STAT

COURSE

IN AGRICULTURAL STATISTICS

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CHAPTER I

BASIC PROBLEMS IN AGRICULTURAL STATISTICS

1. The Subject and Objectives of Agricultural Statistics

The objective of the agricultural statistics course is to become familiar with the methods and practices of theoretical statistics used in studying various agricultural problems, in planning agricultural production, and in the operational management of agricultural enterprises. A course in agricultural statistics should teach one to be familiar with statistical material of agricultural production, teach how to analyse this material, how to draw conclusions, and use them in checking up on plan fulfillment, etc.

Agricultural statistics is a branch of knowledge on the application of the basic methods of statistical science in the study of agriculture, as well as on the use of statistical observations on the organization of observations and processes which take place in agriculture.

The course of agricultural statistics instructs us how to determine the observation unit used in agricultural studies, which data are to be used for various agricultural processes, and the way such data are to be worked out. It teaches us the use of indexes, relative weights, and average values and groupings. It shows which elements in each individual case are to be considered basic in working out a breakdown by groups, in order to ascertain the underlying principles of socialist agriculture, etc.

In his classical works entitled "Development of Capitalism in Russia", the "New Data on Natural Laws of Capitalist Development in Agriculture" and a number of other works, ~~the~~ V.I. Lenin has excellent examples of statistic-economical analysis of elements relating to the social class nature of the pre-revolutionary Russian countryside and of elements pertaining to capitalism in the agriculture of the United States of America. In his work, in addition to an analysis of real data, V. I. Lenin has given very important directives

on the interrelationship between statistics and economical analysis, on the use of averages and grouping of data in agriculture, and on the use of group and combination tables, etc.

In the works of comrade Stalin we find examples analysing data on the distribution of agricultural gross and commodity output among various categories of enterprises in pre-revolutionary times, as well as in the Soviet State. This is extremely valuable analysis in how to go about studying the dynamics of areas, in studying the commodity proportion of agricultural output, and in working out moving averages. In his lectures, treating agricultural problems, comrade Stalin has given us excellent examples of how with few words valuable basic conclusions may be drawn from statistical tables. This is true regardless of whether this applies to shifts of the sowing time, to gross agricultural collections, the quantity of livestock, the number of tractors, automobiles, etc.

2. The Concept of the Unit of Observation in Agricultural Statistics

The statistical unit of observation is a composite, embracing what is being observed, and which is working over the observations noted; it is the basic unit of all groupings. An outside distinguishing feature of the unit of observation is that usually for each unit of observation a separate statistical blank is drawn up in the form of a statistical card. Otherwise, each unit of observation is recorded on a separate line as observations are taken, using a file-card system.

The unit of observation in agricultural statistics usually is an individual agricultural enterprise: a sovkhoz, kolkhoz, or MTS, whose characteristics are represented with programmed data observations. For instance, the characteristics of a kolkhoz are given in stating the number of kolkhoz members, sowing acreage, the size of the parcel

of land assigned to the kolkhoz for permanent use, the size of the collective cattle herd, the quantity of different types of agricultural machinery and equipment, the amount of workdays earned by kolkhoz members, etc., etc. The individual agricultural enterprise is used also as a basic classification unit in processing observation material. For instance, an MTS may be broken down according to the power of its tractor park. A kolkhoz may be grouped on the basis of percent of fulfillment of the State plan for animal husbandry, for completion of minimum breeding plan, etc.

A distinction should be made between the observation and accounting or calculation units, which may be quite different depending upon the subject under observation. For instance, in the cattle census each head of cattle is a calculation unit. In accounting for sowing area, the accepted unit is the hectare, or square meter. In accounting for agricultural machinery, each individual machine is the unit, etc.

A proper selection of the observation unit is important also in working over the data observed. It is important primarily for their correct classification.

The Populists, for instance, in several of their studies, used an entire village for a unit of observation instead of an individual farm. They examined the community with a number of considerations; total number of households and total population; total acreage of owned land parcels, total sowed area, livestock population, total land rented, number of hired laborers, etc. In this way they made it impossible to classify individual enterprises, and consequently a study could not be made of the class stratification of rural life.

3. Classification of Agricultural Enterprises

Since the basic observation unit in agricultural statistics is an individual agricultural enterprise, it is important to consider

classification of the agricultural enterprise. The basis for classification of agricultural enterprises is property status.

The dominant form of property throughout the USSR, including agriculture, is socialist, held in common property. This appears in two forms: State property and cooperative-kolkhoz property.

Taking for a basis the legal property forms determined by Stalin's Constitution, we first consider the sovkhozes "State organized large agricultural enterprises", which are "State property, i.e. wealth of the people" (USSR Constitution, P. 6.). To the same category belong also the machine tractor stations. Among establishments with the cooperative-kolkhoz form of property, are the kolkhozes themselves. In this same category there should be included the agricultural enterprises of the various cooperative associations (like Tsentrosoyuz, Vsekopromsovet, Vsekopromlessoyuz, Vsekopinsoyuz, Vsekopromsovetkassa).

Since, according to constitutional provisions, each "kolkhoz household, in addition to the basic income from the common economy of the kolkhoz, has for personal use, a not large parcel of land around the household, and as a personal property the subsidiary enterprise located on this land parcel" (chapter 7). The subsidiary enterprises of kolkhoz members are to be considered separately in any study of agricultural enterprises.

There is also, on a very insignificant scale, however, the small private enterprise of the private peasants, which is based upon their own labor.

And finally, in studying agriculture, the subsidiary agricultural enterprises of laborers and employees must not be overlooked.

With respect to statistical studies, the agricultural enterprises and households are broken down into the following groups:

a) Socialