucerne; supplementary - "shabdar" clover, Alexandrian clover.

Cover crops: winter vetch, shaggy vetch (vika mokhnataya), fenugreek.

XXVI(4) Amu-Dar'inskiy Region. It is composed of the administrative rayons: Darganatinskiy, Denauskiy, Leninskiy, Sayatskiy, Karabek-aul'skiy, Farabskiy, Burdalykskiy, Khaya-achskiy, Kazyl-Ayakskiy, Charshanginskiy, Khodzhadzhambazskiy, Kerkinskiy.

With respect to soil, the area situated on both sides of Amu-Dar'ya River is characterized by the presence of alluvial deposits and alluvial meadow soils. To the east of the Amu-Dar'ya in the direction of Uzbek SSR there predominate muddy-saline and hard soils of "takyrov" (within the limits of the former Kerkin Okrug). The latter type of soil is also to be found on the left bank of the river near Chardzhou. Takyrnyye soils gradually change to saline and grey soils of gypsum content.

The lands subject to flooding along the Amu-Dar'ya, situated between the river and the cultivated zone at a distance from it, are divided into "adachnyye, "dzhangil'nyye", and "tugaynyye".

The "tugaynyye" lands are generally covered with a dense woody growth, among which there is to be found growing Indian hemp.

The "adachnyye" lands are composed of elevated islands belonging to the first terrace, usually somewhat flooded and covered with small rushes

The third type -- "dzhangil'nyye lands, are disposed between the cultivated zone and the "adachnyye" lands. They have a growth of scrubby brushwood -- "dzhangil" or tamarisk, sometimes considerably salty. They are used by the local population under plantings of cotton,



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sesame, wheat, melons, and sometimes alfalfa, "dzhugara", and vegetables.

"Adachnyye" and "dzhangil'nyye" lands, because of hard use (planning, uprooting, washing away of soils, etc.), do not give an optimum yield. Under proper care they give a fair yield of cotton, from 6.4 to 16 centners per hectare, in general not less than in the cultivated zone. Attempts to sow cotton without irrigation, with sub-soil water ranging from 0.5 to 1 meters, also give fair results.

Inasmuch as "adachnyye" lands are subject to the threat of inundation, construction of protective dikes is required.

In summarizing the above, it may be said that the utilization of "adachnyye" and "dzhangil'nyye" lands for planting is completely feasible, provided that certain reclamation steps are taken (fighting increased salinity, dividing the land into sections, construction of protective dikes, pulling out shrubs, etc.)

Under such conditions it is possible to recommend the following crops: cotton, Indian hemp (kendyr'), hemp (kenaf), Chinese bell flower (kanatnik), of the oil bearing plants - sesame; melons grow excellently.

Climatically the Amu-Dar'ya region may be divided into two sub-regions:

The northern part (former Chardzhou Okrug) -- with a total temperature of 5,077 degrees for the growing season, a 207-day period free from frost, and an annual rainfall of 161 millimeters.

The southern part (former Kerkin Okrug) -- with a total temperature of 5,459 degrees for the growing season, a 224-day period free from frost, and an annual rainfall of 161 millimeters.

The distribution of crops by region is as follows:



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The northern part -- Upper-Egyptian types of cotton and "Si-Alendy" cotton, except in the extreme northern part, where they are of the "Navrotskiy" type. In the southern part -- Lower-Egyptian type of cotton. Other technical crops include Indian hemp (kendyr'). and hemp (kenaf) grown in the flood-lands of the Amu-Dar'ya River.

Grain crops are subject to displacement.

Feed crops: alfalfa; supplementary -- "shabdar" clover, Alexandrian clover.

Cover crops: winter vetch, winter shaggy vetch (vika mokhnataya), summer fenugreek.

XXVI(5) Khorezm Region. To it belongs the former Tashauz Administrative Okrug.

The soils of the Amu-Dar'ya flood-lands are identical with those in the preceding region -- salty accretions and meadow soils. For the remaining major part of the area, excluding the sand area, muddy-saline and hard soils of "takyrov" predominate.

The climate is similar to the Khorezm region in Uzbek SSR.

From the point of view of crop growing the region is suitable for cotton-growing and seeded alfalfa. For the rest it is similar to the Khorezm region in Uzbek SSR (See XXV(5).

XXVI(6) Badkhyz. Here are included the Paropamiz foothills with an undulating relief up to 1,000 meter elevation. It includes the administrative rayons of Takhtabazarskiy and Serakhskiy. Along the Murgab and Tedzhen rivers there is to be found a narrow zone of salty accretions and meadow soils along the flood-lands (tugai). The entire remaining part is composed of sandy grey-soils.



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The total temperature for the growing season is 4,713 degrees in Kushka, with a 195-day period free from frost. Annual precipitation is 251 millimeters. Inasmuch as Kushka is located in the highest part of this region, the climate of the remaining part may be considered to be drier, hotter and with a longer growing season.

The area of irrigated land is very insignificant.

The basic crop for the irrigated lands is cotton of the lower-Egyptian kinds.

The region has up to 1,205,000 hectares of non-irrigated land with insufficient moisture. Part of it is suited to grain crops -- winter and summer wheat or barley.

Technical crops grown on non-irrigated land include: cotton of the "Navrotskiy" type, "azhgon", nutmeg sage, safflower, sesame and oil flax. Seed crops: maize, sorghum for silos, esparsette, kale (Schatve).

XXVI(7) Kopetdag Region. It includes the administrative rayons: Bakhardenskiy, Geoktepinskiy, Ashkhabadskiy, Ginsburgskiy (mountainous parts).

The areas of irrigated lands are to be found in small sections along the valleys. The slopes in between rivers may be partly used for dry farming. The area of dry non-irrigated land is estimated at 300,000 hectares, of that supplied with rainfall at 200,000 hectares.

The harvest of wheat grown on non-irrigated land averaged on the basis of a four-year period by rayons is: Karakalinskiy -- 6.6 centners, Bakhardenskiy -- 7.4 centners, Geoktepinskiy -- 6.3 centners, Ashkhabadskiy -- 5.5 centners.

Thus, the best non-irrigated land is to be found in Bakhardenskiy, Karakalinskiy, and Takhta-bazarskiy rayons, inferior land in



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Ashkhabadskiy, Kaakhkinskiy, and the worst land in Karlyukskiy Rayon.

Of the dry farming crops, there are planted principally winter and summer wheat and barley, with respect to which their sown areas are distributed approximately as follows:

| | |
|---|---|
| Winter wheat . . . . . | 55.8 percent |
| Summer wheat . . . . . | 49.0 percent |
| Barley . . . . . | 3.4 percent |
| Other crops . . . . . | 0.8 percent |

In recent years there has been a tendency to increase summer plantings.

If one were to compare the non-irrigated lands of Uzbek SSR with those of Turkmen SSR, the first would be found better provided with atmospheric precipitation.

The absence of meteorological stations on the high parts of Kopetdag makes it all the more impossible to describe the quantity of precipitation, since the elevation of the mountains does not allow for accurate measuring of increase in precipitation.

The composition of crops for the non-irrigated lands of Kopetdag region, in view of the necessity for easing the sharply deficient cereal-fodder balance for the republic, will have a primarily grain character.

Basic crops: winter and summer wheat and barley.

Technical crops: in the upper zone of dry non-irrigated land -- cotton, safflower, sesame, flax.

Feed crops: alfalfa in the less dry part.



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XXVI(8) Livestock raising regions. They include:

(a) Kara-kum -- sand deserts with spots of "takyr", salt marshes, and stony soils. The grazing region is used for karakul growing, sheep raising, and camel raising;

(b) The Caspian region -- sandy, "takyr" and stony deserts with salt marshes. The grazing region is used for sheep and camel raising.

## XXVII. TADZHIK SSR

Tadzhik SSR, together with the autonomous Gorno-Badakhshan Oblast, occupies about 14.2 million hectares. Its surface structure is that of a typical mountainous country. The entire eastern part of the republic, that is, Gorno-Badkhshan Oblast, occupies the well-known Pamir mountain range and is to be found at an elevation of about 4,000 meters above sea level. The spine of the ridges frequently exceeds this figure, while individual peaks reach 7,000 meters. Only the narrow deep valleys of Western Pamir within the limits of Rushan and Shugnan are cut into the stone masses up to 2,000 to 2,500 meters deep.

The western part of Tadzhikistan also presents in itself a complex system of high ridges, stretching in a lateral direction. Such are the Darvaz, Peter the Great, Gissar, Zeravshan, and Turkestan ridges, and a number of other smaller ones. All the ridges are to be distinguished by sharp-peaked, precipitous spines and steep rocky slopes. Their peaks usually reach 4,500 meters and are covered with perpetual snows.

In the complex labyrinth of high ridges, there are to be found scattered numerous deep valleys, which, however, do not have any



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significant flat surfaces. All of them are crowded with the spurs of the principal ridges or isolated individual elevations, and only in places widen into individual flat depressions, which are connected with each other by narrow defiles. The lowest points within the limits of the republic are: Stalinabad -- 900 meters, Pendzhikent -- 990 meters, Khodzhent -- 324 meters, Kurgan-Tyube -- 420 meters, Kabadian -- 414 meters. Inasmuch as the temperature decreases proportionately with the elevation of a locality above sea level, we have extraordinarily diversified conditions within the boundaries of Tadzhikistan with respect to the intensity of summer heat and the length of growing season. The same thing must be said of rainfall, the quantity of which varies very much in relation to elevation. We submit the following data as characteristic of the indicated variety of climatic conditions:

| Location | Elevation in meters | Average Summer Temperature | Annual Precipitation in millimeters |
|---|---|---|---|
| Termez | 310 | 30.7 | 120 |
| Khodzhent | 324 | 28.0 | 140 |
| Pendzhikent | 990 | 24.3 | 340 |
| Zombarych | 1,067 | 23.6 | 263 |
| Khorog | 2,105 | 21.3 | 183 |
| Iskanderkul' | 2,120 | 17.5 | --- |
| Zeravshan Glacier | 3,057 | 11.9 | 859 |
| Pamir Station | 3,640 | 12.7 | 59 |
| Mura Pass | 3,930 | 6.6 | 608 |



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Certain deviations in the regularity of the decrease in temperature with respect to elevation are to be explained principally by the difference in the latitude of individual locations considered. A strict correlation with elevation is not to be found with respect to precipitation. It may only be said that in the low valleys precipitation does not exceed 150-200 millimeters per year. For elevations of 1,000 meters or more, the amount of precipitation may be very varied, ranging from 59 millimeters on the Pamir, to 859 millimeters in the vicinity of Zervshan Glacier.

In view of the great difference in climatic conditions at different elevations, the same diversity is to be found for the soils of Tadzhikistan, besides which, as a general consequence of the small quantity of atmospheric precipitation, there predominate at all elevations carbonaceous little-humus soils of deserts and arid steppes. However, because of the length of the growing seasons and its conditions of temperature, these soils differ considerably at various elevations with respect to their morphology and their agricultural significance. In view of this it is possible to divide the entire territory of Tadzhikistan into several vertical belts, each of which has its own characteristics. These belts and their characteristics are as follows:

1. The very hot belt with an average summer temperature varying from 28 degrees to 31 degrees centigrade and an average temperature of 22 degrees to 25 degrees for the growing season. Here are to be found the particularly low sections of the valleys of Kafiringan, Vashkha, and Pyandzha (the upper reaches of the Amu-Dar'ya) in the southern part of the republic, situated at lower than 650 meters. Precipitation is about 150-200 millimeters. The soils are composed of grey-earths often moistened by shallow sub-soil waters, and in the latter cases changing

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Certain deviations in the regularity of the decrease in temperature with respect to elevation are to be explained principally by the difference in the latitude of individual locations considered. A strict correlation with elevation is not to be found with respect to precipitation. It may only be said that in the low valleys precipitation does not exceed 150-200 millimeters per year. For elevations of 1,000 meters or more, the amount of precipitation may be very varied, ranging from 59 millimeters on the Pamir, to 859 millimeters in the vicinity of Zervshan Glacier.

In view of the great difference in climatic conditions at different elevations, the same diversity is to be found for the soils of Tadzhikistan, besides which, as a general consequence of the small quantity of atmospheric precipitation, there predominate at all elevations carbonaceous little-humus soils of deserts and arid steppes. However, because of the length of the growing seasons and its conditions of temperature, these soils differ considerably at various elevations with respect to their morphology and their agricultural significance. In view of this it is possible to divide the entire territory of Tadzhikistan into several vertical belts, each of which has its own characteristics. These belts and their characteristics are as follows:

1. The very hot belt with an average summer temperature varying from 28 degrees to 31 degrees centigrade and an average temperature of 22 degrees to 25 degrees for the growing season. Here are to be found the particularly low sections of the valleys of Kafiringan, Vashkha, and Pyandzha (the upper reaches of the Amu-Dar'ya) in the southern part of the republic, situated at lower than 650 meters. Precipitation is about 150-200 millimeters. The soils are composed of grey-earths often moistened by shallow sub-soil waters, and in the latter cases changing

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to carbonaceous-meadow and even meadow-marsh varieties. Agriculture is possible only with irrigation. However the length of the growing season is conducive to the cultivation of late maturing and long-staple types of cotton, even of the Egyptian varieties.

2. The hot belt has an average summer temperature of 25 degrees to 28 degrees centigrade, but an average temperature of 20 degrees to 22 degrees for the growing season. Here are to be found the higher parts of the valleys in South Tadzhikistan, lying at an elevation of 600-1,000 meters, and also the more northern Khodzhent region with an elevation up to 850 meters. In general precipitation here is light, although in some places, the amount is apt to reach even as much as 300 millimeters. The soils are grey soils, principally of the desert-steppe type, but sometimes approaching the light-chestnut type. Detritus is to be observed fairly frequently. In places, moistening results through shallow sub-soil waters, creating a transition from grey soils to carbonaceous meadow soils. Through irrigation, it is possible to grow average maturing cotton, grapes, rice and other valuable crops. In places there is dry-land sowing of cereal grains, without using irrigation.

3. The moderately hot belt has an average summer temperature of 22 degrees to 25 degrees and an average temperature of 17 degrees to 20 degrees for the growing season. Here are to be found the foothills and individual low mountain ridges or their spurs, having an elevation of 1,000-1,700 meters in the south of the republic and 850-1,400 meters in the north. The amount of precipitation here is about 300-400 millimeters. The soils are primarily light-chestnut, being on the slopes frequently stony. Non-irrigated cultivation of cereal grains is fairly successful. With irrigation there are cultivated fast-maturing cotton, maize, apricots, mulberry trees, etc.



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4. The warm belt has an average summer temperature varying from 15 degrees to 22 degrees. To it belong mountainous slopes with an elevation of 1,400-2,500 meters in the north and 1,700-2,700 meters in the south of the republic. Wide diversity is to be observed here in the amount of the rainfall. Together with such dry locations as, by way of example, Khorog with a 130 millimeters annual precipitation, there are in this belt places where the amount of rainfall reaches 600 millimeters per year. The principal soils belong to the grey-earth variety, but in places there are also dark-chestnut soils and even black earth. There are many rocky precipitous slopes and very stony soil varieties. Because of this possibility for agriculture here is extremely limited and exists only in narrow valleys. There are principally cultivated bread cereals, some legumes and fruit trees, in particular, walnut, apricot, apple, etc.

5. The moderately warm belt has an average summer temperature varying from 10 degrees to 15 degrees. Here are to be found the mountainous areas, having an elevation varying from 2,700 to 3,600 meters above sea level. The amount of rainfall here is even more varied than in the preceding belt, and vacillates within the limits of 100 to 800 millimeters. The soils in the majority of cases are little developed. Here predominate outcropping of cliffs and rocky mountainous slopes covered with coarse-bladed grassy plants, various shrubs, and some varieties of trees. Only on the more gradual shelfs of the northern slopes of the mountains and in the upper parts of small ravines, do there flourish small grassy meadows of the sub-alpine type. There is no cultivation of the land. There is summer pasturage.

6. The moderately cold belt has an average summer temperature ranging from 5 degrees to 10 degrees. Here are to be included mountain



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peaks and plateaus, located at an elevation of 3,600-4,500 meters. Here trees do not grow. On the rocky slopes and stony alluvial deposits there are to be found only small alpine grasses. Along the banks of streams and in small hollows there grow green flower beds of the alpine marshes. The air is so dry and rare on the Pamir plateaus that only the most hardy forms of purely desert type vegetation can grow here, while the soils take on the character of high-mountain dry salt marshes.

7. The cold zone has an average summer temperature of lower than 5 degrees and includes the highest ridges and mountain peaks above 4,500 meters. Here are to be found solid snow fields unable to melt during the short summer period.

As is evident from the above-described characteristics, specialization in the economy of different regions in Tadzhikistan must be distinguished by great diversity. In outlining the above-indicated belt divisions and taking into consideration several local peculiarities, we are able to distinguish five fundamental agricultural regions: (1) The southern low-land section or the Bukhara five-river region, (2) the northern lowland section or the former Khodzhent Okrug, (3) the Outer Pamiro-Alay, (4) the Southern Pamiro-Alay, and (5) the high mountainous areas.

Below we give a description of the distribution of crops by individual regions.

XXVII(1) The Bukhara five-river region. The following rayons of the former Surakhan-Dar'ya Okrug of Uzbek SSR are here included: Pattagisarskiy, Dzharkurganskiy, Shirabadskiy, Denauskiy, Saryasiyskiy (southern part). Of Tadzhikistan -- Kabadianskiy (except the northeastern part), Dzhilikul'skiy, Saraykamarskiy,



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Kurgantyubinskiy (western part), Parkharskiy (eastern part), Aral'skiy (southeast), Kulyabskiy (southern part).

The region is situated along the valleys of the rivers of Surkhan, Shirabad, Kafirnigan, Vakhsha, Upper Kyzyl-su going as far north as Stalinabad and as far east as Kulyab.

Under a favorable combination of soil, water and climatic conditions, this region is of extraordinary interest from the point of view of introducing valuable subtropical crops and low-grade varieties of Egyptian cotton.

With respect to soil the region is characterized by the development of desert and desert-steppe grey soils, and being along the valleys frequently of a salty nature and often stony on the foothill slopes.

The region is in general well provided with water, but irrigation, because of the peculiarities of the relief is far from possible everywhere.

Very promising prospects for the development of irrigated lands have to take into consideration the so-called Vakhsha problem, as well as the envisaged irrigation in Shirabadskiy Rayon and from Surkhan River.

With respect to climate, this region, as the most southern (according to the figures supplied by the Termez meteorological station), has a total temperature of 5,760 degrees for the growing season (including temperatures above 10 degrees centigrade), with a long period free from frost, and an annual rainfall of 120 millimeters. In the Tadshikistan part, the period free from frost lasts 235-240 days, the average annual amount of precipitation in some places is as much as 420 millimeters, with relatively mild winters. Although



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minimum temperatures reach minus 15 degrees, this does not happen every year. Generally the minimum is in the vicinity of minus 10 degrees. This makes it entirely feasible to consider the region as being completely subtropical.

The crop-raising tendency of the region is to grow cotton of the inferior Egyptian varieties.

Experimental agriculture is being carried on in the field of perennial subtropical crops. "Guayyula" (a rubber bearing plant) is grown on non-irrigated land. Near industrial centers there are to be found farming zones. The following is the distribution of crops:

Technical crops: basic -- cotton of the inferior Egyptian varieties; supplementary -- "rami"; volatile oil crops: geraniums, rosemary; citric sorghum, Kazanlyk rose; rubber bearing plants on non-irrigated land -- "guayyula"; in experimental agricultural work -- eucalyptus (annual), tanning acacias, sumacs, olive, cork oak, New Zealand flax, yucca, alfa, agave.

Grain crops must be eased off of non-irrigated land.

Cover crops: winter pea, winter shaggy vetch (vika mokhnataya), summer fenugreek.

Feed crops: basic - alfalfa; supplementary -- Alexandrian clover and "shabdar" clover.

Field plantings: cucurbitaceous garden vegetables, oil-legumes, mulberry-bush plantations.

XXVII(2) Fergana region. Of the former Khodzhent Okrug there are included the rayons of Nausskiy, Khodzhentskiy, Aimskiy, Kanibadamskiy, and Isfarinskiy. It includes the exit from the Fergana Valley, bounded on the north by the Chatkal' ridge and on the south by the Turkestan ridge.



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The soils along the Syr-Dar'ya Valley include meadow carbonaceous and salty soils; for the rest of the area they include gypsum bearing grey earths, stony or gravel soils.

The climate in the valley section is little different from the climate of the remaining part of the Fergana Valley in Uzbek SSR. The total temperature for the growing season is 4,837 degrees, with a 215-day period free from frost, and an annual precipitation of 140 millimeters. The region is vegetable-farming, with a small area of the Naus sub-region, where sowings of the average late-ripening cotton are indicated. The distribution of crops in the cotton belt is the same as for the Fergana Valley in Uzbek SSR, plus volatile-oil crops of lavender, iris, catnip, basil, "lipiya", and tuberose.

XXVII(3) Outer Pamiro-Alay. The following rayons of Tadzhikistan are included in it: Ura-Tyubinskiy, Pendzhikentskiy, Zakhmetabadskiy, Shakhristanskiy.

With respect to soil, the region is quite diversified, having soils which vary from the typical grey earths to chestnut soils, and even black earth.

With respect to the climate according to the data of the Pendzhikent meteorological station there is a total temperature of 3,877 degrees for the growing season, with an annual precipitation of 340 millimeters. The more elevated parts of the foothill area are more cool and more humid with a precipitation as high as 600 millimeters.

The irrigated lands are concentrated in the valleys, primarily in the Zeravshan valley. In the irrigated region are to be found vineyards and alfalfa for fodder.

The non-irrigated part of the region is primarily in the zone of less-arid land, and there are great possibilities for developing dry farming. The following crops are to be noted:



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Grain: winter and summer wheats and barleys, with a tendency to increase the wheat crops.

Technical crops: in the lower parts non-irrigated cotton type 1306, sesame; in the upper parts, chick peas, oil flax, muscatel sage, lavender, tau-sagyz.

Feed crops: alfalfa

In experimental farming development -- in the secured part: vetchling, winter vetch, Sudan grass, "mogar", sorghum or Pennisetum typhoideum kidney-beans, lentils, millet, potatoes or Jerusalem artichoke, pumpkins, watermelons, long flax; in the unsecured part: Brassica armoracioides, Astragalus retamocarpus, sweet clover, orache.

XXVII(4) Southern Pamiro-Alay. From Tadzhikistan are included the foothills of the Gissar ridge at the upper reaches of Vakhsha and Khingou Rivers, the tributaries of Kafirnigan-Dar'ya and others. It occupies the northern parts of Shakhrinauskiy, Stalinibadskiy, and Yangibazarskiy Rayons, and Khaitskiy.

With respect to soil, depending on the elevation, the region has grey earths, chestnut soils, black earths and mountainous salt-marsh soils with a predominance of stoney varieties.

According to climatic data, the region is divided into two parts:

The first subregion includes the following administrative rayons: Shakhrinauskiy, Stalinabadskiy, Yangibazarskiy, Khaitskiy.

The distribution of crops and varieties is as follows for agricultural lands:

Industrial crops: basic -- cotton, semi-fast maturing "182" in the first subregion and fast maturing "1306 Shreder" in the second subregion.

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Cover crops: peas, winter shaggy vetch (vika ozimaya mokhnataya).

The non-irrigated part of the region includes both that with and without enough precipitation. It offers great possibilities for increased dry farming. The total area of non-irrigated land with enough moisture is 470,000 hectares, and 690,000 hectares of too-dry land. The distribution of crops is analogical to that given for the non-irrigated part of Outer Pamiro-Alay.

XXVII(5) The High Mountain Region of Pamiro-Alay. Here are included all the high mountainous parts of the above-mentioned regions and all the remaining regions of Tadzhikistan including Gorno-Badkhshan Oblast.

This region, occupying the high mountainous areas with its fields of perpetual snows and glaciers, with an extraordinarily severe climate and with a predominance of stony soils, can hardly be used for agriculture, but presents in itself a region of alpine and sub-alpine pasturages.

The climate of the region may be determined with the help of two meteorological stations.

The Pamir Station has a total temperature of 985 degrees for the growing season (counting temperatures above 10 degrees centigrade), a 90-day period free from frost, and an annual rainfall of 60 millimeters. Khorog, as the warmest location in the region, has a total temperature of 3,210 degrees for the growing season and an annual rainfall of 85 millimeters.

The climate of the region thus may be characterized as the climate of high mountainous deserts. Agriculture is with irrigation, and dry farming is practically impossible. Small areas of irrigated lands are to be found only in the deep river valleys with a

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predominance of cereal grains and legume crops, principally, barleys, wheat, maize, peas, vetchling, chick-peas, beans, and lentils. The upper limit for agriculture is at an altitude of 2,500 meters.



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## ZAKAVKAZSKAYA (TRANS-CAUCASIAN) S F S R.

P. M. Zhukovskiy

General Remarks. The present work is an attempt to describe in a most general way the more typical regions of plant cultivation in the Trans-Caucasus, -- based considerably on the diversified, though very incomplete, literature describing the physical geographic and agricultural conditions in the Trans-Caucasus. The personal observations and suggestions of the author are also set forth in the present work. We do not pretend that this work presents an exact evaluation of the agricultural conditions in the Trans-Caucasus and their immediate prospects. Such an evaluation, of course, would be better done by local workers in the soviet republics of the Trans-Caucasus, and it is only to be hoped that in the very near future the republics will summarize and publish their exhaustive study on the division of the Trans-Caucasus into its natural regions.

The Trans-Caucasus with respect to its physical geographic and agricultural conditions presents extreme diversification, distinguishing it from the other regions of the USSR. The boundary between the North Caucasus Kray and the Trans-Caucasus is the so-called Bol'shoy Kavkaz consisting of a system of mountain ranges, one of which is called the Main Caucasian range (Glavnyy Kavkazskiy khrebet) which stretches without a break across the entire Caucasian isthmus.

The northern boundaries of the soviet republics of Georgia and Azerbaydzhan are located within the system of the Bol'shoy Kavkaz. The soviet republic of Armenia is entirely within the region of the Malyy Kavkaz, a mountain range separated from the Bol'shoy Kavkaz by two tremendous lowlands -- the Black Sea and



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Caspian -- but connected with it by the Meskhis (Suram) ridge. The Meskhis ridge from one side connects the Bol'shoy Kavkaz with the Malyy, and from the other side is the central water divide for the entire Trans-Caucasus, sharply dividing it into two different climatic regions, having the names of Western Trans-Caucasus and Eastern Trans-Caucasus. Azerbaydzhan SSR and Armenian SSR enter as a whole into Eastern Trans-Caucasus, while Georgia SSR occupies the entire Western Trans-Caucasus and part of the Eastern.

The orographic conditions of the Trans-Caucasus and the influence of both the Black and Caspian Seas, create a diversity of climatic conditions, varying from different kinds of subtropical climate to polar and frigid sub-alpine climate.

Plant cultivation comprises the principal branch of agriculture in the Trans-Caucasus, being in part the cultivation of cereal grains, which to the present time stifles considerably the other branches of plant cultivation. Although at present, grains play a most significant role, and if in 1932 grain crops in the Trans-Caucasus still comprised 78.7 percent, industrial crops 14.0 percent, food (melons, vegetables, potatoes) 3.7 percent, and feed 3.6 percent, then in the future this relationship must be radically changed so that grains will comprise approximately 43 percent, technical 27 percent, and feed will increase to 25 percent. Growing useful plants which give fruit and raising vineyards will also be subject to a sharp increase. Of grains, only rice in Azerbaydzhan SSR will be subject to an absolute increase in sown area. Considerable significance in the field culture of the Trans-Caucasus is given to winter wheat, the sown area of which reaches 44 percent, the total area of summer wheat being 6-7 percent.

In the second place after wheat stands barley, accounting for 24 percent of all sown area. The third place in importance is held



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by corn (19.7 percent), 4/5 of which is concentrated even at the present time in Eastern Trans-Caucasus. In 1926 there were in the Trans-Caucasus 932,300 hectares of winter wheat and 130,800 hectares of summer wheat.

Of course, field culture is not everywhere only grain. In the lower zones industrial crops and fruits and vegetables predominate, or agriculture is mixed, including fruit-yielding plants together with grain crops and small animal husbandry. In the medium zones either grain crops or cattle-raising generally predominate, while in the highland zones cattle-raising is the principal branch of agriculture. In connection with this, since the greatest percentage of pasturage is to be found in the foothills of the Bol'shoy Kavkaz, the predominance of cereal grains is understandable. The land area less than 600 meters above sea level is 43.6 percent, while that between 600 and 1,800 meters, is 35.3 percent of the territory of the Trans-Caucasus. All the rest, that is 21 percent, of the territory consists of high mountain area, with an insignificant portion of it devoted to farming.

The lowlands, the low plains, and valleys of the Trans-Caucasus have to be utilized for the development of technical and fruit-and-vegetable crops. This particularly applies to irrigated areas and subtropical regions. At the present time the irrigated areas in the lowlands of the Trans-Caucasus are still devoted to a considerable degree to cereal grains. In Eastern Trans-Caucasus, this is to be found in the cotton areas, and in Western Trans-Caucasus, where there should be a maximum cultivation of valuable subtropical crops, more than 200,000 hectares are still devoted to corn. It is planned to decrease the total sown area to corn



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in the ZSFSR by 36 percent, with the principal part of the decrease taking place in Western Trans-Caucasus.

In Azerbaydzhan, winter crops of cereal grains and certain grain legumes are predominant, while in Georgia and Armenia -- summer crops. The reason is that Georgia and Armenia have more mountain crops than Azerbaydzhan. Moreover, Western Georgia (including Abkhaz and Adzharistan) raise a lot of corn.

The principal problem in the development of socialist economy in ZSFSR is water, both for irrigation, and for electric power. Whereas in 1932 the total irrigated and improved area for the ZSFSR included 1,430,700 hectares, in 1937 it is to reach 2,362,800 hectares. The general tendency of socialist reconstruction of agriculture in ZSFSR in the next few years is to transform it to one of the principal regions for fruit-and-vegetable and viticulture economy in the USSR (and as the principal region of subtropical fruit-and-vegetable growing), transform it to the second in importance cotton growing base in the Union, to a firm base for the growth of "rami" and other subtropical perennial textiles, to a fundamental base for tea economy, planned to satisfy the tea requirements for the USSR, into a region of wide cultivation of tobacco, sweet potatoes, into one of the principal regions for the growing of peanuts, into the main base for the raising of volatile oil plants (like geranium, iris, etc), for the raising of bulbs for export, for the cultivation of the tung oil trees, etc., and also into one of the major regions for the production of dairy products (such as Swiss cheese making).

In regional planning of crops one must keep in mind not only the natural conditions of a place, but also the interference of man with the natural setting, his ability to transform unfavorable



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conditions to those that are favorable. This interference may apply not only to soil, but even to climate and vegetation. The minimum critical temperatures along the coasts of the Black and Caspian Seas may be neutralized by improving the climate (oil heaters, etc.); soils may be drained, fertilized, aerated, even warmed, the growing season of annuals may be shortened by vernalization, non-profitable crops may be made profitable through the mechanization of certain processes, etc.

The entire Trans-Caucasus may be roughly divided into 4 orographic regions and this division corresponds to the basic type of agriculture.

1. The Black Sea lowland and the narrow belt of the Black Sea coast, basically include the valley of the Rion River and its tributaries, the lower parts of the Ingura, Kodora, Khobis-Tskhali and other valleys. The climate is humid subtropical, here and there approximating the Mediterranean. A peculiarity of this region is the existence of a winter growing season. Irrigation is rarely practiced here.

The principal field crops at present are corn, tea, and tobacco.

2. The Caspian lowland includes the valley of the Kura River with its tributaries. Here may be included the Lower Araks and the Azerbeydzhan coast of the Caspian Sea. The climate is primarily dry subtropical, along the Araks -- with a cold winter and subtropical summer. Irrigation is necessary. The principal field crops at present are cotton, wheat, and rice.

3. The Highlands of the Trans-Caucasus. Here may be included a number of plains (Kartalinsk, Mukhran, Alazan, Kubin). It is a most wide field culture region.



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4. High Plateaus and Agricultural High Mountainous Slopes. Here are included those highly situated plain areas of Malyy Kavkaz like the Akhalkalak Foothills, the Karabakh, Gokchin, Loris, Tsalkin, Leninakan plateaus, etc. The climate of these areas is marked by severe winters. The principal branch of agriculture is cattle raising, secondary -- grain crops.

## XXVIII. GEORGIAN SSR

Georgia, occupying the upper part of the Kura River basin, the entire Rion basin, and the basins of other rivers, emptying directly into the Black Sea, in general is rich in river waters which can be used for irrigation. The biggest percentage of tillable lands (over 80 percent) are to be found in the foothills of the Georgian part of the Bol'shoy and Malyy Kavkaz and in the high plateaus of Akhalkalak and Tsalkin regions. Cultivated lands compose 20 percent of the total territory of Georgia. Somewhat more than 8 percent of the total area of plant cultivation lands are composed of irrigated land. Georgia is in need of irrigation and with respect to this major irrigation construction is being carried on by the Soviet state.

The basic irrigation regions are to be found in Eastern Georgia (7.9 percent), and in small areas of the western part of the former Kutais Uyezd (0.6 percent).

Areas which produce a surplus of grain cereals are to be found in the western part of the former Gori Uyezd (Gomskiy Rayon), in the southeastern part of the valleys of the Alazan and Iora (wheat), in the valleys of the lower reaches of Rion River and its tributaries, and other rivers, emptying into the Black Sea (corn). These surplus regions belonging to Eastern Georgia engaged in cultivation have a



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winter wheat which is to be distinguished by its high qualities, and includes hard and soft types of wheat. The western part of Gori Uyezd still has a considerable amount of rainfall and reliable harvests of grain crops. Here the cultivation of sugar beets can be developed. This, however, can only serve the requirements of the republic of Georgia for its own sugar refining plant. The valleys of Western Georgia, producing corn until the present time, must be set aside for the cultivation of very valuable subtropical crops. Corn must be used here as feed for stock raising, the development of which, within definite limits, is stimulated by the proximity of resorts and the opportunity to develop winter crops of root crops, feed crops, etc.

Areas, where grain cultivation is on the same plane with viticulture, horticulture and small branches of animal husbandry, are considerably enlarged, as for example -- Predkakhetiya (Cis-Kakhetiya), the Shaumyanskiy Rayon of Borchaly, and several parts of Abkhaziya and Adzharistan. Areas of the middle zone of the southern slope of the Glavnyy Kavkaz ridge, spurs of Malyy Kavkaz and Akhalkalak Plateau, are characterized by the development of grain crops together with stock raising. The possibilities in these regions are examined by region.

With the single cultivation of grain crops as characteristic for these regions, feed, oil, legume grains are sown only on an insignificant scale. In recent years corn has become widespread in Eastern Georgia, where it must be still further increased, not only as a crop for plowing under, but also as a valuable plant of varied utilization, able to serve among other things for obtaining sugar from the kernel, oil from the germ, etc. In Western Georgia it must



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take even a more important position. In connection with this, dent corn will probably yield its place to the flint variety, because the latter is the more cold-enduring and drought-resistant.

The cultivation of Italian millet (gomi), still continuing in Western Georgia, must be suppressed. Both corn and millet are traditional cereal crops for Western Georgia (particularly in Guriya and Mingreliya). Their suppression, as a necessary process in the development of socialist agriculture, has to be accomplished in the shortest possible period, accompanied, of course, by the import of cereals and the preparation of the population for work in the field of industrial crops.

Grain legume crops take up only 0.2 percent of the entire sown area of Georgia. The soy[redacted] bean occupies first place, followed by the kidney bean, widespread in Western Georgia, where it is sown together with corn. As regards zones, it is grown in Georgia up to 1,200 meters elevation (in places up to 1,500 meters).

Besides Manchuria and the Maritime Kray, Western Georgia was the only soy[redacted]bean region before the war. In the absence of spiked grains in the lowland of Western Georgia, corn and soy[redacted] beans took the place of cereals. Soy[redacted]bean flour was added to corn flour for making bread. The soy[redacted] bean, together with corn stalks, was the only feed crop. It was not used in Western Georgia as an oil-yielding plant. Soy[redacted] bean is met with both in unmixed sowing, and also, principally, similar to the kidney bean, mixed with [redacted] sowing. The local varieties mature at the same time as corn, which hinders harvesting, but it is possible to introduce special American machines which harvest both simultaneously.

The future should see the soy[redacted] bean preserve its significance in the Kolkhid lowland as a feed and oil-yield crop, and then as a



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good forerunner for field crops and as an intermediate crop. Quicker maturing varieties are necessary. It is preferable to plant soy beans in-between rows.

The peanut is a new crop for Georgia. In Western Georgia it has given good harvests. This crop is planned for many areas in Georgia. In Zugdidi Uyezd, it yields a record harvest of up to 32 centners per hectare. However, in Western Georgia, the peanut evidently suffers from "fuzariosa". The problem of the peanut, as an oil-yielding plant, has met with an unexpected obstacle: technology has discovered recently a method for clearing up and completely eliminating the odor of sunflower oil, so that it can completely take the place of peanut oil for sardines, for example, and for canned products in general. Nevertheless the peanut should be developed as a crop with a high yield of valuable oil, both as a cover-crop and as a crop for confectionery use.

Peas, chick-pea, lentil, grain vetch and other crops occupy in Georgia a very insignificant position, and are primarily grown (with the exception of the chick-pea) in the elevated zones of Eastern Georgia.

Grain legume crops must occupy a significant place in Georgia. In the cotton areas of Eastern Georgia, and in the tea, tobacco, and other areas of Western Georgia, legumes must be considered above all as soil-improving agents and cover crops. The only soil-improving crop in the tea areas is weed grass, a fern (poporotnik-orlyak), the struggle with which is very difficult, because from one point of view it is a plague to farming and because from the other it is the only restoring agent for enriching soils.

Manure fertilizers are used only in the uplands and occasionally in the middle zone. In the valleys of Western Georgia, plant cultivation



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on alluvial soils, which are occasionally flooded by the overflow of the rivers, is done naturally. In regions in need of water, it is done to a certain degree with irrigation. As regards hilly and middle-zone areas not in need of water, green fallow is still practiced and is generally used for pasturing cattle. The introduction of growing plowed crops, such as legumes (cover, feed, and food), feed root plants, and potatoes in the highland zone and the sweet potato in the lowland, should solve the problem of enriching the soil.

Summer cultivation of legumes is tenable neither in the cotton, tea nor tobacco regions, because it would deprive the principal crops of moisture. Winter cultivation of peas, vetch, white lupine, legumes, etc., in these regions is firmly established and should be included as the principle part of the field-culture plan. Together with this, the summer cultivation of legumes for grain should be developed in the grain and mixed areas of Eastern Georgia, -- throughout the entire middle and elevated zones. This should be accompanied by the study and selection of local varieties, which in isolated instances are found as extremely valuable stock. Peas of the Manglisskiy, Beloklyuchinskiy, Bakur'yanskiy and other Rayons, the French lentil in Southern Osetiya, the kidney bean in Western Georgia, white lupines in Guriya, "pannonskaya", vetch on the Akhlkalak plateau, etc. -- present native stock for propagation and selection.

Grain legumes of Georgia, especially the soya bean and the kidney bean, should be considered as suited to export since they already have a good reputation in foreign markets.



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Small use of fertilizers, unplanned irrational crop rotation, and the continued operation, according to the geographic conditions, of primitive methods of field culture, is responsible for small harvests: wheat 8-12 centners, barley 9-12 centners, corn 7-12 centners, soya bean 10 centners.

The principal industrial field crops are cotton and tobacco.

Tobacco growing is to be found in Abkhaziya, Guriya and in Lagodekhskiy Rayon, where it should be considerably increased.

Cotton raising is almost entirely concentrated in Eastern Georgia, -- in the Borchala lowland, the Karayaz irrigated region and in the Alazan valley. Until recently the irrigated land in these regions was still used for winter crops of wheat and barley. These cotton-raising regions should receive special attention. Selective work is necessary for the development of fast-maturing and medium-maturing types which have large cotton bolls. The utilization of winter precipitation and winter free water is necessary for the winter cultivation of cover and feed crops, which free the field for sowing cotton. A decisive fight is necessary for the elimination of weeds from plantings and soils, especially wild sorghum. In Western Georgia, cotton raising is not irrigated and is on a small scale, exclusively for the needs of the local population. There is grown here an absolutely special original variety, the Kutais gymnosperm, belonging to a special variety of Gossypium punctatum cotton.

There is no prospect for developing cotton raising in Western Georgia. The once-existent interest in cotton in Abkhaziya cannot be considered as at all practical.

Of the new districts, there should be pointed out as having possibilities that part of Kakhetiya Okrug which is irrigated by the Alazan Canal.



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Potato growing should be developed in the middle and highland zones, which should be considered here not only from a food standpoint but also as fodder.

Let us now describe the characteristics of the individual regions.

XXVIII(1) The shore zone and maritime terraces approximately 100 meters in elevation, stretching from the northern boundary of Abkhaziya to Kodora River (approximate limits). This includes the maritime parts of Gagra, Gudaut, Sukhum, and, in part, Kodora former Uyezds. This region is, as it were, an extension of the Chernomor'ye (Black Sea) Okrug and belongs to the humid subtropics. The length of the growing season is 240 days (8 months). Though having an average annual rainfall of 1,440 millimeters, during the summer months, in some years it is somewhat dry, the average rainfall during the summer being 325 millimeters. The average temperature for January is 6.3 degrees, and for July 23 degrees. The average annual temperature varies from 15.1 degrees to 14.0 degrees centigrade. The average annual minimum is minus 5 degrees centigrade, the absolute minimum for a number of years has been minus 11.8 degrees. Repetition of freezing weather of minus 10 degrees centigrade is equal to 5 percent. The soils are humus-carbonaceous, boracic earths (burozemy), and here-and-there red earths and gravel, and alluvial in the lower reaches and deltas of rivers.

In this region, which is intended for the development of subtropical fruit-vegetable and technical crops, field crops still play a very significant role and are represented here by corn, kidney beans and tobacco. The average yield of corn is estimated at 16 centners. It is grown here as a monoculture on the alluvial river



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banks of the valley and the mountain slopes. The kidney bean is planted together with the corn. In this zone, tobacco yields large harvests, but its quality in the lowest part of the zone as grown on alluvial soil is much inferior to that which is obtained in the more elevated zone, for which reason terraces which have an elevation of 100 or more meters are more suitable for tobacco growing. Corn and kidney beans are to be entirely eliminated from this zone. The most promising field crop is the sweet potato, which necessitates the construction of sweet-potato storage facilities and dryers. On the alluvial soil at the mouths of rivers, the most promising is the cultivation of flower bulbs (lilies, narcissus, gladiolas, eremurus, etc.), having an export value. Flower bulbs can occupy an important position at the mouths of the Bzyb' River, Gumista River, on the right bank of the mouth of the Kodora River and in the Pilenkovskiy Rayon of former Gagra Uyezd. These places are favorable for growing "rami" (on alluvial soils with shallow water and on gravel but not-cemented soils). For "rami", alluvial soils can be used which are adjacent to river mouths, where the relief completely allows mechanized cultivation. However, "rami" cannot occupy here a large area, because the small size of the sectors which can be set aside for "rami" make doubtful the development of this culture in the region. Its base is to be found at Kolkhid. The alluvial river soils are favorable for the field transplanting culture of geraniums (Pelargonium), which must become one of the basic crops of the region, and, moreover, for the culture of lemon sorghum and verbena. Lemon sorghum can also grow well on gravel soils. These areas may be used in the wintertime for growing winter vegetables, primarily cabbage and partly cauliflower. Here it is important to



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take into consideration the time of harvesting summer crops and sowing winter crops. The region is also very favorable for vegetable seed growing. The cultivation of vegetables may be widely developed if one makes full use of the facilities of the Black Sea Railroad.

The cultivation of the geranium is actually based on the accidental, although not bad, strain which is the descendant of two or three varieties. It is necessary to import from abroad first-class stock. In particular, it is necessary to introduce good annual volatile-oil varieties of Pelargonium in order to base the culture on seed propagation. However, among the perennial types, it might be possible to bring out varieties which are capable of surviving the winter in the field. The region is favorable also for club palms, as an intermediate culture on woody slopes. Basically, the region should be thought of as a region of subtropical plant cultivation, with a considerable development of Japanese persimmons and citric plants, in part tangerines and grapefruit, as well as under artificial improvement of climate (through the use of oil heaters, etc), of lemons and oranges. The cultivation of such fruits as feijoya, custard apples and a number of others should also be developed. It is possible to grow certain varieties of avocado on the high mountainous Meksika (with elevations of 2,000-2,300 meters). Of the exotic varieties of vegetables, there should be grown "chayot", which is interesting as a starch-yielding root plant, the stalks of which serve as a good substitute for the raffia palm.

For protective planting, the cultivation of eucalyptus should be forced. Certain varieties of the eucalyptus can play the role as



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being not only protective plantings, which serve as sources of wood and tannic acid, but also as volatile-oil plants. Furthermore, the tung oil tree, technical palms, and sisal, enjoy here certain conditions for development, as the tung oil tree has here one of its principal bases. In the orchards under the trees it is possible to cultivate some valuable arrowroot plants.

For this region there can also be recommended, as an intermediate culture, serving as an accompanying plant, leguminous plants, the cultivation of the peanut and even the soya bean.

The cultivation of tea is also possible in certain areas of the former Sukhum, Gudaut and other Uyezds. Experiments with tea growing should be on an economic scale.

A necessary condition is the introduction of the cultivation of plants for green fertilizers and feed crops.

It is necessary to direct one's attention to the selection of crops for winter cultivation. Good cover crops can be found in peas, vetch, "trigonella", clover, and on alluvial soil -- white lupines. The summer group is more extensive and may be adopted in horticulture. For the cultivation of slopes, it is necessary to use Phaseolus calcaratus by planting seeds for the winter and having them sprout in the spring, with a sowing at the end of August and plowing in before frost. Of the others, there can be mentioned the velvet bean (barkhatnyy bob) and crotalaria. The velvet bean should be planted only on level ground, for slopes, the Phaseolus aconitifolius. Winter feed crops should be developed in every way, the best kinds being vetch-oat mixture, leaf cabbages, winter rape, and turnips. The summer group includes crotalaria, the sweet potato, etc.



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XXVIII(2) The maritime hills ranging from 100 to 450 meters in elevation located in their respective administrative areas. The climate of this zone belongs to the humid subtropic, but with a lesser degree of dryness during the summer months than the preceding zone and with lower temperatures. The average annual temperature is 14.5 degrees to 13.5 degrees centigrade.

At the present time, field cultures here have a dominating position, with a predominance of corn, which takes up more than half of the cultivated area. There prevails a variety of the so-called Kutais hybrid, known here as Sukhumka and presenting a more or less stable cross-breed. Corn is frequently grown with the kidney bean. These crops are now going to yield ground to tobacco. The construction of the Black Sea Railroad across the entire Abkhaziya will make easier the delivery of corn and will aid in its elimination from the humid subtropical zones.

Tobacco takes up more than 25 percent of the area. This is the best area for Abkhaz tobaccos. The yellow tobaccos of Abkhaziya are of high quality, have an export value and stand in the first place in the Soviet Union. Tobacco in this region should be the leading crop. Its yield at present is still low, on the average 6.5-7 centners per hectare. Trapezund and Samsun varieties are recommended. These varieties are not pure stocks, but of Asia Minor origin. There is still met with "tuk-kulak", which grows on the upper part of the zone. The most favorable zone for tobacco lies here at an elevation of 100-300 meters above sea level, the most important location being Sukhum Okrug. However, tobacco may be grown even higher, up to 500 meters above sea level, provided that the soil is not rich in nitrogen. Together with tobacco, grapes are cultivated,



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but there is no prospect for developing grapes until means are found to fight its diseases. Cotton raising is carried on a small scale for consumer use and no varieties which may be used for industrial expansion are being grown.

Thus, the tendency of the region is in the direction of tobacco growing. Tobacco may be a monoculture or sown together with legumes, feed grasses and peanuts. The winter growing season is used for cover and feed crops, utilizing the same variety of plants as mentioned in the preceding region.

Subtropical fruits occupy a supplementary position here.

XXVIII(3) South Abkhaziya, situated between Kodora and Ingura Rivers.

The zone varies from 0 to 200 meters above sea level in the former Kodora and Gal' Uyezds. This is also a subtropical region, but with a colder average annual temperature of 13-14 degrees, with a later spring and higher humidity. Because of an abundance of rivers, there is to be found a predominance of alluvial soils of varying vigor. The wide maritime lowland in Gal' Uyezd stretching to the south from Ochemchir to the mouth of the Ingura is alluvial (loam-marsh and podsol-gley soils often go far up the river valleys). The hilly zone is characterized by podsols, but also with red deposits (red earths).

As in the preceding region, monoculture of corn occupies first place (especially in former Gal' Uyezd, where it is more than 90 percent). It is accompanied by the kidney bean. The growing of foxtail millet is also to be found.

The abundance of alluvial soils in the region, especially in the former Gal' Uyezd, emphasizes the need to cultivate subtropical volatile-oil plants (geranium, lemon sorghum), primarily in Kodora



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Uyezd along the river valleys, cultivation of flower bulbs - in the narrow maritime belt of Gal' Uyezd, and, in particular, "rami", - is the principle culture in Gal' Uyezd. There are possibilities for the cultivation of "rami", but only where subsoil waters are not closer than 1 meter (0.9 meters) and in the absence of a water-impervious layer for the same depth. First and second terraces are preferable. Cultivation must be on ridges having a slope for the removal of stationary water. Water draining ditches and manure fertilizers are necessary. However, the development of these cultures on the necessary scale would be possible only after the promulgation of a number of meliorative measures. This region is still considerably covered with low-lying woods (nizovymi lesami) with lianas, while the lowlands are marshy and in need of drainage. There, where woods have been cleared, tobacco is planted. However, the quality of tobaccos here is inferior to those north of the Kodora, and there are no prospects for tobacco culture here. The presence of heavy soils creates the necessity for introducing the cultivation of legumes for feed and green fertilizer. The scope and conditions of cultivation are the same here as in the preceding regions. White lupine as a winter cover crop should be encouraged in every way. The planting of grasses should be of particular value in horticulture, as well as in-between rows of tea, as a winter culture. Of oil beans, the peanut and the soya bean should be encouraged. The red-earth and yellow-earth soils must be entirely devoted to the cultivation of tea. The sweet potato shows much promise. Many persons consider this region as suitable for the cultivation of forest nuts (funduk), the planting of which has already been begun here and which gives dependable harvests. This



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specialization should not be sanctioned, inasmuch as the cultivation of valuable fruit, medicinal and technical trees can be considered quite promising here. The cultivation of the tung oil tree, the camphor laurel, and tangerines are to have first preference. Funduks should be grown in the elevated zone together with cork oak, tannic acacia, etc.

Winter vegetable growing can be based here on the cultivation of early potatoes and other vegetables.

Stock raising of small animals (hog raising and poultry growing) and silk raising are native trades here, having a consumer character, and they should be preserved and developed in connection with the planned development of the cultivation of feed crops.

XXVIII(4) The hilly belt varying from 200 to 400 meters above sea level between the Kodora and Ingura, as well as a considerable part of the hilly belt in the former Senak Uyezd.

The soils are humus-carbonaceous and in spots boracic-earths (burozemy). The region specializes in growing prunes for export as its main crop. The tobacco grown here is of low quality and shows no promise. Corn and kidney beans should be completely cut out. The region, depending on soils and temperature, occupies the same position as indicated for the preceding region.

XXVIII(5) The littoral hilly belt of Adzharistan ranging up to 400 meters elevation above sea level and the somewhat-removed-from-the-sea hilly belt of the ancient terrace of Zugdidskiy Rayon of Georgian SSR. It encompasses the former Batum part of Ozurget and Zugdid former Okrugs.



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The region is characterized by a narrow littoral belt (Kakheber and Kobulet plains), the gorges of Chakva and Chorokh(a) Rivers, but principally by rolling hills (hills of softly rounded outline), which create the presence of micro-climates and the separation of especially favorable subtropical spots. It is a very characteristic and warm region of the subtropics in the USSR, with an annual precipitation of 2,400 millimeters, having a humid summer (during the summer there is a rainfall of 560 millimeters). The summer growing season lasts on the average more than 8 months -- 245 days. The average temperature of the coldest month (January) is 7.5 degrees, July 23.8 degrees. The average annual minimum is minus 3.3 degrees; the absolute minimum has been for several years minus 8.0 degrees. Temperature does not drop below this level. Quite frequently the winters are completely without frost.

The soils are podzol red earths on the hills, river alluvial in the river valleys and maritime alluvial along the narrow littoral belt.

Tea is the principal culture for this hilly belt region and partly for the plain area (where there are to be found turf-podzol red-earth soils). This is the oldest and most-experienced tea growing region, and because of extremely favorable conditions (a humid summer, abundance of red earths, and a warm winter), it is possible to experiment with and cultivate here the more heat-loving and costly varieties and types of tea. Research work on tea should be concentrated here -- development of varieties and selection, the chemistry and technology of the tea leaf, as well as tea seed growing, that is, the organization of special nurseries, the production of seeds for starting new plantations. There is a strong need for cover



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crops for developing tea growing. In spite of an abundant rainfall, it cannot be considered as sufficient during the summer to satisfy both the tea plants, and also their concomitants, that is, the summer cultivation of crops for green fertilizer in-between tea rows. On the contrary, the late autumn and winter periods may be used for the in-between row cultivation of such crops as legumes, vetch, kidney beans, etc. In view of the absence of lime in the red earths, it is possible to experiment with the cultivation of winter white lupine. The small amount of manure to be found in this region is used for fertilizer on tangerine plantations.

Increase in the amount of manure for use in tea growing will become possible by developing winter and summer planting of feed crops. The considerable population of the region, the presence of resorts, still little-used because of the presence of malaria, show the necessity for a dairy industry, which could assure consumer needs, if only the cultivation of feed crops were to be developed. Moreover space for some of them is available (as in-between row crops) for crops supplementary to tea such as subtropical fruits (tangerines, oranges, persimmons, feijoya, etc.). At present we frequently notice that the ground under tangerine trees is simply overgrown with weeds. For winter crops there can be used vetch-oat mixture, "mozgovaya kapusta" /brain cabbage/ and thousand-headed cabbage, Alexandrian cabbage, while for summer crops under the same conditions there should be grown lucerne, soya beans, crotalaria, annual lespedeza, etc.

Contemporary field culture is represented basically, especially on alluvial soils, by a monoculture of corn, which is being subjected to determined efforts for discontinuing it, and which should be completely eliminated from this region, by securing simultaneous



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assurance of importation of bread and by increase in knowledge and skill in growing valuable subtropical crops. Soya bean and the kidney bean act as accompanying crops to corn.

In Kobuletskiy Rayon, there is grown an endemic variety of dry-growing rice in the low-lying areas where there is much soil moisture. In individual locations the sown area of the dry-growing rice reaches 10 percent of the total sown area. An important feature to be found here is the winter cultivation of the dry-growing Adzhar variety of rice. We consider this culture to have all-Union significance, because it serves as a source for selective work with dry-growing and cold-enduring strains of rice. In spite of the very mild winter in this region, the average absolute minimum temperature reaches minus 3.3 degrees, and the growth of rice on a field scale in such a minimum temperature becomes a factor of extraordinary significance. It is to be understood that the cultivation of rice must be left intact in this region or show some prospects. But the rice strains must be widely made use of. Rice meets here such competitors as the geranium, New Zealand flax, lemon sorghum -- plants which should be encouraged and be grown on field scale. The development of winter vegetable raising must also be subjected to the elimination of winter cultivation of rice in Kobuletskiy Rayon. In this plain zone the principal crops should be New Zealand flax, volatile-oil plants, eucalyptus, and secondary - podzolic tea, etc.

In view of the restricted area of land suitable for winter vegetable growing in this region, (approximately several hundred hectares), it is obviously bound to have a limited local consumer importance.



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Even to a larger extent than Sukhumskiy Rayon, the region under description must be subjected to the development of the cultivation of the more valuable subtropical fruit, such as tangerines and oranges, as well as the growing of arrowroot plants in shady humid places, and to an increase in the growing of palms for industrial use, eucalyptus trees, etc. Bamboo should be grown in ravines on an industrial scale.. This region is the warmest in the USSR and best provided with rainfall for the year around. Here there should be organized the first introductory nursery for the raising of subtropical and to some extent tropical plants.

XXVIII(6) The Foothill belt of Adzharistan and Guriya, with podzolic greyish-boracic soils, ranging in elevation from 500 to 900 meters, having an annual rainfall of approximately 2,000 millemeters, and an annual temperature of 12 degrees, which is higher in some places (Surebi and Khevi). The soils are argillaceous and stony-sand. The region includes former Kedin Uyezd, the highland part of Kobulet Uyezd and Khevsko-Surebskiy Rayon of Ozurget Uyezd.

At the present time the region is characterized by a strong development of grain growing, with corn at the head. Furthermore, the sowing of corn is on a monoculture basis, more than 90 percent of the sown area being devoted to it. Tobacco raising is practiced, especially in Guriya, where the strain has no independent significance, being used in mixture with other tobaccos. In the Guriya section of the region foxtail millet is grown. The relief of the region, with much territory consisting of steep slopes, is little predisposed for field cultures and better suited for arboreal plants, in particular, bamboo. For this region there should be planned here the development of fruit trees and arboreal plants, with bamboo in ravines and gulches.



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The camphor laurel, the persimmon, the mulberry tree for silk raising, etc., must be developed. Corn and the kidney bean should be eliminated from this region and replaced by tobacco. Field culture is possible here, and should primarily consist of tobacco, leguminous plants and the soya bean. Winter crops should be similar to those in the preceding zones, but not from the point of view of feed crops as stock raising here is hardly practical. The cultivation of tea is possible in the Surebi and Khevi defiles.

XXVIII(7) The Kolkhid lowland which is partly watered by Supsa, Rion and Khobis-Tskhali Rivers. It includes the lowlands of the former Senak, Zugdidi and Ozurget Uyezds. The climate is humid subtropical. The probability of freezing weather is much greater than in the Batum Rayon. The first frosts appear toward the end of December. Freezing weather is rare in March. Days without a thaw are very rare and sometimes do not exceed 1-2 for a ten-year period. The absolute minimum temperature in an individual instance has reached minus 11.5 degrees centigrade (at Poti). The average minimum has been for several years minus 4.0 degrees centigrade. The maritime part of the lowland is characterized by a warmer winter and a less hot summer, than the inland lowlands. The annual rainfall is also uneven throughout the territory -- in Poti it is 1,600 millimeters, but in the eastern part of the lowlands 1,200-1,300 millimeters. The maximum precipitation takes place in the summer and autumn, while at Batum it is in the fall and winter. The driest month is May. The region is subject to heavy downpours, up to 100 millimeters, and even 200 millimeters at a single time. The snow cover on the average stays 9-10 days during the year, rarely as much as 15 days. The eastern part of the lowland has a lower relative atmospheric humidity,



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because it is not subject to the action of sea breezes, and, on the contrary, is subject to the action of foehn winds, especially in spring. The Kolkhid lowland is covered in part by low deciduous woods, with underbrush of evergreens, extremely dense and strong, interlaced with lianas, and in part by shrubbery, growing in cleared areas, and trampled over by cattle, in part by grasses on the sand dunes, and finally, to a considerable extent -- by different kinds of marshes (sedge, rush, peat, etc.).

The soils of the Kolkhid lowland are saturated with moisture, as a result of the character of the relief, tending to retain water, remaining from river inundations and rains. They are to be divided into three groups: marshy, podzolic and alluvial. The rivers of the Kolkhid lowland, especially the powerful Rion River, take away tremendous quantities of silt, which has gradually resulted in a higher elevation for these places, resulting in their domination over the marshes and in the creation of favorable conditions for vegetation. The marsh soils should be drained, with work in this connection already having started. With the drainage of large areas of the Kolkhid lowland and their transformation, together with the alluvial soils, into agricultural areas, there should be wide possibilities here for the development of subtropical branches of agriculture, worked together into large farming enterprises.

At the present time the region still is a consistent grain crop area, with a monoculture of corn, which occupies about 95 percent of the sown area, especially in the western part of the lowland on the alluvial deposits in the lower reaches of the Rion and Khobis-Tskhali Rivers. The corn yield vacillates here between 12 and 20 centners, depending on the degree of soil impoverishment, the



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fertility of which is maintained by new silting and the growing of legumes in-between corn rows. Manure fertilizer is not used in field culture, inasmuch as the cattle live on green pasturage, and the collection of small quantities of manure is done only in the areas near living quarters.

Of the varieties of corn, there is grown the "Kutais hybrid" of the dent type, which is late maturing, tall, and with two ears on the average per stalk.

In-between rows of corn there are considerably widespread sowings of soya and the kidney bean. Inasmuch as soya bean here is an old culture, used in baking bread (soya-bean flour is added to corn flour in the baking flat loaves), and as a feed crop (hay). There is also sown foxtail millet and white lupines. The surplus of corn grown here is used for export and for raising small livestock (hogs and poultry). To a very small extent in the region there is cotton cultivation without irrigation (of the type of Kutais gymnosperm related to the Gossypium punctatum), also the growing of rye grass, as a feed crop, and the raising of vegetables. All of these branches have only local consumer significance.

In studying natural and economic factors, we have reached the conviction that in the process of reestablishing plant cultivation, the region must be subjected to big changes.

The Five-Year Plan presupposes the organization in this region of an important crop raising base along the lines of subtropical textile crops, in part -"rami" and New Zealand flax, with the planting of "rami" on the light alluvial deposits, and of New Zealand flax on the heavier ones.



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First of all one must take into consideration that the region has not yet been oriented nor prepared for the development of plant cultivation. The entire Kolkhid lowland may be devoted to growing "rami", provided there is careful drainage and preparation of the soil. Particularly suitable are the first and second terraces of the Rion and other rivers. In view of the lack of drained land, "rami" is still grown on old plowed land, with low lying sub-soil waters (not higher than 1 meter), with spring plowing and the bringing in of manure fertilizer.

The western (maritime) part of the lowlands is more suitable for "rami". The eastern part is subject to foehn winds, which have a harmful effect on "rami". The Rion valley, generally speaking, is with respect to soil the best possible region for "rami", but it requires protective planting against the foehn winds. Experience shows that good results are achieved with New Zealand flax. New Zealand flax can grow in very damp places and even in marshy areas if simple drainage ditches are made. The variety growing in the USSR gives a coarser, but very durable fiber, which is of exceptional quality for making binder twine, cable, etc. While for "rami" we have a not-so-bad starting stock for selection and grade experimentation, with respect to New Zealand flax there is little quality stock and technologically limited, and not at all suitable for making thin cloth. For this reason, and also because of the extremely favorable Kolkhid lowland for New Zealand flax, which can become its specific region, it is necessary to take steps to obtain the valuable varieties, which are to be found in New Zealand and which are a monopoly of that country and have a high reputation.



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The cultivation of the club palm should also find a place here.

The cultivation of geranium and lemon sorghum has for this region theoretically favorable conditions. However, from a practical standpoint, the question of the influence of foehn winds on geranium and also the influence of heavy rains, which take on here a harmful character, have not yet been studied. Both with respect to winds and downpours, the leaves of the geranium, which require dampness, may be spoiled.

Of the other industrial field cultures there should be grown in this region the soyá bean. The great capacity of this subtropical region, where obviously subtropical field crops should predominate (among them "rami", etc.), allows a sown area to be completely set aside for the soyá bean, which does not have to be considered as an independent, but as an intermediate culture. Corn must inevitably disappear as a food crop, in spite of the fact that this is the principal region in the entire Trans-Caucasus for growing it and giving market surpluses. It can retain its significance here only within the framework of supplying grain feed for poultry and hog raising, and sometimes stalks and leaves for silage. Its concomitant cultivation with the soyá bean, which is sown in-between rows, makes it feasible to keep corn in this region, to the extent of several percent of the total sown area. Besides, corn may be grown here through mixed sowing with "dolikhos", which develops into a tremendous green mass in the second half of summer. The soyá bean is thought of as an oil-bearing plant, used in oil cakes for feed, but besides this, soya hay, after harvesting, can play a certain role as an insuring agent in case of crop failure of other feed crops. The peanut suffers in this region from "fuzarioza".



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The region can develop its own productive stock raising, completely satisfying its own needs and those of nearby localities. A whole series of special crops can serve for feed, divided into summer and winter crops. In winter we have turnips, leaf (brain) cabbages, winter rape, Alexandrian clover, vetch, legumes, etc. As summer crops there should be mentioned: sorghum (for silage), feed sweet potato, crotalaria, rye grasses, paspalum, etc. Parallel to this, the cultivation of green fertilizer plants, such as the velvet bean, "tsiamopsis", and a number of others, should receive wide development by using the winter growing season. These were mentioned by us for the preceding regions.

Winter-sown white lupine should acquire extraordinary significance in this region for planting on alluvial soils, especially the multileaf, few-spiked varieties, like the winter shrub forms to be found in the collection of the Institute for Plant Cultivation. This can become of primary significance not only with respect to supplanting manure, but also from the point of view of feed if there should be planted and propagated non-alkaloid types.

The growing of the sweet potato as a food and fodder crop should be widely encouraged on the light alluvial soils of the region in those places where there are no close subsoil waters and where in general there is no supersaturation of moisture, and even possibly on the breeze-swept hilly areas. It would be necessary to set up experimental sectors for testing different varieties in 2 or 3 locations of the region and to construct sweet potato storage facilities with dryers.

With respect to winter vegetable growing, the region is very promising in the non-marshy areas of the Rion valley. The lack of



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manure for the vegetable sown areas may be supplemented by total lupine fertilizing together with the addition of the missing phosphorus and potassium in the form of superphosphates (or the cheaper phosphorite fertilizer) and potassium salt, as well as by the proposed development of stock raising, though on a consumer basis, with possible accumulation of manure. Sametredinskiy Rayon, as well as the belt of slopes along the railroad, is suitable even now, while the proposed reclamation of the lowland will increase the land area for vegetable growing. A competitor may be found in the early-growing garden strawberry, which has already proved to be, in Soviet practice, of export value. Construction in the Kolkhida lowland of large power plants requires the supplying of workers to a large extent with vegetables, sweet potatoes, etc.

Much importance is not attached to fruit growing in this region. But it is important to determine the lemon growing possibilities of the region. In Poti there are old but good fruit-bearing lemon trees, which have not suffered during recent and past severe winters, when the tangerine plants were destroyed, even though they have grown again from the roots. For protection against winds and for fighting malaria, the protective planting of eucalyptus trees of the more winter-resisting and fast growing types should be widely carried out. For this region there are planned areas for industrial plantations growing the tung oil tree (for the lac dye industry). The growing of the mulberry tree should also be developed.

As can be noticed from all that has been said, this region has a special character, its great potentialities demand extensive reclamation measures, like the draining of marshes, the clearing of low-growing timber and shrubbery, the fighting against malaria

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(which here is on the scale of a national disaster), fighting against the consequences of heavy rains, and making efforts to crowd out the widely grown corn, orienting the entire territory for establishing new crops. They require the construction of a mineral fertilizer plant and of plants for the processing of raw materials, arranging to supply the local population with shipments of grain, etc.

XXVIII(8) The lowland and hilly section of West Imeretiya, approximately up to 200 meters above sea level. It includes the lowland section of former Kutais Uyezd.

This region extends latitudinally from Samtred to Kutais, and even further. The climate is not as humid as in the preceding region. There is a smaller rainfall. May and June are considerably drier, sometimes quite dry. The relative humidity of the atmosphere is relatively low. Frequently foehn winds blow from the northeast. The rainfall is 1,200-1,300 millimeters, most of which occurs during the winter. The average annual temperature is 14 degrees. The average absolute minimum temperature for Kutais is minus 6.1 degrees.

The soils around Kutais for a considerable area are river alluvial deposits with an admixture of gravel, for most of the remaining part -- podzolic.

Field culture does not play a basic role here and its greatest economic significance is to be found in silk-raising and small stock-raising (poultry-raising and hog-raising). As in the preceding regions, field culture is based on a monoculture of corn, with in-between row sowing of the soya bean, the kidney bean, and pumpkin. Corn takes up more than 90 percent of the plowed land. Cotton raising is on an insignificant scale (without irrigation, the Kutais gymnosperm variety) and has no industrial significance. Tobacco is grown to an even smaller degree.

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Because of a dry spring, irrigation is frequently resorted to during the dry season.

In perspective, the region specializes in the cultivation of European and partly subtropical fruits, for export and for the local working population. The fruits are grown on podzolic soil, while only the light river alluvial soils are used for growing "rami". For successful growing of this crop protective trees must be planted. For silk raising, there must be mulberry bush plantations. Corn, in spite of its high harvest (up to 50 centners), must yield its place on alluvial soil to "rami". Besides "rami", light soils may be devoted to growing sweet potatoes. With respect to feed crops, it is necessary to encourage the winter cultivation of white lupine (on alluvial soils), the winter cultivation of legumes, vetch, the summer cultivation of the velvet bean, etc. The soya bean and feed crops (summer and winter) can be grown on podzolic soils under orchard trees.

The transforming of Kutais into a socialistic industrial center (silk-weaving and textile mills), the proximity of industrial anthracite and manganese mines and of a ferrous-manganese plant at Zestafoni, the canned goods combine being built at Kutais, urgently call for establishing vegetable growing and dairying in this region. For later vegetable growing ("tardivy") there are required alluvial river soils. Consequently they must be broken down into three categories: "rami", late growing vegetables ("tardivy"), and the sweet potato. The sweet potato can replace the ordinary potato both in autumn and summer.

As regards early vegetable growing, that can be done on the irrigated gravel soils, which become warm easily. The growing of early potatoes is also possible here.

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XXVIII(9) The hilly belt of Central Imeretiya, varying from 200 to 600 meters above sea level. It includes the eastern part of the Rion valley and the valleys of the lower reaches of the Kvirila rivers and neighboring rivers. Here are included the hilly part of former Kutais and former Shoropan Uyezds.

The climate is colder. Field culture is based on corn (more than 95 percent), and partly on cotton, (the gymnosperm), tobacco, etc. A leading role is played by viticulture (Svir' wine). This branch must continue to be a leading one.

Moreover, the development of subtropical and European fruit growing (persimmon, medlar, fig, peach, cherry [both vishnya and chereshnya]) is planned. In the northern part of the region, on the timber soils, fruit growing will become a leading culture. The alluvial river soils must be set aside for the growing of "rami" (principally), partly for vegetable growing for the workers in Zestafoni, and for feed crops. Bread grains must be brought in. Inconvenient land may be used by such valuable plants, as the mulberry tree (for silk-growing), bamboo, cork oak, etc. It is possible to grow American nuts - pecans.

Feed crops, both summer and winter, are needed everywhere, and are of the same kinds as in the preceding regions.

XXVIII(10) The foothill zone of Abkhaziya and Mingreliya, varying from 500 to 900-1,000 meters above sea level. It includes all the former uyezds of Abkhaz SSR within the limits of the indicated altitude, as well as parts of Zugdidi and Senak former Uyezds. This highland zone is characterized by a very broken relief, a moderately warm climate, with a rainfall of 1,700 and more millimeters. It is covered by mixed forest of the mountainous zone and has river slopes



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suitable for plant cultivation. The soils are varied, being more frequently humus-carbonaceous and sometimes non-carbonaceous.

At present the principal agricultural branches are: field culture, stock-raising, and partly apiculture. Of the field cultures, corn is predominant, the Kutais hybrid being grown, as everywhere else, in West Georgia. But here the dent tendency of this hybrid almost completely disappears, and is replaced by the flint type of hybrid. There already begins in this zone the cultivation of wheat -- primarily soft and principally the non-bearded varieties (Lyutestsens and Mil'turum), and partly the bearded varieties of Eritrospermum and Ferrugineum. There also is grown a Caucasian endemic variety of wheat (Triticum persicum). To a small degree barley, rye, potatoes (Early Rose variety), tobacco, and hemp are grown. The red seed, non-creeping, fast maturing variety of kidney bean is sown together with corn.

Because of the distance of individual localities in the region from good transportation, corn, kidney beans and wheat (winter) are significant here only to a slight degree, and also because suitable land is limited.

On the whole, the region should be devoted to such nut-bearing crops as pecans, walnuts, hazelnuts, etc., crops which can be easily transported, as well as European seed-bearing plants. Here the cork oak should be cultivated on a wide scale.

XXVIII(11) The highland zone of Abkhaziya and Adzharistan varying in elevation from 1,000 to 1,500 meters above sea level. This zone enters into all uyezds of Abkhazii and Khudoyskiy Rayon of Adzharistan.



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The climate of these regions is moderately cold, with a winter of many snows. Timber covers these highlands to a considerable degree. Wheat and barley are sown in the more level open areas. The region is suitable for tobacco, nut, apple and berry cultivation. Field culture of a consumer nature must preserve its significance. There is possible the cultivation of Racha and other highland fast-ripening varieties of flint corn (with small ears), the cultivation of soft wheats (winter), and in particular Persian wheat (summer), and of summer barley. The growing of grain legumes and also various vegetable crops is needed. Wide promotion should be given to the growing of potatoes and sown feed grasses in the areas reserved for fruit orchards.

XXVIII(12) The Eastern foothill Imeretiya and Lower Racha-Lechkhum, varying in elevation from 600 to 1,000 meters above sea level. This includes the eastern part of the former Shorapan Uyezd and the lower part of the former Racha-Lechkhum Uyezd.

The climate varies from moderately-warm to moderately-cold. Winter is with snow cover. Precipitation is up to 1,300-1,400 millimeters. The soils are grey-soil forest and to a lesser degree humus-carbonaceous.

The region has a considerable development in viticulture and field culture. Corn takes up more than 80 percent of the sown area. Here winter wheat is met with to a considerable degree, and to a small extent, summer barley.

The hard wheats of Racha are little prevalent. A small place of other field cultures is given to ordinary millet and to foxtail millet. Animal husbandry (small) is developed only on a consumer scale. Fruit growing is of considerable importance (seed varieties).



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In perspective, the region offers a foundation for the development of viticulture and fruit culture, as well as stock-raising, which must be serviced by sown feed grasses, using together with them natural pasturage and feed (beechnut for hog-raising, and acorn).

Field culture is not adequate to feed the population with its own grain and bread grains must be brought in. Winter sowing of hard and soft wheats is possible, and fast-maturing flint Racha corn, summer barley, food and fodder potatoes for hog-raising are grown.

XXVIII(13) The Upper-Racha (Verzhne-Rachinskoye) and Upper-Lechkhum (Verkhne-Lechkhumskoye) plateaus varying in elevation from 1,000 meters to more than 18,000 meters. It includes the former Verkhniy Racha-Lechkhum Okrug.

The climate is moderately cold, with an annual temperature varying from 6 degrees to 8 degrees and an annual rainfall of about 1,200 millimeters. The winters are long and with a deep snow cover. The region of deciduous forest changes with altitude to pine-fir forest. The soils are forest grey clay with different hues. The percentage of sown area is insignificant, only about 6 percent. The population, because of the difficult conditions for farming and the insignificant sown area, takes part in seasonal trades. The poverty of the soils makes it necessary to fertilize with manure. Animal husbandry plays a dominant role. Both large dairy cattle and small animals are raised.

For elevations up to 1,400 meters, corn takes first place in field culture, occupying here 43-45 percent of the sown area, in some places less, in others, more. Local flint fast-maturing varieties are grown. In the 1,400-1,200 meters zone, there is cultivated a short,



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exceptionally fast-maturing variety, the Mtis-Sishindi, having small conic cobs about 12 centimeters long, with 100 kernels weighing 22-23 grams. In the 1,200-900 meter zone, there are grown two varieties, the white-grain and the yellow-grain, also with small cobs, but with a larger kernel, so that the weight of a hundred kernels reaches 31 grams. They yield 3-5 centners per hectare. These three strains of corn are of exceptional interest for selection, and in this sense can have all-Union significance.

Winter wheat can be grown up to 1,400-1,500 meters in elevation. In all of Georgia and throughout the entire Trans-Caucasus, the culture of wheat does not know of pure-strain sowing. There are growing mixtures not only of strains, but of completely different varieties and even species of grain (wheat and rye, wheat and barley).

In Racha the cultivation of wheat begins at an elevation of 700 meters, and in the zone above 1,200 meters, where corn reaches its upper limits, it becomes the main culture. Winter sowing considerably exceeds summer (percentage of winter wheat is 25-35 percent, that of summer wheat up to 7 percent). Sowings of wheat here have to be weeded because of extraordinary growth of weed grasses. The stock to be sown is little cleaned and because of this there are sown up to 2½ centners per hectare, inasmuch as a significant percentage belongs to seeds of weed plants. Most of all, there are grown soft wheats, and of these, the bearded varieties of eritrospermum and ferrugineum, which reach the limits of agriculture. The non-bearded soft wheats can grow only up to 1,000 meters in elevation, and consequently are to be found in Lower Racha. Second place is taken by a new form of wheat, the Triticum persicum which is endemic to Georgia and Armenia, incorrectly called Persian wheat (for it is not to be



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found in Persia). It begins to grow at 1000 meters and is a single-color crop. This type of wheat is a typical high mountain variety.

Barley is almost exclusively summer grown and is to be distinguished for its relative mono-variety. There is widespread here a famous strain of double-row barley -- Kolkhikum -- serving as stock for selection of barley for the European part of the USSR. This strain is famous for its resistance to the Swedish fly, and for the high quality of its kernel. Four-grained barley is very rare in Racha and is mostly encountered in Lower Racha.

Rye is not cultivated in Racha, but the weed-field rye chokes wheat and barley to such an extent, particularly when approaching the limits of agriculture, that sometimes 80 percent of a wheat sowing is found to consist of this rye plant.

Oats are also not cultivated here, but are characteristic as a weed-field plant in sowings of wheat, particularly spelt.

Potatoes have become widespread recently in Upper Racha-Lechkhum, which together with barley at the limits of agriculture are the only cultivated crops.

Field culture is carried on quite extensively. Steep slopes of mountains frequently make it necessary to construct small, primitive terraces. Field sectors are small, work is by hand, the sowings are scattered and weeding of wheat and barley is carried on by hand. The cattle during the summer are pastured and during the winter are fed with straw and hay, as a result of which the cattle is little-productive. Lack of feed determines the extent of animal husbandry.

The future of Upper Racha-Lechkhum is to be based on the development of animal husbandry (large and small), with processing



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of milk into butter, cheese, etc. To provide for cattle raising it is necessary not only to make use of natural pasturage, but also the nuts of beech trees, and also to establish the cultivation of feed crops, such as root plants, vetch, legumes, beans, etc. These crops must be rotated with winter wheat, summer barley, and potatoes. The ancient cultivation of grains has resulted in the creation of fast-maturing and resistant types, which should be studied and used as a basis for selection. Sown area for potatoes must be considerably increased. The development of animal husbandry and the cultivation of legumes helps to keep the soil fertile. The cultivation of vegetables should be of local consumer significance.

Technical crops that can be raised include hemp, long-staple flax, makhorka, gold-of-pleasure and lallemantia.

XXVIII(14) The high-mountain limits-of-agriculture areas in Abkhaziya Mingreliya, Svanetiya, and Imeretiya.

The climate of this region is cold, with a short growing season, an average annual temperature below 6 degrees, a prolonged severe winter, precipitation of 1,000 millimeters, frequent mists, and cloudiness. The soils are grey forest and mountain-meadow. Poor routes of communication isolate the population for long periods of time from the culturally more advanced areas.

It is a cattle-raising region, with insignificant field culture somewhat resembling the oasis-type (on convenient slopes, artificial terraces) and having insignificant harvests. There is cultivated a Dika (Persian) spring wheat, several strains of soft wheat, spring barley, sometimes peas, and potatoes.

The region can be developed for stock raising. There will be required an increase in feed crops to provide cattle with winter feed.



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Cereal grains must be brought in. The cultivation of potatoes shows much promise, and for industrial crops -- the oil-yielding gold-of-pleasure, white mustard and long-staple flax.

XXVIII(15) The Akhaltsikh plateau basin, with an average elevation of 1,005 meters above sea level. It is surrounded by mountain ridges, -- in the north, by the Akhaltsikh Mountains, in the southeast, by the Ulgar ridge, and in the west, by the Arsian ridge. It includes the former Akhaltsikh and in part Borzhom Uyezds. The inner parts of the basin consist of a rolling territory crossed by the Kura River interrupted by spurs and gorges of the Akhaltsikh and Trialet ridges, covered with coniferous and deciduous forests. The climate in the very small area of the central part of the basin is moderate (along the right bank of the Kura), but in general, for the greater part of the center of the basin - moderately cold, and is mostly dry continental, except for the outskirts, where it is sub-Alpine cold. The average annual temperature varies from 9 degrees in the center to 6-7 degrees at the periphery. The annual rainfall is 500-600 millimeters. It has a prolonged cold winter. The soils are primarily grey-forest in the central part and mountain-meadow on the outskirts. Vegetation presents elements of Kolkhid (here and there) and mountain-Armenian plant life. Farming is more frequently non-irrigated, except for the middle part -- along the Kura, Koblianchay, and Potskhovki Rivers -- where it is irrigated. Grain cultivation is strongly developed, wheat occupying more than 50 percent of sown area, barley 30 percent, and corn 11-12 percent. Corn is to be met with in the warmest zone; the central part of the basin is the zone of winter cereals, while closer to the periphery one finds a



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belt of summer cereals. Spring unmixed crop sowing consists principally of barley, followed by wheat and potatoes; winter sowing, of wheat. Close to the large inhabited places in the central part, fruit growing (principally apple) is developed.

Field cultures in the main have not been at all studied.

Soft wheats are rather widespread, with the winter varieties concentrated in the lower zone (from 750 to 1,100 meters), along the river gorges and carrying the names of Dolis-puri, Kartulipuri (among the Georgians), and Kyuzlyuk (among the Turks), while the spring varieties grow in the elevated zones (1,500-2,000 meters). In the great majority of cases there predominate the bearded red-kernel varieties, especially the variety of Ferrugineum, followed by Eritrospermum (in certain sections of the region, on the contrary, Eritrospermum predominates). The beardless soft wheats are very scarce, being met with as admixtures and only in the variety of Del'fi, which is rarely observed in pure sowing.

Hard wheats have a limited distribution, being met with on flats and consist primarily of the black-tasseled Tserulestsens variety.

Persian wheat is rather widespread (in the second place after soft wheat), but it occupies the elevated region, the zone of summer cereals, varying in elevation from 1,200 to 2,000 meters, in the form of more or less pure sowings, but more frequently as an admixture to spring soft wheats and to emmer (two-kernel spelt). There is prominent a variety of Rubiginozum. The local name for Persian wheats is Dika, and for spelt Asli (Georgian). Sowing of spelt (emmer) occupies the elevated zone. Other varieties of wheat are to be met with, but rarely.

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The region is characterized in general as being wheat, barley, and potato growing. Cattle raising is developed relatively little, but shows promise.

The possibilities for irrigation are great, inasmuch as the region is many-watered, but the relief is little suited for delivery of water. The development of tobacco growing is planned for the irrigated areas and already has taken hold and should be promoted together with the development of seed horticulture.

It is possible to develop the cultivation of cucurbits, sorghum, corn, and legumes -- chick-peas and kidney beans. Grass growing is necessary for the cattle-raising zones, inasmuch as natural hay harvests fail to satisfy feed requirements. It is possible to grow feed root plants.

Winter wheat and spring barley, and in places even winter barley, should be promoted. It is necessary to study the local varieties for selective breeding purposes.

XXVIII(16) Akhalkalak plateau (Akhalkalak Uyezd) is bounded on the north by Trialet ridge, on the west by Kura River bed, and in the south by Chaldyr ridge. The average elevation of the plateau is 1,800 meters, but in the eastern and southern outlying parts it reaches 2,600 meters. The undulating but rather flat, treeless, lava relief in many places is made of the usual outline of broken-up treeless extinguished volcanoes. Depressions of the plateau are filled with fresh-water lakes. It has a continental plateau-steppe climate, with a wide annual range in temperature, an average annual temperature of 7-8 degrees, an annual precipitation of 500-700 millimeters primarily in spring and summer. The winters are severe. Most of the soils belong to typical mountainous black earths, in



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the lower zones to chestnut. There prevails a mountain-steppe zerophitic vegetation with a grassy sod. At high altitudes the mountain black-earth steppe becomes sub-Alpine meadow. Agriculture is non-irrigated, with the exception of a few places which are irrigated (near Akhalkalak). The fertile soils in view of a general water deficiency are restricted to cattle raising and dry farming. The principal occupation is still field culture, the main crops being wheat and barley. Spring sowings prevail. Winter planting is very rare, inasmuch as there are severe dry winters, with winds which blow away the snow-cover protection for winter crops. In spite of the fertility of the soil, the yield of grain crops is generally low and wavers between 7-8 centners per hectare for wheat, and 11-13 centners for barley. The reestablishment of fertility for old-tilled soils is difficult in terms of manure, since the absence of trees on the plateau, remoteness from other regions, and poor communications, makes it necessary to use manure for fuel.

Soft wheat prevails among the wheats, and, as everywhere else in East Georgia, there predominate the bearded red-kernel varieties of Eritrospermum and Ferrugineum, consisting of complex strains, which mostly have a tender spike, thin beards, with an easily threshed grain. There also exist varieties with coarse spikes and non-falling grains. The local strain has the reputation of being drought-resistant and being well suited to bread-baking. The beardless soft wheats are very rare and generally consist of Lyutestsens and Mil'turum strains. Together with the soft wheats, Persian wheat is fairly widespread, being grown in pure sowings, with a predominance of red-tasseled, red-grain variety: Rubiginozum. The primitive quality of the agriculture here is reflected in wheat fields containing not only mixtures of type and



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strain, but even visual mixtures, so that mixed sowings of soft, Persian and dwarf wheats are a common occurrence. They always contain an admixture of rye, sometimes as high as 50 percent. Hard wheats are met with on the plateau, as an accidentally brought-in admixture. Dwarf wheats are frequent and are accompanied with sowings of soft and Persian wheats. The Turkish and Armenian population frequently grows the two-kernel spelt (emmer).

Rye is rarely to be found as a pure culture, but is widespread as a weed on all wheat fields. This also applies to oats, which are practically unknown as a pure culture on the Akhalkalak plateau and are generally to be found in considerable diversity in sowings of emmer.

Barleys belong almost exclusively to the double-row types and particularly to the Nutans variety, represented principally by such strains as Kolkhikum, Montikolyum, Zonikum. The smooth-bearded variety of Medikum and occasionally the bare-grained Nudum are also to be found in this region. The multirowed barleys are very rare; among them are to be found winter types.

Oil-yielding field cultures are of considerable importance in the region and include flax, gold-of-pleasure, and rape, and particularly the first-mentioned, which belongs to a curly type and presents a relatively homogenous strain with fast-maturing, small-vessel and small-seed characteristics.

Flax is used for feed oil. More frequently one observes mixed sowings of all three cultures.

Hemp and grain legumes are rare. Of considerable interest are field peas, being found here partly in a cultivated, but more frequently in a wild-weed state, and showing considerable diversity. But most interesting is Alkhakalak winter vetch, belonging to the type



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Vicia pannonica (pannonskaya vika). It is found here as a weed, but, because of its extraordinary rich harvest, it serves as excellent fodder and is readily eaten by cattle. This strong winter-withstanding weed vetch has been adapted as a culture by the Akhalkalak peasantry and is sown in the autumn, yielding up to and exceeding 16 centners of seed per hectare. Its crushed seeds are used for feed either together with straw or by themselves. Of the spring vetch, ordinarily planting vetch is sown, which also is developed from local wild growing varieties. Potatoes are also grown on the plateau.

The future of the region should lie in an all-around development of dairy cattle raising for cheese and butter making, which should become leading industries. Hog and poultry raising should also be developed. In connection with this, there is complete justification for introducing into field culture the growing of root plants (turnips [Brassica campestris rapifera and Brassica napus rapifera] and carrots), an increase in the growing of potatoes, as well as an increase in the planting of feed grasses, partly legumes, Pannonian winter vetch, selected from local strains, introduction of the cultivation of winter varieties of melilot, alfalfa, clover (Bakur'yan varieties), timothy, etc. With respect to alfalfa, specific interest is presented by the local Dzhavakhet alfalfa (Medicago dzhawakhetica), which grows well on soils of disintegrated lava types, the typically high-mountainous frost-withstanding alfalfa, which has great diversity as to types, from the tall branching large-leaf types to the procumbent pasture varieties.

It is difficult to use it for grass growing, because it is a high-mountainous variety which does not grow below the pasturing zone. But it is necessary to turn one's attention to improving the condition of mountain meadows of this region and for providing the

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proper amount of participation by this alfalfa in mountain pasture lands.

Increases are also necessary in the sowing of barley and wheat, keeping in mind the considerable reserve of fallow land, the habitual deficit of grain in the region, and the possibility of using barley for feed. It is also possible to develop fruit growing (apples) and berry cultivation (raspberries, currants).

Apiculture has big possibilities in the region.

XXVIII(17) Tsalka plain, in the southeast crossing over into Gomaret plain and Bashkichet plain.

It includes the southwestern part of the former Tiflis Uyezd and the elevated part of the former Borchala Uyezd.

It is located in the basin created by the upper reaches of Khram, Karabulag, and Mashavera Rivers and has an average elevation of 1,500 meters. Its surface presents a treeless plain, bounded on the north by the Trialet ridge, on the east by Somkhet ridge, and on the west and south by the Mokryye (Wet) Mountains. The climate is mountainous-steppe, with severe winters, an average annual temperature of 7-8 degrees and an annual precipitation of 500 millimeters. The soils belong to mountain black earths, and, in the elevated parts, to mountain-meadow. The region is primarily a cattle growing one and, after that, grain growing, with promise of big development in apiculture. Farming is non-irrigated.

Spring [redacted] grains are grown exclusively, and only in individual cases does one come across winter rye. The prevalent culture is Persian wheat and its seeding consists almost exclusively of the red-tasseled Rubiginozum variety, with an insignificant admixture of other varieties. Soft wheats are rare. The cultivation of emmer, on



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the contrary, is not rare. The barleys are also spring, two-row and consist of the Nutans variety. In Upper Tsalka there is sown a wheat-barley mixture, known here as Ker-dika. Potatoes are grown successfully in this region. The presence of large summer pasture lands aids in the development of dairying, the production of Swiss cheese and butter. The western part of Tsalka is more suitable for small-horned cattle, in view of its being encumbered by fragments of mountain land. The region has been little studied.

XXVIII(18) Gori plain with the valleys of Kura, Bol'shaya and Malaya Liakhva Rivers, crossing over in the east to the Mukhrano-Saguram plain, with gradually sloping hills. It encompasses the former Gori Uyezd, the lowland and foothill part of South Osetiya, the western part of the former Tiflis Uyezd and a part of the former Dushet Uyezd.

The region stretches from west to east slanting towards Kura River.

Average elevation is about 750 meters for Gori plain and about 550 meters for Mukhran and Saguram plains, watered by Ksanka and Aragva Rivers. The climate is moderately warm, with a hot summer and a moderately cold winter, with an annual precipitation of 500-600 millimeters, and with an average annual temperature of 11-12 degrees. Rains fall primarily in spring and autumn. Half of the summer and winter is dry. The soils in Gori plain are light carbonaceous alluvial (so-called "lami"), with occasional tongues of deteriorated black earths in the northern part, becoming chestnut on the right bank of the Kura and in other places. On the western limits of the plain the soils are dark-grey forest. The carbonaceous alluvial soils of Gori plain are fertile in general, containing



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3-4 percent humus and 30-35 percent lime, but they are structureless and heavy for cultivating.

From the point of view of vegetation the region consists of a semi-steppe and is actually composed of three subregions: (a) Western (Gomi) subregion is a more elevated, hilly, more humid, and colder (winter barleys die from frost) with grey forest soils, hardly watered, typically grain area with a surplus of cereals; (b) Middle (and largest) subregion, with mostly (Gori-Tskhinval') carbonaceous alluvial soils, with considerable water resources, is a fruit-vegetable growing area, with a secondary significance with respect to grain crops; and (c) Outer Eastern (Mukhrano-Saguram) subregion, with chestnut-grey soils, partly watered, is a grain-growing, grape-growing, and partly fruit-growing area.

For the entire region, about 18 percent of the total sown area is estimated as being irrigated; the rest of the area is non-irrigated. In general, the principal occupation of the population is growing cereal grains. Approximately half of all field sowing consists of wheat; somewhat more than one third is devoted to corn, and a small percentage is taken by the cultivation of barley. The areas under corn are increasing very much in this region, and its cultivation here should be promoted as an industrial crop. Only winter wheats are cultivated in this region. Barley is concentrated in the eastern part of the region, wheat, on the contrary, in the western, for here barleys are killed by frost. Gomskiy Rayon, the valley of the Bol'shaya Liakhva, is one of the largest wheat regions in Georgia, giving a dependable, though not high, yield (6-9 centners) and possessing a grain surplus, with which it supplies other regions. Mukhran and Saguram plains also have significant sowings of winter wheat.



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In recent years in the western part of the region, the cultivation of sugar beet has been developing, with high yield, used as a raw product by a sugar refinery, built to supply Georgia with a sugar of its own cultivation.

The region is very poor in meadows and experiences a large shortage of feed, and, because of this extreme meagerness of meadows, in this respect it is one of the most deficient in all of Eastern Georgia. The middle section of the region with its carbonaceous muddy alluvial soils is largely irrigated and is occupied with commercial fruit growing (apples) and vegetable growing (cabbage), and partly with grape growing.

The apples have a good and far-flung market, while the cabbage is used to supply Tiflis and other large cities. Besides apples, pears, peaches, etc., are grown.

Viticulture of a high quality is established on Mukhran Plain (Ksan and Ton gorges), and Mukhran wines enjoy a good reputation.

Of legume plants, there is sown the kidney bean, the chick-pea, and the French lentil, generally in-between rows with corn.

The wheats of Gori plain (Gomskiy Rayon and South Osetiya) are extraordinarily rich in the composition of their sorts and its fields present a live collection of sorts in mixture. The most widespread are bearded soft wheats, with a predominance of the Eritrospermum, followed by Ferrugineum. The bearded soft wheats are collected only as admixtures (Lyutestsens, Mil'turum, Velyutinum, etc.). Still other numerous varieties are to be met with, the total number of which is eighteen. Hard wheats as predominating groups in the field are frequent and consist mostly of the black-tasseled varieties of Tserulestsens and Libikum. There are known two local strains of hard



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wheats: (1) Tavtukhi shav-tavela (Georgian), consisting basically of Tserulestsens, and (2) Tavtukhi Shav-pkha (Georgian) with a predominance of the red-tasseled variety: Apulikum. Hard wheats are generally to be found with a substantial admixture of diversified varieties of dwarf wheats.

Barleys, on the other hand, are relatively homogenous and represented by two local strains: (1) four-kernel types locally called Dzveli-tesli, with the variety Pallidum predominating, and (2) two-row types locally called Akhali-tesli composed of the Nutans variety.

There is also found as an admixture a black-tasseled barley called Nigrum.

Rye is not cultivated, but is common as a weed as everywhere else in the Trans-Caucasus. Corn belongs to the flint group.

All sowings of cereal grains have extraordinary collections of weeds. Among the weeds on Gori plain there is the so-called "makhobeli", related to the species Cephalaria syriaca, the seeds of which the local population deliberately allows to be ground with wheat for bread baking. This results in a bread with a blue color and a peculiar taste, which does not become hard for a long time. The blue Gori bread is known to all throughout Georgia. Researches by the Institute of Plant Cultivation have shown that a certain admixture of "tsephalyarii" causes the dough to be raised in baking, thereby improving the bread-baking potentialities of a number of sorts of wheat.

In perspective Gori plain shows much promise in the development of a more intensive agriculture.

The size of the sown area under sugar beet, fruit and vegetable cultivation may be increased to reach 50,000 hectares. This should



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at first correspond to the capacity of the specially constructed sugar beet refinery for satisfying the sugar requirements of Georgia and avoiding the import of sugar from the North Caucasus or the Ukraine. The cultivation of sugar beet demands still greater agrotechnical measures for assuring harvests. Besides sugar beet there should be developed grain legumes, oil-yielding plants (soya bean and peanut), field legumes and hard winter wheats. The last named, because they yield reliable harvests, should be continued, but to a smaller degree because of setting aside of acreage for sugar beet and legumes. The region is also suitable for establishing seed growing of selective strains of sugar beet and legumes. The shortage of feed crops should be eliminated so as to capitalize on the local propensities for the development of dairy farming for local needs and for the cities of Tskhinval and Gori. Mechanized cultivation is acutely needed here, because the local structureless soils are so heavy that for plowing, eight pair of oxen are required per plow, thus bringing about on the part of the local population the mobilization of all communal resources and thereby demonstrating the advantages of collective farming. The middle part of the plain has all the necessary conditions for an optimum development of fruit growing (apples, followed by pears and peaches), on a large commercial scale, for export to all-Union and foreign markets. Besides commercial orchards, there should be established experimental fruit nurseries for supplying sorts to other regions. In-between row cultivation in the orchards is carried on, of clover, winter vetch, winter rape (cold resistant sorts). Vegetable growing should also be developed for local consumption and for supplying nearby cities, among them the Tiflis industrial center. The relative intensity of farming in this



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region demands that chemical fertilizers be shipped in, as there will always be an appreciable shortage of manure. Viticulture shows much promise in Mukhran plain (Ksan and Ton gorges) for the manufacture of high-quality wines (Aligote, Ateni, and Khidis-Tavi).

XXVIII(19) Tiflis plateau and Iora plateau include the eastern part of the former Tiflis Uyezd and the southern part of Signakh Uyezd, known under the name of Ukanam-khare, as well as the Shirak steppe. The region stretches eastward from Tiflis to the south as far as Karayaz steppe and the border of Azerbaydzhan, to the north to the Kakhetian and Tsivi-Gombor ridges, and to the east also to the Azerbaydzhan border along the Iora River but not including the El'dar steppe. In general, the region is rather heterogeneous, having a continental climate which changes to a dry one, of plains and basins characteristic of the steppe and semi-steppe. The average elevation for the region is about 500 meters. The region orographically consists of plains, basins and rolling elevated expanses not higher than 700-800 meters. The soils are chestnut, chestnut-black earths, chestnut-grey and light chestnut. Here is included the plain of the Sagaredzho and Garedzhi steppe (the Nayemari basins, the Tariban steppe). The annual rainfall is 400-450 millimeters, the average annual temperature 12-12.5 degrees. Agriculture is not irrigable except along the Iora. Rainfall is during the spring and fall, during which period the plateau becomes covered with grassy vegetation, attracting herds. The hay harvests of the Garedzhi steppe and the Azambur district are sold in Tiflis. But besides these hay growing areas, there are significant dry plains and rolling pasture lands of different zerophytes, used by the population as winter pasturage. The snow cover is insignificant here, the winter being



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relatively warm, the cattle being able to subsist on green fodder during fall, winter, and spring. Only during the summer, when the plains and hills are completely burned out, are the herds driven up to high mountain meadows. In this way, a seminomadic way of life is perpetuated here. There is far from a sufficiency of feed, the fodder of these pastures being poor nutritionally and its supply for the winter is either insignificant or entirely absent. Dairy cattle, providing milk for Tiflis, are kept on good diversified cereal grass plains. Small-horned cattle (sheep raising) are maintained on zerophytic, craggy pastures, particularly on the Shirak steppe. Grain cultivation in this region is poorly developed, being concentrated in the western (Tiflis) part of the region, and only along the Iora in the eastern part.

A considerable part of the area should be irrigated (the entire eastern part of the region, the northern part of the Shirak steppe). The adoption of irrigation would radically change the character of the region. A part of the region, near to the Karayaz irrigated sector, should also be set off for cotton growing. The Sagaredzho plain can be utilized for the cultivation of sugar beet, viticulture, fruit growing and vegetable growing. All these products have a ready market in Tiflis. Dairy farming should be developed, in view of the necessity of providing the working population of Tiflis with milk. In the same way with irrigation, there will be an assured supply of vegetables, table varieties of grapes, early fruits (cherries, both Prunus cerasus and Cerasus avium, and plums). To properly establish dairy farming there would be required the sowing of feed grasses for the purpose of storing feed for the winter in transferring the cattle to stall feeding. Of legumes, there should be grown clover (red, white,



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and Swedish), esparsette, alfalfa, and vetch. Here fast-maturing sorts of soya bean may be grown for their oil. There is need also for juicy feed crops like corn, sorghum (without irrigation), feed pumpkins, sweet clover, etc. In growing hay without irrigation, it is possible to make use of the local small-blossom Parvifler variety of alfalfa.

For grain cultivation, the only possible legumes are the soya-bean and the kidney bean, and that, only to a small extent. The region can also be used for poultry raising (selling the eggs and meat in Tiflis) and for silk-worm raising.

XXVIII(20) The El'dar steppe along the Iora River. It encompasses the eastern Iora section of the former Signakh Uyezd. The climate is dry, and the soil alluvial-carboniferous. Farming is with irrigation. Its chief emphasis is on raising cotton.

XXVIII(21) Karayaz and Borchala plains along Kura River to the Azerbaydzhan border and along Khram River to the foothills. It encompasses the irrigable part of Karayaz region and the lowland part of Borchala. The Karayaz plain lying on the left bank of the Kura at an elevation of 300 meters above sea level is almost completely level, with few hills. The Borchala lowland is located in the valley of the Khram River and, being surrounded in the south and in the west by mountains, enjoys a gradual rise, in some places with elevations of 300 meters, in others 600 meters, and even 900 meters.

The climate is dry continental, with an average annual temperature of 12.9-13 degrees, with a considerable daily variation in springtime, and a seven-month period free from frost. The annual rainfall on the average is 400 millimeters, but in individual years it has dropped to



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260 millimeters. Most of the precipitation falls during the latter part of spring. The region is subject to northwest winds, blowing very frequently with great force, causing a large scale dropping off of the grain germ, flattening of crops, breaking of stalks, and even uprooting young grain sprouts. This phenomenon is so marked on the Karayaz steppe, that treetops are lopsided and look like flags. Protective tree and shrub planting is necessary here.

The soils are chestnut, leached by irrigation, and along both the Kura and Khram they become carbonaceous, forest, and alluvial types. At a certain elevation above the Borchala valley they become chestnut-grey, and still higher -- grey forest. According to the character of the natural vegetation (in the unwatered part), the region is a [redacted] mugwort grass semi-steppe, with a predominance of "borodach" grass (Andropogon Ischaemon) and "fragrance" [redacted] mugwort.

Agriculture in the region is irrigational. In the Karayaz plain the irrigated area is equal to 15,000 hectares. This territory is a cultivated oasis with a considerable development of cotton growing. The yield of the cotton is low here, 6-7 centners of raw cotton per hectare. A local sort is prevalent, called Karayaz King (of "uplandov"), and it is the only variety.

In the Karayaz, hay grown under irrigation but not sown is widely prevalent. It grows naturally, composed of perennial grasses, with a predominance of rooted quack grass (Agropyrum repens), sometimes extremely dense and high, with an admixture of meadow grasses, foxtail grasses, and legumes - clovers, with a small admixture of lotus. Thus, the hay may be referred to as quack grasses. They take up somewhat more than 10 percent of the total area and provide the Caucasian Red-Banner Red Army with hay. This fodder is little suited to horned cattle, but



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it is completely acceptable as a feed for horses. It is true that the quality of the hay is gradually deteriorating, because of the dampening of the soil, its impoverishment by the quack grass, and the spread of an overgrowth of rushes and reeds.

In the Karayaz part of the region melon growing and vegetable growing are considerably widespread, and to some extent, fruit growing, because of the proximity of Tiflis and the presence of a railroad.

The Borchala part of the region, protected from several sides by mountain slopes, is favored as regards winds, and is divided into two characteristic subregions. Agriculture is also primarily irrigational. The principal culture in the 200-600 meter zone above sea level is field culture, primarily cotton raising. Here, until recently, winter wheats were grown in the lowland. These were almost exclusively the hard varieties, with a predominance of the Levkurum variety in some plantings, and in others, Apulikum, and in some cases Tserulestsens. Besides these basic varieties, there were also found cultivated 10 other hard varieties, and up to 10 soft varieties, and also single admixtures of dwarf, and even English and Polish wheats. This subregion even produced a surplus of cereals. Of all the wheat growing regions in Georgia, the Borchala region is the richest in hard wheats, including such varieties which are rarely met with beyond the Main Caucasian ridge (with the exception of Tserulestsens and Gordeiform). The vigorous development of cotton growing in the Trans-Caucasus transposed the cultivation of wheat from the Borchala lowland to the mountain region.

In this cotton subregion melon growing is also carried on for supplying Tiflis with the more early watermelons. The large black-



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skinned Borchala watermelons, although not of very high quality (with thick rind and little saccharinity), is fast-maturing and appears in the market before all the others. Vegetable growing is also prevalent.

The foothill zone, varying in elevation from 600 to 900 meters, is an irrigated grape-growing region (Shaumyan and Lyuksemburg). The Shulaver (now known as Shaumyan) sorts are white and make a wine of almost as good a quality as some of the Kakhetian wines. The Lyuksemburg sorts (on German collective farms) produce a European type of sour wines, which are not sold independently, but only for mixing (coupage).

The prospects for this region as a whole lie in the field of a maximum development of cotton growing. This is the largest cotton area in Georgia. It is the coldest region in the Trans-Caucasus, but at the same time it is a tested, reliable cotton-raising region and for this reason all other cultures should yield their place to cotton as much as possible. Particular attention should be given to the development of quick ripening or average ripening large boll varieties. The best varieties for the past 2-3 years have been Shreder-1306 and 915. The Karayaz and Borchala parts of the region should be devoted to the cultivation of cotton, although in order to improve the soil of the Borchala lowland, crop rotation must be introduced, rotating with cotton a fairly large percentage of various leguminous plants, with the understanding, however, that cotton occupy the greater part of the sown area. It is necessary to provide the region with mineral fertilizers, and sow winter feed crops like peas (Badshkhan, also Nicholson and Austrian sorts), beans, and winter vetch. The question of raising the yield



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of cotton for this region is most pertinent. Increasing the fertility of the soils, mechanized plowing and cultivation, and the introduction of fast-maturing varieties with a large yield of cotton -- these three problems should be dealt with at the present time.

The region should also have in mind the interests of industrial Tiflis, to which it is very near and which serves as an inducement to the development of supplementary branches of agriculture, including dairy farming, vegetable growing and melon growing. Related to this is the question of feed grass sowing and related feed crops.

The question of the Karayaz irrigated hay fields, of their replowing, improvement and diversion to the planting of cotton, was based on the necessity of providing the Red Army with hay. If a guarantee could be secured to provide fodder from the highland regions, it would be possible to set aside a place for cotton.

The region is suitable for growing peanuts and the soya bean, but they can find a place here only as in-between row crops or as rotating crops with cotton only in some places of the Borchala part of the region on soils that are in need of improvement. Besides, the peanut may be grown successfully as a cover crop in vineyards (Shaumyan subregion).

The cultivation of grapes in Shaumyanskiy (former Shulaverskiy) and Lyuksemburgskiy Rayons should be developed, but table varieties should be introduced for the Tiflis market (and not only wine varieties).

Besides, the Shaumyan subregion should also have fruit growing.

XXVIII(22) Alazan' plain (Shua-Kakheti). It includes Kakheti Okrug (former) Telav Uyezd and the northern part of Signakh Uyezd, known by the name of Tsinamkhare). The region is limited in the north by some very steep wooded slopes of the Main Caucasian ridge, and in the



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west by the Kakheti ridge, in the south by the Tsivi-Gombor Mountains and the Kash ridge, and in the east by the Azerbeydzhanian SSR (Nukhin plain). The Alazan' plain is flat with an incline to the southeast, having in the northwestern part an elevation of 450 meters above sea level, and in the southeastern part, 200 meters. The entire region along the line of the incline transverses the Alazan' River into which there is a confluence from the north, from the Main ridge, of numerous mountain streams. These wash down from the mountains the remains of ancient ground moraines and alluvial deposits. During the time of rains and melting snow in the mountains, these streams turn into flood currents which descend onto the plain with much destructive power.

The climate of the plain is warm and humid, with an annual temperature of 12-13 degrees, a relatively mild winter, and an annual rainfall of 1,000 millimeters, of which a large part comes down during spring and fall. Surrounded by mountains, isolated, as it were, in broad daylight, and serving as a natural thermostat, Kakhetiya has a relatively high atmospheric humidity. This is conducive to a forced vegetation growth during the warm period of the year. The Trans-Alazan' part of the region (left bank) is covered with "tugay" forests, while the right bank is relatively woodless and is used for plant cultivation. The river belt of Kakhetiya is composed of alluvial mud, carbonaceous, "melkozemistyye" [meaning small or fine earth] soils (lami), which contain much lime (30-35 percent), and 3-4 percent humus. These soils are structureless and difficult to work. Along the right Kakhetian bank beyond the lami belt, there are fertile dark forest humus-carbonaceous soils, which grow most of the Kakhetian vineyards.

On the left bank part, beyond the belt of alluvial carbonaceous soils lie dark-grey soils.



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Agriculture is primarily unirrigated. Irrigation exists in the western (left bank) part of the region and is used in grape growing. Planned irrigation, already undertaken to a significant extent, includes the right bank of the eastern part of Kakhetiya.

The region is not homogenous with respect to plant cultivation, but, depending on the soil and also on water resources, is divided into three subregions (of main cultures): grape, cotton, and tobacco.

The grape-growing subregion is to be found for the main part in the Cis-Alazan' part (and in part Trans-Alazan' part, including the villages of Napareuli, Shil'd, Sabus, Yaniseli, etc.), together with a number of independent centers with their own varieties, from which are made Kardanakh, Gurdzhaan, Mukuzan, Tsinodal' and Kurdgelaur wines. The best Kakhetian wines are produced in these centers. They are both white and red and are known throughout the USSR, and to some extent abroad, for their thickness, energy, and fine bouquet and superlative natural color. The red Teliani wine is used for export. Unfortunately, the yield of the grape is small, on the average, 75 centners per hectare.

The cotton-raising subregion is found in the eastern part of the region along the right bank of the Alazan' River on a small scale, primarily as a dry farming crop. Because of the humidity of the atmosphere, the cotton here grows as a large plant, thereby resulting in delayed picking.

The tobacco subregion is found in the southeastern part of the Trans-Alazan' region, in the so-called Kizikii (Lagodekhskiy Rayon). Vegetable and melon cultivation is developed in the riparian part of this subregion. The Kakhetian watermelons are large, elongated oval in form, with stripes on their green rind. They mature later than the



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Borchala, but are extraordinarily sweet and succulent, and are highly prized at the Tiflis market.

Further from the bank are to be found low yielding tobacco fields, of relatively good quality tobacco. Vegetable growing is considerably developed in the foothill area.

There is a large shortage of feed crops in the area, and only draft cattle and sheep are raised, which are driven for pasturage to the elevated part of Kakhetiya (Ukanamkhare) and the Shirak steppe.

The cultivation of cereal grains makes for another significant aspect of agriculture in Kakhetiya. The principal grain culture is winter wheat, which yields, however, because of extensive farming, low harvests, up to 5-7 centners per hectare. Most of its sowing is concentrated in the vicinity of Signakh and in the western part of the region. A peculiar feature of this region is that beardless soft wheats are widely prevalent, in contradistinction to the other regions of the Trans-Caucasus. The bearded soft wheats on the whole predominate, even though in Signakh Uyezd there are places where the beardless varieties are prevalent. Of the bearded varieties, there are Eritrospermum and Ferrugineum. The beardless varieties are Lyutestsens and Mil'turum. The hard wheats in Kakhetiya occupy an insignificant position. Corn stands in second place after winter wheat.

In Signakh Uyezd, there is considerable cultivation of millet of many kinds, tending to gravitate toward the elevated dry part of the uyezd. Besides this the sunflower plant is grown successfully.

It must be admitted that prospects for Kakhetiya are rather diversified.

The western part of the region and partly the plain area of the eastern left bank has been set aside for the development of



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viticulture. This is the most important and best wine-producing region of all-Union significance. During the past ten years viticulture in Kakhetiya has had a serious setback because of philloxera. But the crisis now is past and the renewed viticulture is being built on American wild varieties for grafting with local vines. In connection with this, it is necessary that here in Kakhetiya there be established nurseries for vines to be grafted on American wild vines, replacing all ungraftable varieties. The question of raising the yield can be resolved to a considerable extent by using the most elementary methods of healing, combatting diseases and caring for the vines. The eastern right bank of the region abutting on the Alazan' Canal should be set aside for cotton on a basis of semi-dry farming, with water to be used only in case of necessity. The Shreder-1306 and 915 varieties of cotton should be cultivated. Here, a number of industrial crops, should be developed, headed by ramie, and followed by the peanut, and the Kazanlyk rose. Should ramie prove successful in this region, it can serve as a competitor to cotton. Of course this question is debatable, inasmuch as in connection with this, there is the problem of transplanting ramie to a more northerly zone in the North Caucasus. This area, however, does contain sufficient moisture to make it yield a good harvest. "Tugay" woods must be uprooted.

Cover crops must be grown, and the area must be supplied with mineral fertilizers. The carbon content of the soils here does not allow for the adoption of lupines as cover crops. It is possible to use the velvet bean, the Phaseolus mungo bean, winter vetch (Badakhshan, Nicholson and Texas varieties), etc. In Lagedekhskiy Rayon, tobacco growing should be continued, but at the same time wide experimentation



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in types of tobacco should be carried on. We also consider that there should be continued to a certain degree, the cultivation of melons, that is to say, the growing of local large-sized, sweet, Kakhetian watermelons, as an exceptionally valuable variety, with a wide sale in Tiflis, where they are preferred over all others. Vegetable growing should be of local consumer significance. Fruit growing can have a big future, inasmuch as the fruit grown here is of a very high quality, particularly the apple (the valuable sorts like Kandil'-sinap, Dantsigskiy Kal'vil', the Champagne rennet, etc.), pear, peach, greengage, fig, and even the olive.

Grain crops should be removed to the Shirak steppe, with the exception of corn, which should be continued to a certain extent for stock raising.

The development of stock raising and vegetable growing, as well as the cultivation of the sweet potato on the alluvial soils, is to supply food to those workers employed in the region's growing enterprises (electrical, canning, dairy, machine-tractor, etc.).

XXVIII(23) The foothill region of the southern slopes of the Main Caucasian ridge of Eastern Georgia up to 1500 meters in elevation, and also of Manglisskiy Rayon, Borzhomsko-Tsemskiy Rayon. It includes the foothills of the former Telav, Tionet, Dushet, Tiflis, Tskhinval' and Borzhom Uyezds.

The region is far from homogeneous. Essentially, it is a region of forests, grey forest soils, with occasional mountain-steppes seemingly black earths, chestnut-grey soils, and in Bakur'yan, podzolic soils. Precipitation is 600-1,000 millimeters. The climate is moderately cold, with an average annual temperature of 6-9 degrees.



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The region on the whole is one of dairying, potato and grain growing, and in some places, fruit growing and, particularly, berry growing. In this region a significant part of the land is used for grazing productive and draft cattle and for preparing winter fodder by hay mowing. But grain cultivation is also carried on here. The cultivation of winter and spring wheats can be met with almost everywhere, on a scale for local consumption.

In general the entire zone may be characterized as a zone of winter soft wheats and spring barley. There are also sowings of spring wheats, both soft and Persian. Winter and spring wheats are to be found almost to an equal degree at around 1,300-1,400 meters. Corn is prevalent to a significant elevation (Tsemi Station on the Borzhomsko-Bakur'yan RR.) in Borzhomsko-Bakur'yanskiy Rayon (as well as in others).

In the highland areas, the cultivation of potatoes is spreading fast, and so is that of sunflower. Grain legumes, on the contrary, are rare and only bean is frequently sown in corn fields.

The prospects for the region (with the exception of the highland area of the Main Caucasian range) are being based on a preeminent development of dairy farming, while in the more elevated zone, it would be coupled with cheese making and butter making. However, under present conditions, it is not possible to develop dairy farming on a large scale because of a shortage of natural fodder. Hay and pasturage, as a rule, deteriorate under such an unplanned regime as prevails throughout the entire Trans-Caucasus, principally because of overloading the pasture lands with cattle. An urgent and timely problem is increasing the sowing of feed grasses through crop rotation with grains, through a special cultivation of perennial grasses, and through sowing



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grasses by airplane on meadows and pasture lands. To the same degree, the development of root plant cultivation is required, and the establishment of silage facilities. The composition of feed grasses to be cultivated in this area should be local, for which one should resort to the very rich natural stock of varieties to be found in the Trans-Caucasus. In connection with such a plan, it is imperative to organize seed sanctuaries in different regions by fencing in large areas growing specific species and varieties of alfalfa, clover, esparsette, lotus, rye grass, Triticum cristatum (zhitnyak), and many other varieties. In this way, large collections of seed may be obtained from these sanctuary sectors. It is time to think of such a measure seriously, inasmuch as it is of tremendous significance not only with respect to plant cultivation in the Trans-Caucasus, but also on an all-Union scale.

The cultivation of potatoes should be promoted and it is necessary to organize grade sorting of potatoes in different places of the region. Corn and sunflower should also be developed by being moved to a higher zone and made use of in part, for silage. Winter and spring wheats should continue here for satisfying the local needs of the region, because lack of roads hinders bringing in grain from outside. Spring barley also should be continued, but as a feed crop. The region is exceptionally suited to the cultivation of grain legumes. Therefore, it would be desirable to begin the work of introducing peas, legumes, lentils, etc.

Fruit growing and vegetable growing have prospects, particularly in those parts of the region where irrigation is possible.

In addition to sunflower, it is completely feasible to cultivate oil flax as an industrial crop. In humid areas, hemp may be grown. It is also possible to cultivate [redacted] abutilon and makhorka.



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XXVIII(24) The high mountain zone of the Bol'shoy Kavkaz (Upper Osetiya, Tushetiya, Pshaviya, Khevsuretiya) and of the Malyy Kavkaz in Eastern Georgia. The region occupies the zone from 1,500 to 2,100 meters above sea level. The climate is moderately cold to cold, the average annual temperature being 4-7 degrees, daily variations being considerable, the winter long and severe, and annual rainfall 500-700 millimeters.

The region being mostly woodless (although Bakur'yany is forested), the highland steppes and meadows are little suited for the cultivation of grains. In this region, field culture is carried on a limited scale (with the exception of the potato, which, on the contrary, is entirely suited to the region) and is based on spring cereals (spring wheat and spring rye). Field culture, on the whole, withdraws here to second place, and on most used land, there is pasturage of naturally growing hay. The prospects for the region are in the field of productive cattle raising (Malyy Kavkaz) and sheep raising (Bol'shoy Kavkaz). It is possible to develop apiculture. Of field cultures, potato raising is feasible, also long-strand flax, gold-of-pleasure, white mustard, particularly fast maturing varieties of spring wheat (particularly for Bakur'yany, where the wheat frequently fails to mature), spring barley and peas.

Summer cultures, such as raspberries, local blackberries, currants, and strawberries grown in Bakur'yanskiy Rayon, make out well and should be developed for local consumption, in view of bad communications.



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## XXIX. AZERBAYDZHAN SSR (INCLUDING NAKHICHEVAN ASSR).

Soviet Azerbaydzhan is a land with a predominance of low-lying plains and small highland area.

The lowland expanses with elevations up to 250 meters above sea level make up 46.8 percent of the entire territory of the republic, and with elevations varying from 250 meters to 2,000 meters, 47.1 percent. Consequently, almost 94 percent of the entire area of Azerbaydzhan is located in a zone of possible agriculture. Isolated locations in the Caspian area, composing in all the significant percentage of 9.8 percent, are even situated below the level of the Black Sea. Unusable lands make up 27.1 percent (not including Nakhichevan ASSR). The biggest percentage is occupied by winter and summer pasturage (39.5 percent), especially winter pasturage which includes 1 million hectares, about half of which could be used with the application of irrigation to cotton raising and to other valuable cultures.

Plant cultivation in Azerbaydzhan is determined in the great majority of cases by the availability of water that can be used for irrigation. At the present time, all the sources used for irrigation do not permit a large increase in cultivated area in the lowlands. Future development of valuable crops will be impossible without new irrigational facilities and without capital repairs in the former irrigation system. It may be said that not less than half of the entire tilled area in the republic is irrigated, but this figure, though high, nevertheless does not properly represent the significance of irrigation, as here are included the highland areas, the humid Talysh, etc., where irrigation as a whole is insignificant. If one were to examine individual uyezds, it would be found that in the



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former Agdash and Agdam Uyezds not less than 90 percent of the land is irrigated, in Sal'yany, 84 percent, Gandzha, 61 percent, etc. The total irrigated area for the ASSR exceeds 850,000 hectares. The insufficiency of irrigational facilities is felt primarily in the summer, when a maximum quantity of water is essential for constant use, inasmuch as occasional watering of crops is far from sufficient. To a lesser degree, a need to increase irrigational resources is felt in the former Lenkoran', Zakataly, and Kuba Uyezds. Such large water resources as the Kura and Araks Rivers are made use of only to a slight degree, while, at the same time, their various tributaries, and also small streams, descending from the heights of the Bol'shoy and Malyy Kavkaz, are used to such an extent, that any future increase in irrigated area depending on these waters is impossible without the construction of water reservoirs. The reason is to be found in the fact that under native means of irrigation, it is impossible for the population to divert water from the Kura and Araks without the assistance of engineering construction. An engineering system of irrigation exists so far only in the Mugan' steppe. The native irrigational system consists not only of using canals with naturally flowing waters of the tributaries of the Kura and Araks, the small mountain streams, but also "kyagriz" irrigation and water pumping irrigation. "Kyagrizy" consist of an underground irrigational system for using subsoil waters, while water-pumping irrigation is based on a mechanical pumping of water from rivers and water reservoirs. The water-pumping method has that useful feature that it makes use of water only when required, while the tributaries of the Kura and Araks, flowing without interruption sometimes result in useless waste of water. Finally, mountain streams provide water during



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a time abounding in water, as in spring, in the season of thawing snows and rains. From here it is evident how great a need exists for engineering irrigational structures for obtaining water from the Kura and Araks. The Kura, as the more potent source for irrigation, is utilized on an insignificant scale by exploiting its high waters /upper reaches?/ only for the riparian belt, when the soil is saturated with water from inundation. This assures a harvest. The floods of the Kura also fill up the so-called "chaly", i.e., saucer-like depressions. Formerly, winter barley was sown on the chaly, and after its harvest, it yielded two crops of millet, as a drought withstanding culture, satisfied with what moisture remained in the high chaly. Besides this means, Kura furnishes water through pumping. Araks River is the most important source for irrigating Mugan' and Mil' steppes (which are semi-desert), and the principal base for present Azerbaydzhanian cotton growing.

Mention should be made of those difficulties which are borne by the population in the basin of the Araks and Kura. Fighting annual overflows of these rivers, which flood tremendous expanses, the population has been forced to build dikes along the shores, from year to year making them thicker and higher, inasmuch as the bottom of the river has been rising because of deposits of gravel and silt. However, there frequently occur breaks in these barriers, once resulting in the Araks changing its bed to the extent that it no longer flowed into the Kura but independently emptied into the Caspian Sea. These breaks have led to the inundation of large areas, to troubles with cotton, to the destruction of a number of settlements, to the forming of marshes and to an increase in malarial beds. Not only is the entire territory along the Kura and Araks subject to flooding



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but also, for example, the entire Zakatalo-Nukha plain, where the flood waters, carrying with them masses of stones, gravel and alluvium, inundate cultivated fields.

Protective dikes along the Kura and Araks, nevertheless, protect large areas of cultivated lands in the former Sal'yany, Geokchay, Agdam, Agdash, and Shemakhin Uyezds from being destroyed.

There is scheduled to begin in 1933 the construction of a magnificent dam at the Mangechuar mouth of the Kura, for the purpose of erecting an artificial water reservoir with a capacity of 12-13 billion cubic meters. This construction is to be finished within a five-year period, after which the problem of providing the Caspian lowlands with water will be largely solved. Besides this, the Mil'sko-Karabakh and the 2nd Shirvan Canals will be in operation.

Field cultivation plays an important role in the plant cultivation of Azerbaydzhan. There has been a predominance of winter cereals to the present time. This, in part consists of the cultivation of winter wheat. The growing of spring wheat occupies an insignificant place, 2-3 percent of the total sown area. One may find cultivated hard and soft wheats, English, Pyramid, and dwarf wheats, and, finally, emmer. An an individual admixture, Polish wheat is noted. Persian wheats are not found in Azerbaydzhan. The most important are bearded soft wheats, followed by hard, and finally, by English wheats. English wheats are known here as a pure culture, being distinguished at times by a glass-like appearance of the kernel. They are grown in the low zone as winter wheats. Winter barleys also are prevalent, and like the wheats, are grown with and without irrigation. More significant is the growing of rice, but this is the only cereal crop whose sown area will be increased in the future. A most valuable field culture

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is cotton, which is to be greatly increased throughout the entire Caspian lowland. Already, the amount of cotton growing in the republic considerably exceeds prewar proportions, but the development of cotton growing in the future is closely related to the development of irrigation, while the latter in the near future is to be improved by a fundamental overhauling of the native naturally flowing irrigation net, by overhauling kyagriz irrigation, by an overhauling of water reservoirs and pumping facilities, and by carrying out new irrigational construction. As a result of these measures the irrigated area in Azerbaydzhan may be doubled.

It is planned that more than a half-million hectares (535,000 hectares) are to be devoted to the cultivation of cotton in Azerbaydzhanian SSR.

Tobacco growing is developed on the Zakatalo-Nukha plain and in Gandzha Uyezd, but it is based upon a low level of agricultural technology.

Fruit growing is developed on the Kuba plain, in the Nakhichevan' territory, in the former Gandzha and Sakataly Uyezds. This fruit has a fairly high reputation, although its grades are inferior to other fruits, like those of the Crimea. The prospects for fruit growing reach rather large proportions, if one includes a considerable development of subtropical fruit cultivation.

Grape growing for wine making is natural to many regions, but it has its biggest development in the former Gandzha, Shamkhor, Kazakh, Shemakha, and Geokchay Uyezds and in the highland Karabakh, with wine making on a large scale in the former Gandzha and Shamkhor Uyezds. In the lowland areas, the vineyards are irrigated; in the highlands, they are not.



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Vegetable growing is the principal branch of plant cultivation in the republic. The most important vegetable-growing areas -- the littoral Caspian areas, that is, the former Baku, Kuba, and Lenkoran' Uyezds. With respect to the future, winter vegetable growing must be developed.

The feed problem in Azerbaydzhan is very critical. The existent system of summer and winter pastures speaks for the preservation of a seminomadic economy. In 1931, on the average, 54.4 percent of the economy was carried on in Azerbaydzhan SSR on a nomadic basis. Summer pasturages, the so-called "eylagi", are located primarily in the highlands of the Malyy Kavkaz and Talysh, and partly on the slopes of the Bol'shoy Kavkaz, beginning at an elevation of 2,000 meters above sea level and ranging up to and exceeding 3,100 meters. In areas that do not have high mountain zones, eylags do not exist. Winter pasturage ("kishlagi") are found in the lowlands, on the plains and in low valleys, which on the whole do not exceed 600 meters in elevation.

Feed grass sowing among the native population exists in insignificant proportions in Nakhichevan' territory, in the Lower Karabakh. The transition to a nonnomadic economy demands the establishing of reliable feed bases, while at present the area devoted to feed grasses comprises only 1-2 percent of the total sown area.

Below, a more detailed description and the future prospects of plant cultivation are given by regions.

XXIX(1) The Caspian lowlands, lying along both banks of the lower reaches of the Kura and Araks Rivers, including the Sal'yany, Mugan', Mil', Karabakh, and Shirvan steppes. The total area of these lowlands comprises about 46 percent of the entire territory of Azerbeydzhan.



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The western limit of these lowlands may be considered to be Yevlakh, while the eastern limit is the Caspian Sea between Alyaty and the Kura sand bar. The region presents a plain with insignificant hills and depressions, having an average elevation of 50-75 meters above sea level, though a large part of the plain lies below sea level. (Normal sea level is considered to be the level of a sea that corresponds to the level of the ocean. For this reason in the given instance the level of the Black Sea, rather than the Caspian, is used for computation.)

The climate as a whole may be described as being subtropical of the South Mediterranean type. Because of the wide extent of the region's territory, it would be better to examine individually its principal components.

(a) The Sal'yany steppe occupies the basin of the Kura River, and is completely below sea level by 20-25 meters, and presents a homogeneous plain, with mounds and extensive depressions.

Its soils are very fertile, but slightly salty. They belong to contemporary alluvial deposits, which in the maritime part consist of sands and dunes, and further to the west, of wet and swollen salt marshes. The Sal'yany steppe is the warmest part of the lowland.

The climate is dry subtropical, warm, of the Mediterranean type, and in the maritime belt having lesser temperature variation; there is a warmer winter, and a somewhat cooler summer. In the maritime part, the average temperature of the coldest month (January) is 4.0 degrees. During the hottest month (August) it is 26.5 degrees. In the inland part, the corresponding figures are 2.6 degrees and 27.1 degrees (July), respectively. (The temperatures cited correspond to the Centigrade scale.)



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A possible growing season for summer crops lasts approximately 215 days (more than 7 months). The absolute minimum rarely goes below minus 7.0 degrees in the maritime part and minus 10.0 degrees in the interior of the steppe adjoining Mugan'. In extremely rare years the temperature has reached minus 21.3 degrees. Thawless days do not occur every year, although there are on the average 24 of them for the interior and 4 for the maritime area. The winter is generally mild, and autumn is very warm. Humidity in the air is considerable, averaging for the year 62-70 percent. There is an annual precipitation of 210-240 millimeters, principally in the fall in the maritime part and in the winter-spring in the interior of the steppe. For the entire summer, there is an average rainfall of 25 millimeters. The winds have a monsoon character. In the winter and fall they are strong northeastern. During the warm half of the year, there are to be found good shore breezes in the maritime part.

The vegetation is semidesert with a large number of ephemeral plants. The more characteristic types of vegetation are to be found on salty meadows, dry salt deserts, and salt marshes of the transitional type.

(b) The Mugan' steppe has the appearance of a shallow basin, a large part of which is below the level of the Black Sea. The total area of the steppe is approximately 240,000 hectares. The climate is dry continental, subtropical, with an average annual temperature somewhat exceeding 15.0 degrees, and an annual rainfall of 200-250 millimeters. The period free from freezing weather is not less than 207 (on the average 213) days long. Summers are hot and dry, autumns warm, with rains falling in late fall, winter, and early spring.



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The number of days with freezing weather is rather large, from 60 to 85, and even more. The absolute minimum temperatures, lowest in January, reach minus 12.0 degrees, and in unusual years minus 24 degrees, and even minus 26 degrees. The entire winter on the average is mild. Soils in the southern part of Mugan' belong to light-chestnut, in central Mugan' to brown saliniferous, salt flats and salt marshes (wet and swollen), and in northern Mugan' and bordering upon the Sal'yany steppe, contemporary alluvial formation with spots of brown-grey earths. The landscape of southern Mugan' presents a mugwort growing semidesert, the central part, a saltwort semidesert with clearly outlined saltwort halophytes, and the northern Mugan', a saltwort semidesert with an admixture of moisture absorbing elements.

(c) The Mil' steppe lies in a triangle formed by the confluence of the Kura and Araks, and is separated from the neighboring Karabakh steppe by the Karakar-chay River. It presents a homogeneous plain with insignificant mounds and numerous hollows. Its eastern part lies below the level of the Black Sea. The climate is dry, subtropical. The average annual temperature is 15 degrees. The rainfall is about 200 millimeters, principally in the winter and spring. The summer is very dry, there being seven dry months. The soils of the Mil' steppe are more formed than in Mugan', particularly in the Sal'yany steppe, and are composed of brown-grey earths on the more recent alluvial deposits of the Araks, brown saliniferous soils forming salt flats on the more ancient alluvial deposits of the Araks, and, finally, surface subsoil on the alluvial deposits of the Kura. The vegetation is semi-desert and generally ecologically homogeneous. Along the shores of the Kura and Araks, stretch "tugay" woods, which are undergoing intense



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clearing to make use of the littoral belt for irrigational cultivation. Most of the area is occupied by a mugwort and elm (Ulmus densa) [redacted] semidesert. In the foothills, where chestnut soils can be found, there are many caper tree groups (Cappariceturn). Beside the semidesert and "tugay" vegetation, there are variations of dry meadow, swamp, and sandy vegetation.

(d) The Shirvan steppe is located on the left bank of the Kura and is a large plain with a dry subtropical climate, on the whole warmer than either the Mugan' and Mil' steppes. Its average annual temperature is 15.4 degrees. Absolute temperatures in rare years have reached minus 19 degrees. The period free from freezing weather averages 213 days. The hot period (with an average temperature above 20 degrees) continues for more than 140 days. The annual precipitation of the left bank of the Kura on the whole is higher, and for this reason Shirvan steppe has an annual precipitation varying from 340 to 400 millimeters, most of which comes down in spring and autumn, and in some places like Agdash even in the summer. The soils are heavy, saline and belong to the grey-brown salt flats, with wormwood and a wormwood saliniferous semidesert vegetation.

(e) The Karabakh steppe occupies the extreme western part of the Caspian lowland. Because of its peculiarities it may be considered as an independent subregion. In the west it borders on the Gandzha steppe, in the south and southwest it merges into the foothills of Nagornyy Karabakh (Highland Karabakh), where it occupies a more elevated part of the steppe. In the region of the Terter River, the steppe drops down to the Kura River, where it becomes a lowland. The foothill part of the steppe contains hills running in various directions.

The Karabakh steppe is cut by many rivers, running northeastward. The principal river of the steppe is the Terter, used by the population



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for irrigating their cultivated areas. The Karkar-chay, Khachin, and other rivers, contain little water and drying up in the steppe, do not reach the Kura. The climate is dry subtropical, changing in the more elevated zones of the steppe to a moderately warm semidry or a moderately warm semihumid climate. The dry subtropical zone in the low Kura part of the steppe has an annual average temperature of 15.0 degrees and a precipitation of 200 millimeters. The moderately warm semidry zone in the vicinity of the foothills has an average annual temperature varying from 15 degrees to 13 degrees and precipitation from 300 and 400 millimeters, depending on the elevation. Finally, the highest zone, located in the foothills, has an average annual temperature of 12 degrees and precipitation varying from 400 to 600 millimeters. Most of the precipitation is in June, while the least is in wintertime. The dry period varies from a half-year to seven months. The soils of the Karabakh steppe also are in zones. In the lowland zone, dark grey earths predominate, in the foothills, chestnut soils. The salt marshes occupy a small area and are concentrated in the neighborhood of Yevlakh. Vegetation undergoes a gradual change from the bank of the Kura to the foothills. Along the Kura River there is a "tugay" forest and further on, thickets of tamarisk changing to a mugwort-saltwort semidesert occupying a wide territory. In the foothills this becomes a beard-grass steppe.

Such is the physical geographic landscape of the Caspian lowlands, expressed in broad schematic strokes. As can be seen from this description, there are five steppes included in the lowlands, which, though possessing certain individual variations with respect to climate, soils and vegetation, on the whole, have in common a characteristically flat landscape with a dry, subtropical climate,



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an average annual temperature of 15.0 degrees, a rainfall of 200-250 millimeters, a hot summer, a dry period of 210-215 days, a relatively mild winter, but a cold January, when the absolute minimum temperature drops to minus 16 degrees and more, and in exceptional years, considerably lower, and with frequent winds. These five steppes have saliniferous soils, which are very young, lying on alluvial soils which frequently have the characteristics of a subsoil rather than of a topsoil. They have semidesert vegetation, including saltworts, mugworts, grass annual ephemeral plants, and salt marshes without vegetation.

It should be particularly emphasized that the growing season for the principal crop in the lowland, cotton, almost coincides with the period above freezing. If remaining unripe bolls are frostbitten, the fault lies with the low level of agricultural technology (particularly late sowing), and also with inadequate grade testing of the material.

A basic factor with regard to plant cultivation in the Caspian lowland is water. Inhabited places tend to be located near this or that source of water, with the result that wide expanses of the steppes are still devoid of population and remain untilled, serving only as winter pastures. Here and there are to be observed attempts at dry farming, generally unfertile.

It is interesting to note that definite traces of ancient irrigation and much cultivation are still evident in the Mil' steppe. Ancient peoples knew how to irrigate this steppe.

In present irrigated sections of the Sal'yany, Mugan', Karabakh, and Shirvan steppes, the principal crop is cotton. Until recently, factory mixtures of the King Karayaz varieties prevailed, but



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now there is considerable distribution of the Navrotskiy and numbered varieties of the selections made by the Central Asiatic Cotton Research Institute and the Trans-Caucasian Cotton Research Institute. Cotton picking takes place from the middle of September to the middle of December, where the last pickings (fifth and sixth) take place after frosts have begun. The light frosts, although they kill the leaves, do not interfere with the maturing of the boll. For this reason, the warm autumn, characteristic of the Caspian lowland, is an essential factor in the maturing of the cotton.

In view of the coincidence of the above-freezing period with the growing period of the cotton, it may be assumed that American medium-maturing varieties are fully able to mature in the lowlands; and if there still are cases where a considerable part of the harvest is caught by frost, the fault lies with late sowings. This occurrence should be fought against. One can estimate the total heat for the growing period in the lowland to exceed 4,000 degrees, i.e., a sum which should be adequate even for the profitable cultivation of Egyptian varieties of cotton under conditions of modern sowing and correct agricultural technology. For this reason Egyptian sorts should occupy a significant place in the cotton culture of ZSFSR. The conditions for cotton growing here are more favorable than in certain regions of Central Asia (Tashkent).

The salinity of the soils of the Caspian lowland makes cotton in this region irreplaceable with respect to plant cultivation. The area devoted to cotton may be greatly increased by improving and increasing irrigation. The Mugan' and Mil' steppes have great reserves of land that can be irrigated by the waters of the Araks and to some extent by the Kura Rivers. The Shirvan and Sal'yany steppes also



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have large land reserves which could be irrigated by canals from the Kura River.

Many experiments as well as the practice of the peasant farmers on the Mugan' shows that the high stability of ground water and the drought-withstanding quality of the cotton make it possible, through early sowing, to grow cotton on a semidry farming basis by using one presowing watering (arat). The yield is not high, but one must become reconciled to this because of the acute water deficit. The yield of the cotton is considerably increased by providing the fields with second and third waterings.

The agrotechnical conditions of cotton growing on the Caspian lowlands, the degree of density of planting cotton through crop rotation, "gidromodul'" [the water coefficient], etc., are not everywhere the same and depend on the salinity of the soil, on the height of the water table, on the impoverishment of the soil, etc. The greater the salt content of the soil, the more desirable would be the introduction of legumes; the higher the ground water, the more economic the irrigation of plantations.

The heavy soils of the lowland require improvement through mastering the care and cultivation of soil-enriching plants.

One of the characteristics of heavy soils is the formation of a crust on their surface after rains or after watering a field, when a sowing has been made throughout the entire field. Formation of the crust hinders the appearance of the young plant. Mechanization of all the processes in the cultivation of cotton on the lowlands (while using tractors with caterpillar tracks) is a timely problem. Another serious and unavoidable problem that must be admitted is the battle against the locust, which periodically threatens the entire region. There is also the struggle with weeds.



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Selection of cotton must follow the line of increasing the yield of the cotton fiber. The prevailing Navrotskiy variety can no longer be considered as being the best, and it should be supplanted by varieties selected by the Trans-Caucasian Cotton Research Institute. Those varieties satisfactory for Mugan', Sal'yany, and Shirvan steppes would be 0158 and 0278, as well as 0629, 0624 and 0617. Variety 114 should be adapted for the region of Agdam and Terter. In the region of the Sal'yany and Shirvan steppes, as well as in South Mugan', it is necessary to introduce the selection of Egyptian cottons and to put them into practice. Of particular interest would be the propagation of the first generation of the hybrids of American and Egyptian cottons.

Besides cotton, which should be reinforced by crop rotation up to 75 percent, there is needed a widespread distribution cultivation of winter soil-enriching and feed crops. Alfalfa should be considered as the best crop for rotation with cotton on the Caspian lowlands. Summer crops for this region having an acute minimum of moisture should include the cultivation of sorghum for fodder. It also is possible to cultivate the best varieties of sesame.

The fact that the best winter pastures are on unirrigated areas makes it possible to raise cattle for dairying and meat by including cotton and sesame oil-cakes among the fodders. Growing peas, vetch, beans, etc., is recommended for soil-enrichment.

Of considerable significance in the Shirvan steppe and the lowland parts of the Kyurdarmirskiy and Geokchayskiy Rayons at the present time is irrigated viticulture for the manufacture of dessert wines of local types, for sale in the RSFSR. Here more wine can be extracted from the grapes than in Western Azerbeydzhan. The water



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problem here is very acute. Taking into consideration the facts that in the lowlands area the grapevine is allowed to climb on trees, that the region is not one of fruit growing, and that the grape yield is low, this branch of farming should be liquidated, and the land should be devoted to sowing cotton.



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Winter vegetable cultivation is possible, in the first place, in the Sal'yany Steppe, with its milder winters and the higher moisture content of the air, and, secondly, in the former Agdash Uyezd, in the valley of the Al'dzhigyan River, where a subtropical subregion is found. The cultivation of cucurbits is of importance in the Sal'yany Uyezd, where the local late-ripening watermelons are of superior quality. The absence of good communications with such large markets as Baku is an obstacle to the broadest development of vegetable cultivation in the Sal'yany Steppe.

In the Karabakh Steppe, in elevated places which are abundant here, non-irrigated field crops must be developed -- if selective, winter-withstanding species are to be developed -- of guayule, and of orchard crops, olives and pistachio nuts. The complete inability of guayule to thrive in saline soil places a limit on its extension into other steppes of the Caspian lowlands. Perhaps more than guayule, it is necessary to push the cultivation of drought-resistant and winter-withstanding chrysothamnus, which gives rubber of better quality than guayule and more is productive in rubber yield per unit of area. It is desirable also to carry out experiments in growing tau-saghyz on a large scale.

In many places bamboo can be grown on the banks of canals.

XXIX(2) Apsheron Peninsula. The eastern extremity of Azerbaydzhan, extending out into the Caspian Sea for 60 kilometers, in a plain with small hills in the northwestern and central part of the peninsula, which do not exceed 140 - 150 meters above sea level. The surface of the plain in many places is at the level of the Black Sea and below it. The climate in the northern and eastern sections of the peninsula is a dry, subtropical maritime climate, and in the southwestern part it is a very dry, subtropical maritime-steppe climate. The average yearly temperature is 14 degrees C. in the northern maritime section and 14.9

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degrees C. in the southwestern part.

There is no intense cold due to the moderating influence of the Caspian Sea. The absolute minimum for a number of years at the Apsheronskiy lighthouse did not exceed 5.1 degrees C., and at Baku, which is considerably lower — 10.6 degrees C. The number of days of frost per year differs sharply from the northeastern shore of the peninsula, where it averages 11, to the Southwestern shore, where it reaches 42. The duration of the frost-free period (excluding morning frost) is important, and is the most extensive in the whole of Azerbaydzhan, totalling 251 days. The average yearly rainfall equals 245 millimeters, with the greatest quantity in November and during the winter, and with the least during the period from May to September inclusive, when only a few millimeters fall per month. The area is greatly subject to winds, which are often very strong, the recurrence of strong winds totalling 105-140 days per year, with an average annual wind velocity of 9-9.5 "balls" (on the Beaufort scale). These winds are known as "Norda"; they rise up from the sands of Apsheron and create dust storms, which deposit the sand. The soils of Apsheron, in the great interior part, are of the serozem type. The narrow northern littoral and the eastern extremity consist of alluvial sedimentation (maritime sands); the southern strip of shore is of the solonchak type. In many localities of the peninsula there are outcroppings of native rocks, in the form of hard limestone slabs. The general landscape of the peninsula is that of a semi-desert. The area suffers from a deficiency of water. The irrigation system consists of numerous wells, from which the water is obtained by means of buckets made of buffalo hides and is poured out into distribution canals for the irrigation of orchards and gardens. The fresh subsurface waters at a depth of 1 to 1½ meters are the basic source of irrigation, as a result of which many crops,



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such as grapes, pomegranates and figs can be grown without irrigation, their roots utilizing the water which is near the surface of the ground. An important part of the northern section of the peninsula is occupied by orchards and vegetable gardens (around Mashtag, Nardaran, Bil'ch, Pirchag, and also the territory between the Caspian Sea and Mardak'yan). Field culture is based on winter wheat and barley, cultivated without irrigating and often rotated with fertilized vegetable crops. The yield of grain is very low -- 3 centners per hectare. To a significant degree the cultivation of grain here is for the purpose of producing fodder for the feeding of cattle, inasmuch as all feed here is brought in and is usually insufficient. The feeding problem is extraordinarily acute. In May the plain is burned out and only thorny plants and several grasses (Lolium persicum being the best of them) of very inferior quality for feeding remain half-green. Grain has no prospects here and must be reduced. The cultivation of vegetables is of exceptional importance, both in regard to the feeding of the agricultural population and also in regard to the partial supplying of such large markets as industrial Baku, which imports nearly 70,000 centners of vegetables, chiefly potatoes and cabbages, although cabbages are produced also on the Apsheron Peninsula. Irrigation is used here in the cultivation of vegetables. Winter vegetable cultivation produces onions, carrots, and cabbages; early spring and summer cultivation produces eggplants, tomatoes, lettuce and others. In order to protect the gardens from the winds and from being covered by sand, shelter belts of camel-burr thickets have been set up.

However much the cultivation of vegetables is developed here, it does not meet the demand of the Baku market, and the chief sources of supply for Baku remain the former Lenkoran', Gandzha and, in part, Sal'yany uyezds. Therefore, a branch of vegetable cultivation must be developed here which gives perishable products. An interesting develop-



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ment here is the organization of seed stations for exportable cauliflower and cabbage, entirely verified by experience and promising large profits, inasmuch as cauliflower seeds have a high value on the foreign market.

The cultivation of cucurbits here is non-irrigated but requires manuring. Excellent late-ripening melons are produced. Of great importance now is the cultivation of vineyards, which is carried out by the spreading of the vines to protect them from the wind. Irrigation of vineyards is not practiced. Very good table varieties are the "Akh-Shany" and the "Kara-Shany". Unfortunately, the vineyards suffer from an Oidium fungus. Grape cultivation must provide the workers of the region with fresh products. There is no cultivation of fruit-bearing plants of commercial importance on the Apsheron Peninsula. Figs and pomegranates thrive and bear fruit abundantly. The experiments of the Institute of Plant Culture show that here the Japanese persimmon and the olive develop excellently. The fig and pomegranate, and also the mulberry, can have exceptional importance for the reclamation of the sands on the Apsheron Peninsula, and for the final stages of the securing of the protective dunes along the shore. The cultivation of such fruit trees as the fig, pistachio, olive, and pomegranate in the worker's settlements of the oil region is of real importance.

The cultivation of saffron on the Apsheron Peninsula is unique in the USSR and has here all the natural prerequisites for development. Dairy farming for supplying the working population of Baku must be broadly developed (in the Marizilskiy Rayon) and in order to guarantee fodder for it, it is necessary to divert areas formerly planted in grain.

The Apsheron Peninsula is interesting as an original stage in the study and reproduction of plants introduced for dry subtropical areas.



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XXIX(3) Lenkoran' humid subtropical region. The lowland includes the first and second terraces of the Talysh Mountains, up to an elevation of 300 meters in the former Lenkoran' Uyezd. The maritime lowland, about 20-40 kilometers wide in the north and 5-9 kilometers in the south, is a plain, intersected in the direction of the sea by a network of important rivers, of which the largest is the Lenkoran' River (or Bazaru). In addition, many small rivers drain off in the lowland which do not reach the sea, but help to create swampiness in the area. The rivers are rich in tributaries in their mountainous parts. The Talysh Mountains, which rise up over the lowland, are a longitudinal and transverse mountain chain, interlaced in various directions by numerous gorges and valleys, and genetically are connected with the main range of the Talysh Mountains.

With respect to climate, the region is divided into two subregions, the northern, from the Bolgar River to the Takhta River, and the southern, from the Takhta River to the border of Persia (The Astara River).

In the northern steppe region, is the Prishib climate of subtropical Mediterranean type, warm, semihumid, steppe-like, with mild, damp winters and poor precipitation in summer. The average annual temperature is 14.5 degrees, the absolute minimum for a number of years equalling 17.8 degrees 45 days per year with frost, and the frost-free period 241 days. The precipitation is 526 millimeters per year, with the greatest amount in the autumn, spring and winter, and with dry summers (60 millimeters).

The southern part of the region has a warm and moist climate of the eastern sub-tropical type, especially along the Persian border. The average annual temperature in Lenkoran' and in Astara is 14.7 degrees. Frost begins in November and ends in March. The absolute minimum for a number of years in Lenkoran' dropped down to 15.0 degrees,



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with 47 days of frost in the year. At the same time in Astara, that is, in the same southern part of the region, the absolute minimum is 12.0 degrees, and the general number of days of frost only 8. Corresponding to this there is a frost-free period in Lenkoran' of 227 days, and in Astara a period of 288 days. These figures are not completely reliable. However, there is no doubt that in the southern part of the region, bordering on Persia, the climate is distinguished by unusually warm winters. Days without thaw are rare. The precipitation is 1,222 millimeters in Lenkoran' (in the central part of the region) and 1,302 millimeters in Astara (the southern part), with the greatest quantity during the course of the autumn (more than half of the annual total), next in winter and spring, and with drought during the summer, although the total in Astara per summer is 148 millimeters. Autumn in the entire region is very warm, much warmer than spring, in spite of the fact that during this period there is a great deal of precipitation. The moisture content of the air in the region is high (in the southern half); the air is damp, to which the swamps and forest thickets on the lowlands contribute.

The soils in the northernmost part of the region are of the chestnut type; farther in the Privol'ny and Prishib okrugs, and also in the region of Astar along the southern border are forest and podzol soils, and, finally, the main part of the lowland and the first and second terraces, occupying a vast territory, are represented by yellow earth soils (yellow-colored varieties of red earth), which are characterized, in distinction to the red earths, by the absence of carbonate of lime. The narrow strip of shore is covered with alluvium.

The northern part of the region, to which applies, as we saw, the Mediterranean type of climate (semihumid), is semiarid. The entire southern half of the region is covered by forests on the lowland, with



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an abundance of liana, with the presence of the local chestnut-leaf oak and nettletree, and with a grassy covering of sedge and meadow grass. Only the narrow part of the shore is covered with sandstone, together with brushwood thickets on the sandy soil.

The northern semi-arid part of the lowland experiences a great deficiency of irrigation water, but in the near future no large irrigation work is planned here, since cotton production does not have a dependable prospect in consequence of the approach of a very rainy period in the early autumn, during the very season for collecting the raw cotton. There are here in some places a few artificial reservoirs. Therefore, this part of the region is a grain area. Winter grain here is cultivated without irrigation (wheat and barley), from wheats for the most part of soft bearded variety with red kernels (Eritrosperum and Ferrugineum). Very rarely are seed-pod legumes and flax encountered. Until the organization here of irrigation construction, the cultivation of grains must be reserved to this part of the region, as well as the cultivation also of fodder plants, in view of the presence here of animal husbandry. The cultivation of kenaf is permissible in localities where the precipitation is not less than 600 millimeters per year. Rice also demands the guarantee of water. In order to increase the yield of grains it is necessary to develop the cultivation of legumes. The development of the cultivation of sorghum and chick-pea is completely possible.

The southern part of the region does not experience a lack of water, on the one hand, in view of the abundance of precipitation, and, on the other hand, in view of the proximity of ground water, which comes to the surface in places. However, in view of the dryness in summer and the development of such cultivation as rice and vegetable plants, the population converted the entire southern part into an irrigated



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region by the construction of primitive reservoirs, which are filled by the mountain rivers. Irrigation must be maintained, and for this purpose the repair and improvement of the reservoirs is necessary. The ordinary cereals here give low yields and therefore are sown in small amounts. On the other hand, rice occupies the dominant place in the entire southern lowland to the extent of being a mono-culture. Seed-pod legumes and winter flax are sown in small quantities. The cultivation of vegetables here is a development of considerable extent, especially the cultivation of cucumbers, tomatoes, eggplant, and squash, and are intended for the supplying of Baku. The cultivation of cotton here is impossible because of ground moisture and very rainy autumns. The cultivation of fruit here also is undeveloped.

The prospects of this part of the region are based entirely on the utilization of valuable subtropical crops, although in the near future a significant part of the lowland must be, as before, devoted to the cultivation of rice, while the absolute increase of the area under rice is permissible. Here exist exceptionally favorable conditions for the broad cultivation of New Zealand flax, with emphasis on the better varieties for the manufacture of cloth. The cultivation of the club palm is possible. The existence here of chance plantings of New Zealand flax creates the impression of an exceptionally favorable development, better than in western Georgia. This plant does not fear damp soils; in case of extreme super-saturation of the soil by moisture it is possible to construct simple drainage ditches, as is the practice in New Zealand. On the other hand, there is scarcely any basis for planning the cultivation of ramie in the region. The root system of ramie cannot endure getting wet; therefore the prospects for its development are restricted even by the light alluvial soils, with a level of ground water not higher than one meter.

The lowland is favorable also for a significant development of



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winter vegetable cultivation. The areas situated on the terraces which rise up over the lowland, approximately 300 meters high, are characterized by a warmer climate, owning to the inversion of the temperature; cold air from the elevations descends to the low terraces and spreads over the lowlands, chiefly in the gorges, valleys and ravines. On these terraces the yellow earths have a depth of more than a meter and must be utilized for experimental plantings of tea of various tested cold-resisting varieties. The presence of carbonate of lime in the yellow earths hinders the cultivation of tea, but the development of tea plantations in nearby Persia, namely in the Caspian region among others, and in the region of Astara,



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together with the excellent qualities of Persian tea, provides a basis in some measure for these assumptions. It is known that amateur plantings of tea were successful, but consequently the enterprise was left unfinished and the tea was lost, being smothered by forests.

Citrus cultivation here has a positive basis. In nearby Persia there exists the ancient commercial cultivation of oranges. It is logical then to try to grow tangerines and oranges even in the Astara region. The Japanese persimmon and feijoa also have all the prerequisites. The development of the fig, camphor laurel, tung oil tree, and bamboo, the last-named in ravines, is possible. In the shade of fruit trees, and also in the forest zone, the cultivation of valuable subtropical root crops, namely Chinese yams, taro, xanthosomes, and arrowroot, is possible.

It is necessary to secure these terraces with soil-enriching crops to the utmost, since animal husbandry here can have only local significance.

XXIX (4) The Kuba Plain. The Kuba Plain embraces the lower part of the former Kuba Uyezd. The region is isolated from the rest of Azerbaydzhan, and is confined to the territory of the north-eastern slope of the main range of the Caucasus. It comprises a Caspian plain forming a narrow coastal strip. A number of rivers cut through the plain and discharge on the way stony, gravel-like deposits. The climate is moderately warm, semi-arid. Due to the absence of meteorological stations, we cannot exactly determine [redacted] the elements of the climate. The winter is mild. The soils are alluvial including deposits brought down from the mountains by mountain torrents in the northern part and solonetz in the southern part. Close to the mountains standard soils



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alternate with grey earths. The northern part is covered by forests in the lowland, and the southern part is covered by semi-arid mugwort. In the northern part of the region irrigation water is assured. Cotton fails to prosper here because of rainy autumns. In the southern part, cultivation of rice is being extended. The region is very favorable for textile crops, as for example kenaf and hemp, and also for fuller's teasel. The hemp here is of very high quality. It must be cultivated on irrigated lands with even contours, and on fertile non-saline soils. The region is favorable for the cultivation of orchards and vegetables and these are among the leading branches of agriculture [redacted]. Experiments show (Khachmas Station) that here the European, Crimean varieties of apples turn out well, and also pears, plums and apricots. Here, apparently, the fig and the pomegranate also can progress. Vegetable cultivation here is of a commercial character; the products are sold in Baku and are processed in the local cannery. The development of the canning industry has broad prerequisites. [redacted] /S/owing of/7/ rice in this region should not be curtailed.

XXIX (5) The Foothills in Kuba Uyezd. The foothills in Kuba Uyezd have an average elevation of 600 to 650 meters. The climate is moderately warm, semihumid, of the forest type. The average annual temperature is 9.9 degrees Centigrade, with a precipitation of 400 millimeters in Kusari, and 560 millimeters in Kuba, with the maximum in the autumn, but with a great deal in May and June. Winter is mild. The soils are grey earths, light chestnut, forest and podzols. The region is an area of mountain forests. The cultivation of fruits on a commercial basis occupies here a dominating position, and the entire region is covered with orchards. The annual export of fruits is nearly 400,000 centners, while a



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tremendous amount of fruit is retained locally, and even fed to the cattle. The further development of high-grade commercial fruit demands the organization of drying plants and canneries for the processing of the fruits locally, since only the varieties which can be picked and left to mature may be exported fresh. The organization of nurseries of uncultivated plants and a nursery of the European and Crimean variety is required. The region is supplied with vegetables from the lowlands. The cultivation of fodder grasses in the orchards is necessary here, and also the cultivation of legumes.

XXIX (6) Western Kura Lowland and Kura-Iora Plateau. The western Kura Lowland and the Kura-Iora Plateau embrace the lower parts of the former Gandzha, Shamkhor, and Kazakh uyezds, the Erik-Tara Steppe and the Dzheyran-Choli Steppe. The Kura Lowland begins at the Georgian Border and Stretches as a narrow strip along the Kura River to the railroad line, gradually broadening out and reaching up to Yevlakh, where the Caspian Lowland begins. The tertiary plateau between the rivers, enclosed between the Kura and Iora rivers, is slightly elevated, not having outlets to the plain, which is broken by ridges and hills, and also by numerous ravines and bluffs eroded out of the terraces. The Kura and Iora rivers have extraordinarily tortuous courses here, and are deprived of tributaries along the section under consideration. The soils of this plateau are, for the most part, brownish-grey solonetz soils and soils of the grey earth type. Alluvial grey earths cover a small area, but are more important with regard to plant cultivation, along the beds of the Kura and Iora, and are well expressed in the area of the confluence of these rivers. Other kinds of soil occur also, as, for





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example, humuscarbonate (in the western part), which cover the Barodachev Steppe. The climate of this plateau is moderately warm, semi-arid, continental, with snowless, warm winters and dry, sultry summers, and an annual precipitation of 300 to 400 millimeters, the maximum amount of rainfall coming at the end of spring and the beginning of summer (May-June).

This plateau, known under the names of the Erik-Tara Steppe and Dzheyran-Chola, is covered in many places with clumps of saltwort and mugwort. In the northern part, on the slopes of the mountain ridges along the Iora River, there are rather many juniper forests, with grasses which are good for pasturage. In general, the plateau is used at the present as winter pasture (kishlagi), and only in the extreme eastern part, on the irrigated grey earth soils, does plant cultivation exist with prospects for important development of fruit-growing.

The Kura Lowland (Gandzha-Kazakh) stretches, as was indicated above, along the course of the Kura River and the railroad line to an elevation of 350 to 450 meters above sea level, whereas the right bank of the Kura is intersected by numerous tributaries. The right bank, with its exceptional soils, is indebted to the common actions of the Kura and its tributaries. The climate is moderately warm, semi-arid in the western (Akstafa) part and moderately warm and arid in the easter (Gandzha) part, with an average annual temperature of 12.9 degrees for Gandzha and 12.6 degrees for Akstafa. The warm period of the year is somewhat shorter (by 15 days) than the cold period. The number of days of frost in exceptional years reaches 103 (in Baku in such years, only 42), at which time even in March there are up to 26 days of frost. In October, in unfavorable years, two frosts occur (during the last days), in November there are already from 14 to 17, while sometimes the frosts begin only at the end of



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November. Spring morning frosts during favorable years cease during the first days of March; in unfavorable years, as late as the twentieth of April. The absolute minimum for a number of years in Gandzha dropped down to 16.5 degrees, and in Akstafa to 11.1 degrees. The shortest frost-free period equals 184 days and, in general, coincides with the growing season. The farming period in Gandzha lasts 145 days from the sowing to the first cotton harvest, 168 days to the second, and 175 days to the third. Thus, the chief [redacted] cotton pickings are [redacted] completely accomplished during the frost-free period and only the fourth and fifth pickings [redacted] are accomplished during the freezing period. Hence is explained the necessity of selecting early-ripening varieties. The average quantity of annual precipitation for the whole of Gandzha is only 252 millimeters and 348 millimeters for Akstafa, the maximum precipitation falling in May.

The soils of the Kura Lowland in Gandzha Province (eastern) are characterized by [redacted] grey earth soils and light chestnut soils, and in the western (Akstafa) part, by chestnut soils. The boundary between these basic soil areas passes near the city of Shamkhor. The light chestnut soils are found in the center of the region; they have a compost contour of 25-30 centimeters, but with a small content of humus (3 percent) and are based on the thick alluvial deposits of the Kura River and its numerous tributaries. The overwhelming portion of these have been under cultivation for a long time and as a result of systematic irrigation have been subjected to considerable modification. Besides irrigation, the mixing of these soils in viniculture influences their structure and chemical affinity, in addition to which the soils on the German collective farms reveal significantly a rich humus as a consequence of constant



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manuring and other fertilization. Such alterations of irrigated soils leads to the formation of light chestnut, deteriorated loamy varieties.

The eastern part of the region, adjoining both sides of the railroad line from Mamedla to Yevlakh, contains grey soils and grey earth soils, with a depth up to 1 meter and more, [redacted] with the salted remnants of a tugay forest and a significant distribution of tamarisk. At Yevlakh a strip of young alluvial soils begins.

The southern and most elevated part of the region, which adjoins the light chestnut and grey earth soils in the north, and represents in the south the beginning of the mountainous region, is covered with light brown and brown skeletal soils.

The western section of the Kura River area, in the vicinity of Akstafa, is covered with chestnut and dark chestnut soils, which, as is the case in the Gandzha also, in a large part of it, underwent modifications as a consequence of lengthy irrigation and cultivation. The prohibited chestnut soils here have a depth of humus of 60-70 centimeters, which are quiescent on the carbonate strata. Both of these layers in watered places greatly deteriorate in quality. On mounds and hills here are also evolved brown and skeletal soils. The region described belongs among the more valuable plant-growing areas of Azerbaydzhan. Exceptional conditions for the cultivation of valuable crops, in particular cotton and grapes, are created by the thick chestnut soils with a very favorable mechanical composition, the water-permeable ground, the plain-like topography which slopes to the Caspian Sea, the warm winter, frost-free period somewhat exceeding six months, a highly developed river system from the precipitation that accumulates in the mountains, the bringing





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of this precipitation to the lowland, the proximity of ground water, river waters, and the well-developed kyugriz (underground) irrigation system (although it does not, by far, meet all the needs for water). The northern part of the region is more favorable for the cultivation of cotton, while the southern part is more favorable for viniculture, where there is found alluvial and gravelly soils.

The selection of early-ripening cotton pllants is an essential question in the region. However, early-ripening varieties should be considered not in terms of pure forms, but in combination with large seed-vessel varieties. The work of the Gandzha Selection Station (now the Trans-Caucasian NIKhI) has resulted in the evolution of a very valuable variety of cotton plant, which should supersede the Navrotskiy Variety.

Especially evolved for the Gandzha , Shamkhor and Kasum-Izmaylovskiy regions is the early-ripening 114 line, which gives nearly 16 centners of fiber of good length per hectare. The varieties of the selection of the Central Asia NIKhI known as 0556, 0482, 0487, and 2017, of the medium ripening variety, merit attention.

The southern part of the region is the largest wine-making region in Azerbaydzhan. Viniculture and wine-making is almost completely concentrated in the German collective farms, formerly the German Settlements. The grapevines are irrigated and grown on poles and wires. Water, because of the pebbly soil, is quickly absorbed and the soil layer is promptly dried up. Therefore irrigation is carried out here often, up to six times, and sometimes even up to ten times, although the repetition of irrigation is often carried out not because there is a need for it but because it is that area's turn (water is in short supply and





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this creates a waiting list). Excessive irrigation, which increases the yield (up to 1,000-1,500 pails of wine per hectare), decreases the quality of the wine and causes furious weed growth. The wine varieties Tavkveri, Rundveys, Rkatsiteli, and Saperavi are propagated here, and also a number of European vines such as Cabernet, Pinot-Gris, Riesling and others. Of the table varieties there are White Gandzha and Tabriz. A great obstacle to secure yields often is the absence of mixed plantings. Such a variety as Takveri is incapable of self-pollination, and therefore it is necessary to plant Rundveys in addition. It appears, in general, that the Tavkveri is a variety with poor prospects, although it is most widespread here. Here, in the first place, work should be carried on with the selection of pollinators in order to assure harvests, and, in the second place, to work with crossbreeding to obtain better varieties. It is necessary also to organize nurseries of American vines in order to obtain wildings. As a soil-enriching plant during the summer period in the vineyards, the peanut is strongly recommended. Besides peanuts, the velvetbean (on level places) can be recommended, as well as the "mash" bean (phaseolus mungo). As winter soil-enriching plants, Badakhshan peas should be used, which produce a large green mass, and the Nicholson and Austrian peas, which can withstand very low temperatures. Badakhshan peas and selected issues of peas by the Gandzha Selection station must be encouraged in every way as soil-enriching plants of the cotton fields. The construction here of a large vegetable oil combine guarantees the fertilizing of the fields with cottonseed cake. The question concerning the utilization of the winter period for the growing of cold-withstanding plants, the utilization of available winter moisture, and of winter precipitation, is an exceptionally serious and ever-larger one. The utilization of



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winter moisture by the plants rids the region, to a considerable degree, of malaria, since then the accumulation of non-utilized water will not form swamps in faulted places.

In the region of light chestnut soils, which lie on permeable alluvial ground, the cultivation of sweet potatoes of the variety which resist irrigation should be tried.

The cultivation of forage plants is of real significance here in view of the need for developing dairy and meat farming for the provisioning of Gandzha and its vigorously developing industry (the Aluminum Combine and the rest), as well as its cultural growth (a number of institutions of high learning), and for the provisioning of the huge cotton and grape-growing collective farms. The proximity of winter and summer pasturage can assure the region meat cattle. Forage plant cultivation can take place winter and summer. Peas and vetch could be grown during the winter, clover, sweet clover, sorghum, corn, with soybean and dolikhos, and Jerusalem artichoke for silage (utilizing quick-growing leaves of root-bearing plant such as the Fyuzo variety of the species Helianthus Helianthi), etc.

For the utilization of winter moisture, perhaps, winter oats of the Avena byzanthina species is also recommended, which easily hibernate in Gandzha and ripen at the very beginning of spring. These oats could be used for the winter cultivation of a mixture of vetch and oats. The prospects for fruit cultivation are those of a secondary branch of agriculture. Apples of the good European varieties succeed best of all.

The cultivation of lemons and oranges under the shelter of cold sheds should be tried (in imitation of Italy, on Lake Garda). The experiment already has succeeded. Cucurbit cultivation [redacted] can produce high-quality melons. Vegetable cultivation even



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now exists on a large scale, but it must be developed on a scale to supply the region and also to supply raw material for the canneries.

On the banks of canals bamboo can be successfully grown.

XXIX (7) Shekin Plateau. The Shekin Plateau is isolated among the low-lying steppes, rising above the monotonous plain to an average elevation of 250 meters, bounded on the north and south by low ridges, with smooth slopes to the plateau and sharp slopes to the low lands. The climate is moderately warm, semi-humid, with an annual precipitation of 400-500 millimeters. Summer is sultry and dry, beginning in the middle of June. The western part of the plateau, known as the Adzhinour Steppe, has no rivers or



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other irrigational means and is an uninhabited, waterless plain. The eastern part, with the Turut and Sarudzha Steppes, in damper, intersected by many rivers which discharge from the Main Range and do not reach the Kura River, swamping certain parts of the Agdash-Geokchay Lowland. The soils are black earth-chestnut. Basically it is utilized as a winter pasture for sheep. The eastern part of the region, by utilizing the river waters, is suitable for the cultivation of cotton and fruits. The region has been little investigated, but may be of value as a possible grain region on the basis of an agricultural rationalization of the cultivation of spring wheat and the more drought-resisting summer chiv crops (chick-pea, sorghum, cucurbits, etc. ).

XXIX (8) Alazan Nukha-Avtar Plain and the lower foothill zone of the Zakatal Nukha part of the Bol'shay Kavkag. This region embraces the former Zakatal Uyezd and the northern part of the Nukha Uyezd. The Alazan Valley in Azerbaydzhan is a continuation of this valley from Georgia. Farther on, the Alazan Valley becomes the Nukha Plain, which in its turn becomes the Avtar Valley, reaching up into the spurs of the Lagichskiy Ridge. The slopes of the Main Caucasus Ridge border these valleys, the lower zone of which forms a subregion of the region being described. All three valleys, especially the Nukha Plain, are crossed by numerous rivers flowing down



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from the slopes of the Main Caucasus Ridge.

The climate of these plains is moderately warm and moist, with an annual average temperature of 12.9 degrees in Zakataly and 12.3 degrees in Nukha. The winters are mild, and during the whole winter there are only a few days that have an average daily temperature of 0.0 degrees.

The absolute minimum for a number of years for Zakataly is 13.3 degrees. The frost-free period lasts seven months and on the average totals 214 days in Zakataly, and in Nukha as many as 233 days. In particular years the frost-free period lasts as long as 8½ months. The absolute duration of the frost-free period even during the most unfavorable year was 198 days. The number of hot days, with the average temperature above 20 degrees, [redacted] is 92, and occurs during the three summer months. The moisture content of the air is high. The greatest amount of precipitation occurs between April and September, totalling 900 millimeters for Nukha. The least precipitation occurs during the winter. Showers are very characteristic for the region on the whole, especially in the western part, where the number of showers per year reaches 46; the period of showers lasts from May to September, occurring particularly frequently in the latter month. Rains and cloudbursts in the mountains, on the steep slopes of the Main Range above the valley, cause periodical muddy floods, known as "seley", which



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rush down with destructive force, discharging boulders and gravel into the valley. Such abundant boulder and gravel deposits are especially characteristic of the Nukha Plain and the eastern part of the Zakataly Plain. The soils along the Alazan River and the Ayri-chay River consist of sedimentary deposits washed down from the nearby slopes of the mountains in thick tapering layers of rocks and pebbles. Farther up, on the slopes of the mountains above the plains, extend forest and podzol soils. The vegetation of the lowland, in view of the rapid drying-out of the sedimentary soils, consist of semi-arid plants such as mugwort and beard grass; the slopes of the mountains are covered with mixed forests, with oak predominating.

The entire region is guaranteed irrigation water. With intensive farming in the region, a shortage of land is experienced, a condition that is aggravated by the fact that a significant area in the Nukha Plain is buried under sedimentation.

The cultivation of the rice which must be preserved is of great importance in the Zakataly and Nukha lowlands. In the southeastern part, where the plain crosses the cotton belt (the Nukha part of the region), the cultivation of the cotton plant under conditions of semi-dry farming is possible. Its seeds must not be planted in areas where there are frequent showers and where precipitation occurs in early autumn. The cultivation of sweet potatoes

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is possible. Peanut cultivation must be encouraged. The soy-bean also must be developed here. Of the plants from which are derived volatile oils, the Kazanlyk rose has the best prospects. Tobacco raising in Azerbaydzhan is 90 per cent concentrated in Zakataly Plain and partially in the Nukha Plain, not in the lowlands, however, but in the forest and podsol soils of the foothills. The quality of the tobacco is low, due in part to the primitive methods of drying.

In the foothill district, tobacco-raising, together with the cultivation of orchards, must be made the leading branch of plant cultivation, with the substitution of Samsun and Trebizond varieties of tobacco for the low-grade varieties. The cultivation of orchards also must be given a significant place in the foothill subregion and, in part, on the lowland. The isolation and remoteness of the region from a railroad, the poor condition of local roads, which are washed out by cloudbursts and "selly," hampers the export of fresh products and compels the region to specialize in the cultivation of nuts -- the funduk (a type of hazelnut), walnut and, to some extent, the chestnut. Here is found a broad belt of walnut trees, stretching for 250 kilometers and containing approximately 20,000 trees. The cultivation of seed-bearing fruits, the apple and pear, is seldom encountered, and then chiefly in cities. The pit bearing varieties, the plum and cornel, are frequently encountered, on



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the contrary, in the rural areas. In the Nukha Okrug, the cultivation of figs, which ripen easily here, has been proven, but they are utilized in their green form rather than their dried form. The development of a commercial fruit cultivation is fully justified here, with widespread introduction of the best European and Crimean apples, pears, and pit-bearing fruits, as well as figs and possibly date plums, and is limited only by the absence of a railway in finding a ready market for fresh products, and by the need for a projected local plant for processing as canned goods. Bad roads, however, cannot serve as the grounds for further specialization of the subregion in the cultivation of nuts; it is necessary to construct good roads and simultaneously develop seed-bearing and pit-bearing fruits, figs, etc.

The cultivation of the mulberry tree for silk-worm breeding is an old occupation in the region and its commercial development here is great.

The cultivation of forage plants in the region is necessary in order to guarantee to it milk and milk products, as well as meat. The organization of good health resorts is possible here, which also would require the products of animal husbandry.

Of the forage crops, spring vetch, spring rape, soya, sorghum, long-tasseled corn, and certain edible root crops ought to be introduced. Of the silage crops: sorghum, sweetclover, Jerusalem artichoke (of the variety with developed leaves) and fodder squash. Of the hay crops: the soybean (after



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removal of the grain) shabdar clover, winter peas with winter vetch, and canary grass, and a number of others. Soil-enriching plants must be developed widely in orchards, and subsequently, during the winter, at the time of the mono-culture of tobacco (winter peas, winter vetch), and during the winter period on the lowland. Cucurbit cultivation, especially the watermelon, should be developed for local demands.

XXIX (9) Kabistan, [redacted]. Includes the former Shemakh Uyezd. The highland occupies the southeastern extremity of the Main Caucasus Ridge, with numerous hill-like elevations from 300 to 800 meters high and two low mountain ranges, whereas the western part of Kabistan has a more mountainous and elevated topography, and the eastern part, on the contrary, is characterized by low hills with gently rolling contours, with small valleys between them, intersected by numerous ravines, which are eroded by the streams resulting from the rains in the spring and autumn. The climate is moderately warm and dry, except the extreme western part of Kabistan, around the city of Shemakha, which must be placed in a special subregion, specifically the part of it devoted to viniculture.

The average annual temperature is around 13.0 degrees and higher. The precipitation is from 20 to 300 millimeters, the dry period lasting from May to October. Light chestnut soils are found in the west, grey earths and brown soils in the central part, and solonetz soils are encountered in the east. The vegetation, basically, is mugwort semi-desert with mugwort-saltwort, together with mugwort-grass. The region is characterized by extreme dryness and in its present state is



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useful for winter pasture. The sparse population lives only along the shores of the rivers, completely dependent on the scanty irrigation. There are in the region artificial reservoirs, which contain water that is unfit for drinking.

The region is fit only for the winter cultivation of wheat and barley, and in the near future these crops must be developed here. Spring grain crops are unreliable here. Only the drought-resisting forms of chick-pea, sorghum, and millet can be cultivated. Cover crops ought to be planned here for fallow lands. Of the forage crops it is possible to grow several edible root plants (carrots etc.), Garedzha alfalfa, esparsette, zhitnyak, triticum eristatum and mogara. Sorghum, corn and Jerusalem artichoke are needed for silage. The cultivation of winter rye as a fodder crop is not recommended, because of the unavoidable subsequent obstruction to it by the planting of winter wheat. The organization of experimental farms is needed for the study of procedures for the possible utilization of the arid region.

The Shemakh district, which is characterized by considerable moisture and the development of grape cultivation, must specialize in viniculture.

XXIX (10) The lower zone of the Shakh-Dag and Murov-Dag Mountains and the Gandzha Rayon. The region is broken up by deep ravines, which are the valleys of the numerous tributaries of the right bank of the Kura River and which cut through the northern slopes of the high Shakh-Dag and Murov-Dag mountain system paralleling the Kura Lowland. The climate is moderately



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warm, semiarid. Precipitation in winter is in the form of snow; the summer is dry. The region is subject to hailstorms and considerable fluctuation in temperature. The soils are forest, brown, grey, and chernozem-type. The main soil type is the brown soils, which are of varying depths, with 13 per cent humus in the tillable layer. After the uprooting of the forest, these soils give, during the course of several years, secure harvests of grain crops, but gradually the physical properties of the soils deteriorate. On the other hand, in the course of mixing these soils in growing cultivated crops, and in the course of persistent efforts to aerate and mellow these soils, they give, over a long period, good harvests. Therefore, the growing of grain non-cultivated crops must be carried out very cautiously. On the other hand, the cultivation of corn, edible root crops and potatoes must be stimulated. Dairy farming must be established as a leading occupation, with the processing of milk for Swiss cheese and butter. The cultivation of forage grasses (clover, esparsette, etc.) must provide productive animal husbandry with feeds. Conditions are favorable here for the cultivation of orchards and this must be given an important place. For the utilization of the products it is necessary that a cannery be constructed in the region.

XXIX (11) The central highland and high-mountainous zones of the Bol'shov Kavkas Malyy and Talysh The climate is moderately-cold and cold, humid in the Bol'shoy Kavkas, semi-humid in the Malyy Kavkaz, and with a forest climate in the Talysh. The winters are long and severe. The soils are of the forest and mountain-meadow types. In the Bol'shoy Kavkas, in may places, con-



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ditions are more favorable for cattle, whereas, on the other hand, they are more favorable for sheep and goats in the Malyy Kavkaz.

The region, on the whole, is distinguished as a cattle-raising area. However, in the central-highland part there must be developed an intensive field agriculture, with the cultivation of soft and hard wheats, barley, early-ripening flint varieties of corn, kidney beans, and peas in the Bol'shoy Kavkaz, and chick-peas in the Malyy Kavkaz. In particular in the Nagorno-Karabakh, the leading grain crop would be winter barley (up to an altitude of 800 meters above sea level), as a forage crop. At the same time, the zone is dependent on the development of the cultivation of the mulberry tree. The central-highland and high-mountainous zone is solely a cattle-raising area, with a development of edible root plants (beets and potatoes), silage crops (corn), and fodder grasses (vetch, esparsette). Above 2,100 meters there is summer pasturage. The cultivation of potatoes must be advanced to utilize the vast areas, especially in the high-mountain zone. Not everywhere, however, is intensive field cultivation possible and its prospects are limited to the exposed slopes, with the influence of the foehn and strong mountain-valley breezes, moisture conditions, a thick soil covering and a number of other conditions. The central-highland zone, in any case, must expand considerably the framework of its grain and root-crop farming. The presence of vast summer pasturage and hay fields still does not guarantee feed for the cattle; consequently, the rapid introduction of the cultivation of forage crops is needed, aided by the sowing of forage grasses by airplane, together with the



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improvement of meadows and pastures. Here, precisely as in Georgia, is needed the introduction of local wild-growing alfalfa, esparsette, clover, vetch, forage grasses etc., as well as the organization of silage farming with suitable crops (thousand headed and Mozgoraya cabbage, (cauliflower) Jerusalem artichoke, turnips, (Brassica napus rapifera) etc.). Of the fiber crops, the cultivation of long fiber flax should be introduced in the high-mountain belt. Of the vegetable oil group of plants, the cultivation is possible of flax for flaxseed oil in the mid-mountain zone, and in the higher belt the cultivation of "konring", lallemantia, white mustard, gold-of-pleasure and indau, almost all of which can be grown up to the limits of the limits of the agricultural zone. In planning winter and summer sowing one should be guided by zoning.

XXIX (12) The Nakhichevan' The Nakhichevan' occupies a geographically isolated location, inasmuch as it is separated from the rest of Azerbaydzhan by the southern extremity of the Armenian Republic. It is located on the left bank of the middle course of the Araks River and is enclosed on all sides by high mountain ranges (Zangezur, Daralagez and Paltap). This isolated location of the region makes it unique in its natural conditions. The region consists of terraces of the various exposures of the slopes to the Araks River and consists of three [redacted] basic zones -- the plain, foothill, and highland.

The flatland part (with an average altitude of 800 meters above sea level is a narrow belt 15 to 25 kilometers wide, considerably narrowing in the east, where it [redacted] joins the Margin ravine. In the west the Nakhichevan Plain is a continuation of the Erivan Plain. The basic characteristic of the



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climate of the plain and the lower zone of the mountains is the long, severe winter, when during the course of the three months the average monthly temperature remains below 0.0 degrees. On the other hand, the summer is very sultry, of a dry, subtropical nature, lasting four months or more, and is characterized by the dryness of the air and the lack of rainfall. The average annual temperature range equals 30 degrees; the annual temperature (around 12 degrees) does not afford any idea concerning the region because of the sharp difference in temperature conditions in summer and winter. The warm period lasts 7 months, the cold period 5 months. The long and warm autumn, and the warm, long (because of the spring) summer, would afford the complete possibility of cultivating subtropical perennials, if the winter were not severe, which makes it necessary to cover even such a cold-resisting liana as the grape-vine for the winter.

The frost-free period lasts 195 days and the growing season [redacted] 190 days, that is, it is completely sufficient for the cultivation of average-ripening cotton varieties. The great deficiency of the region as a whole is the great lack of snow in the winter, so that the highland zones do not guarantee the possibility of winter grain cultivation. A further obstacle to this, in addition, is the deficiency of precipitation during the autumn, the sowing season for winter grain. The annual amount of precipitation on the average is around 300 millimeters, and less for the lower zone, and 500-600 millimeters for the higher zone. The maximum precipitation falls during the spring, from March to May, the summer is very dry, the autumn also is dry (from 25 to 60 millimeters in the higher zone). The air is dry, and during the night the moisture content of the air is significantly increased. The general defi-



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ciency of moisture is greatly aggravated by the constant strong mountain-valley winds, which blow along the valleys of the Arak River during the warm half of the year, beginning in the morning and abating at sunset.

The soils of the plain are serozems; the foothill belt contains brown soils, and the uplands light chestnuts. The vegetation of the plains is sandy, gravelly semi-desert, with an abundant growth of the grasses Aristida plumosa and one of the varieties of Achillea. The entire highland zone is covered with highland xerophyte.

Agriculture is possible on the plain and in the hills only by means of irrigation. The existing native irrigation system does not provide the region with water, however, and those places where there is no water are utilized for winter pasturage. Irrigation water is obtained from rivers, springs, and partially from kyagriz (underground system of wells). Almost no reservoirs are in existence, and the spring thaw waters remain unutilized. The projected irrigation system provides for the mechanical raising of water from the Araks River by the construction of pumping stations.

The Nakhichevan Plain, in regard to the cultivation of crops, is divided into two sections: the valley of the lower course of the Arpa-chay River, up to its outlet into the Arks River, that is, properly the Nakhichevan field-cultivation plain, and the Ordubad orchard-cultivation plain which bounds the Megry Canyon. In the Nakhichevan part, the cultivation of cotton and rice is developed. It is interesting that rice here enters into crop rotation, inasmuch as the water on the rice fields does not stand for long and the soil, in view of its permea-



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bility, and also in view of the great evaporation, quickly loses moisture. In order to restore the fertility of the soil there exists here an ancient cultivation of fenugreek (Trigonella Foenum graecum) in rotation with cotton. Fenugreek is used as a cereal forage plant. The manure goes for fuel. This part of the region must be drained off chiefly for the cultivation of cotton. The growing season completely falls within the frost-free period, but care should be exercised in regard to the spring planting. Clover and fenugreek can be utilized in rotation with cotton, and also excellent new fiber plants of the leguminous species -- crotalaria -- which yield a good fiber, a good harvest of seeds for propagation (other varieties of crotalaria we have do not yield seeds) and which are distinguished by the development of tubers on the roots, thanks to which the nitrogen content is greatly restored. However, [redacted] cotton in crop rotation here must comprise the greatest percentage of the total amount of crops grown in the cotton region of the ZSFSR. Besides cotton production, a certain importance must be attached to viniculture here, which is carried on for the propagation of vines. Fruit cultivation consists of apples, pears, plums and apricots. The most winter-resisting apricots and other fruits suffer during the colder winters from neglect.

The Ordubad region along the Araks River and the canyons leading into it is fruit-growing oasis. Pit-bearing varieties predominate, chiefly apricots, which are exposed to drying by the sun, but this is done with the pits left, which greatly reduces the value of the product. In recent years curing with sulphur and drying without pits has been introduced in many places. The



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cultivation of cherries and plums is considerably developed. Peach cultivation, completely warranted here, is connected with the development of the canning industry. Also developed is the cultivation of the quince, the mulberry tree and the walnut. Viniculture is not of great importance.

There is in existence here the cultivation of a local variety of rose, the leaves of which are used for jam and even for the extraction of rose oil. This circumstance permits the assumption that it is possible to raise here the voluble oil producing Kazanlyk rose, but with protection during thw winter, and still further to look forward to the introduction of the cultivation of the local Azerbaydzhan rose, which contains volatile oils. It will be necessary to put it in canyons which are protected from the winds that blow along the Araks River. In order to intensify fruit cultivation it is necessary to organize nurseries for grafting valuable varieties of fruits. Grain crops absolutely must be moved from the lowland to the highland zone.

The upland part of the Nakhichevan in addition to animal husbandry, must cultivate spring wheat (winter wheat is destroyed by frost in view of the dry, snowless winter and the insignificant precipitation during the planting period for winter wheat), and also chick-pea, lentil, esparsette, vetch, etc.

## XXX ARMENIAN SSR

In its orography, the Armenian SSR is extremely mountainous. More than half of the area of its territory is located above 1,800 meters above sea level, whereas the larger part of the territory of Azerbaydzhan, on the contrary, does not vary.



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Only 3.6 per cent of the territory of Armenia is included in the zone below 600 meters. The high-mountainous location of the country determines the vast forage areas, chiefly of the pasturage type, which are used only during the summer; on the other hand, there is very little winter pasturage. The important role of Armenia in agriculture, consequently, must pertain to animal husbandry. Of all the areas that are utilized, approximately half are used for field crops, and almost as much again in meadows. The remaining small (3 per cent) part is fit for other branches of plant cultivation. Among the field crops the cereal grasses predominate -- 87 per cent; cotton around 7 per cent, and potatoes 4 per cent.

Grain crops have only consumer significance, except brewing barley. The importance of winter wheat is determined by the vertical zones of field cultivation in the separate regions, and the 1,800 meter level is the limit for this cultivation. The acreage sown in winter wheat in the regions amounts to 35 to 55 per cent of the remaining crops.

Winter barley has very little importance in consequence of its susceptibility to frost; spring barley and potatoes are grown up to the possible limits of agriculture. Spring wheat is grown in the highland zone from 1,300 meters up to the subalpine belt; corn is grown up to 1,600 meters, and cotton up to 1,200 meters or somewhat less. However, cotton cultivation, as the leading branch, is adapted to the zone from 900 to 1,000 meters. Orchards and viniculture, and tobacco in part, have been significantly developed from 1,000 to 1,400 meters. Grain farming still is of secondary importance. The greatest development of grain farming is found in the zone from 1,400 to 1,800 - 1,900 meters, and the highest zone is advantageous for animal

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husbandry. Certain regions, however, especially the Loriya Plain and the Leninakan Plateau, in part, particularly in view of the concentration here of the best high-quality hay harvests, between the altitudes of 1,400 and 1,700 meters, are not regions of field cultivation but regions of productive animal husbandry.

The arid climate of Armenia makes agriculture without irrigation impossible in the lower and often in the middle zone. With a deficiency of low-lying areas, all space suitable for cotton is reserved for it and requires irrigation. At the present time, thanks to the exceptional influence of the Soviet power in the socialist construction of Armenia, not only has the native irrigation system been overhauled, but also a huge irrigation installation has been created, so that cotton cultivation in perspective can be brought up to 90,000 hectares. Such a magnificent construction as the Sevan-Zanga system irrigates a large part of the Ararat Basin for cotton cultivation and other crops. In addition to cotton cultivation, viniculture, which is also carried on only on irrigated lands, has important prospects and specific importance. The cultivation of grapes here is more difficult than in Georgia or Azerbaydzhan (except in the Nakhichevan' ASSR), so that covered vines are needed for winter and a considerable quantity of water.



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The climate of Armenia is characterized by a high range of temperature, due to the formation here of a sizeable constant Armenian anticyclone, the activity of which leads to an intense cooling in the winter and an intense warming in the summer. In the cotton and grape district in Armenia the summer is dry, hot and subtropical and the winter severe, making it impossible for vines to be left in the open. Grapes of this area are used for wine, cognac, alchohol, famous on markets of the USSR, and for raisins. From grape juice is prepared an excellent nutritive product: Churchkhely, unique fruit sausages made of thickened grape juice and walnuts. Orchard cultivation is of no small importance, also gravitating towards lower zones but found as high as 1400 and more meters above sea-level. An important part of fruit harvesting lies in canning and dehydration. Prospects are that up to 40,000 hectares can be devoted to fruit cultivation in the Armenian SSR and up to 35,000 hectares to viniculture. Tobacco-raising is rapidly developing with good Turkish varieties, brought out of Turkish Armenia by refugees, being introduced. An overwhelming preponderance of wheat cultivated in Armenia is Triticum vulgare, with Triticum compactum next. Hard wheat, on the other hand, is very rare and is being displaced from districts now given to it--



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irrigated lowland sections which have been marked out marked out for cotton-growing. English, Persian, and pyramidal wheats are also encountered. Emmer still holds important position. In Armenia are, growing wild in considerable variety, real wild filmy wheats, known formerly only in Syria and Palestine. Of the remaining types of soft wheat, the variety Grekum, as well as the common Ferrugineum, and, of the breadless varieties, the drought-resistant variety Delphi, are widely distributed. Dwarf wheats are highly valued in Armenia for their yield, their winter resistance, their resistance to hot, dry winds, and also for their good properties for baking. Semi-bearded non-shattering harvest wheats, and also the naturally arising skverkhednyy type of wheat. As every-where in the Transcaucasus wheat on the fields is a very complex population. The yield of wheat on the average is around 8 centners. There are wheats in certain places which have penetrated here from the Van Vilayet of Turkey, very unique ecological types, giving exceptional harvest up to 40 centners on the average.

Barley in Armenia is important not only for forage but for food--barley flour is mixed with wheat flour, or bread is made entirely from barley especially in high-mountain villages, where barley



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is the main grain crop. Winter barley is sown in the lowland water-supplied zone. Spring barleys in Armenia give high harvests. In recent years, the experiments of Professor V. V. Talanov have proved that the Leninakan plateau gives beer-brewing barleys, of record-breaking quality, a fact of importance for the entire Soviet Union. The average yield of summer barleys is around 8 centners per hectare. Two-row barleys predominate, chiefly the variety, Nutans. Rye is not very important, though it is an old crop in Armenia: but, as everywhere in the Transcaucasus, rye is better known as a weed. There is a large variety of weed ryes-- around 30 varieties. Rice cultivation on the Araks plain has come to nothing, because of the growth of cotton cultivation and because of the formation of malarial foci. Corn is still unimportant in Armenia and has been unsuccessful in certain districts. A low flint type is cultivated. Potato-growing is especially widespread in the northern part of Armenia and succeeds best of all on the northeast shore of Lake Sevan, in the Krasnosel'skiy rayon. Grain leguminous plants occupy in Armenia a tenth of all the utilized land. Vegetable-growing ought to be very important for the population of the Armenian SSR, especially in conenction with industrial growth and large-scale water projects. Cucurbit cultivation is notable for high-



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grade melons, known as Dutma. Of the forage plants only in the lower zone are alfalfa, esparsette, and fenugreek (trigonella).

XXX(1). The Araks plain and the Erivan' basin, 600 to 1000 meters above sea level. Includes the Araks River part of the Erivan' and Echmiadzin uyezds.

Continental climate, with a dry subtropical summer and a harsh winter. Average yearly temperature 11.5 degrees precipitation around 500 meters, at a maximum in the second part of the spring and with a rainless period from June to October. Low bottom land sections have solonchak-solonetz surplus moisture complexes on alluvia; high places formed from alluvia have dry alluvial soils. In the Malyy Saradabad steppe, soils belong to the light-brown class. Vegetation solonetz-argillaceous semidesert and islands of argillaceous semidesert. Agriculture is exclusively irrigated. The entire area once occupied by cotton, irrigated winter wheats and barleys, rice, and the castor plant, is given over to cotton and, to some extent, grapes. American cotton is cultivated the Navrotskiy yariety, factory mixtures are still widespread, small-bole varieties, mainly Kniga. The matter of establishing crop rotation in cotton is very urgent. Because of the harsh winter we cannot hope for winter cultivation of peas, although it is possible that Badakhshan varieties, and also the



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Nicholson and Austrian varieties, can withstand the winter. The introduction of leguminous plants into crop-rotation with cotton, among them also alfalfa, not less than 25 percent in quality, is inevitable. The cultivation of shabdar clover Trifolium resupinatum is possible. Cultivation of grapes is still important (with covering in winter time).

The industrial and power installations in Erivan with the huge growth of the population of the capital of the Armenian SSR, demands the creation of large bases make the establishment of vegetable cultivation, fruit-growing and viniculture, a basic need; and a fodder basis must be established for productive livestock-rising.

XXX - 2. The southern foothills of the volcanic system of the Alagez and Akhmaugan ridge, with heights from 1,000 to 1,500 meters. Undulating region of lava rocks, arid and stony. The climate is little different from the climate of the preceding districts. Somewhat more precipitation falls -- 350 to 400 millimeters. Brown soils in the southern part of the district, where stony semi-desert predominates, and chestnut soils in the northern part of the district, where the semi-desert becomes arid steppe.

Cotton in this district ought to occupy an irrigated section in the lower zone (up to 1,200 meters). The leading crop should be tobacco. Viniculture is still important, and also remains with grapes the most important crop (with covering in winter time). Places unsuitable for other crops may be occupied by mulberry bushes for silkworms. Of fodder crops, vetch and esparsette may be grown. Of grain crops, the chick-pea.

XXX -3.Leninakan Plateau (former Leninakan uyezd) occupies a flat surface, with average height 1500-1600 meters. Matrices here are very permeable volcanic rocks (tuff and trachyte). The Araban valley and the valley of the upper Zanga may be included in this district. Con-



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tinental climate, average yearly temperature 5-6 degrees, average temperature of the coldest month, minus 8 or nine degrees, 450-500 meters yearly of precipitation. Typical dark-colored chernozems, with steppe of feather grasses and various other grasses. Of technical crops, the sugar beet is the most important; of grain crops, spring barley, which gives here the best material for beer-brewing and is of national importance. Winter wheat is possible only in certain places (up to 1700 meters above sea level). Spring wheat is chiefly cultivated here. The kidney bean and the chick-pea are the minor crops. Livestock-raising is important here, for the good hay harvests provide a good supply of fodder; development is planned in the milk field, with cheese making. Root plants should serve as fodder for livestock-raising (including refuse from beet sugar production), as should sowing grasses.

XXX - 4. The Loriya and Akhbabin plains, with an average height of 1400 meters (from 1000 to 1600 meters), include the Akhbabinisk, Kyzyk-Koch and Loriya districts. The climate is moderately cold, average yearly temperature 7-7.5 degrees, 500-600 millimeters precipitation. Soils are degraded chernozems.

Livestock-raising for export is the most important branch of farming. In this district are received the best hay harvests in Armenia and here we find the most valuable types of cattle. Of fodder crops, we must introduce: root plants, Jerusalem artichoke, "brim" and "thousand-headed" cabbage, rape, esparsette, Dzhavakhet alfalfa, winter vetch, etc. The potato ought to be widely developed; and of technical crops, hemp, flax, lallementia; and of grain crops, spring and winter wheat, spring barley.

XXX - 5. The Eastern bank of Lake Sevan. Altitude, 2000 meters and over. The climate is dry, moderately warm. Includes the Basargechar-



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sky Rayon, and the area of the Gyuney bank of the lake; and also, as a subdistrict, the Krasnosel'skiy Rayon. Light-colored arid mountain-slope soils.

Winter wheat, giving in this area reliable harvests, ought to be the leading crop here; and potatoes in the Krasnosel'skiy Rayon. Of technical crops, oil flax is possible.

XXX - 6. Mountain-forest district, 900-1,500 meters and higher in northern Armenia (Delizhan-Karaklis section) and 1,600 to 2,400 meters in southern Armenia (Zangezur forests). Forest soils, with weakly expressed podzolic qualities (morphologically). In the northern part is a dry-steppe zone with chestnut soils (in the foothills). In many places it is essential to develop fruit-growing and viniculture, for which there are very favorable conditions. District of fruit-growing, grain cereals, potatoes. Essential to develop flax, hemp (in northern part), clover (in northern part), vetch, esparsette.

XXX - 7. High mountain district of pasturage. Encompasses the larger part of Armenia, the alpine and subalpine zones of the Alagez Volcano, and of the Bezobdal', Pambak, Miskhan, Gokchin, Zangezur, etc., ridges. In the northern part of Armenia, the lower boundary of this district is at 1,700 meters; in the southern part, at 2,400 meters. Subalpine grassy steppes and subalpine and alpine meadows with varied grasses. Subalpine meadows on chernozem-like and brown soils, alpine meadows on weakly-podzolic peaty soils. District of cattle-raising for export. Essential to develop crops of potatoes, vegetables, and in addition provide cattle-raising with winter fodder.

The course of cattle-raising is dependent on the value of various parts of the land for fodder, on the topography and other conditions. In some places (for example, the Geryusy section), large-horn



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cattle-raising ought to predominate (cattle-raising for milk, with cheese-and-butter-making), in others (as the Kel'badzhar section), only sheep-raising, in still others, the combination of this and another is possible.

XXX - 8. Megry district. A climate of subtropical hot summers and severe winters with little snow. The narrow gorge of the Araks River is subject to strong winds. Soils represent a district of outcropping and talus. District of fruit-raising and viniculture.

ADDENDA

1. Preliminary totals of the winter 1930 and spring 1931 sowing.
2. Chart of zones and districts of field cultivation in the USSR.
3. Chart of agriculture in the USSR (general sowing area, 1929).
4. Chart of the natural zones and districts of the European part of the USSR.
5. Chart of the natural zones and districts of the Asiatic part of the USSR.
6. Chart of field-cultivation zones of the European part of the USSR.
7. Chart of field-cultivation zones of the Asiatic part of the USSR.



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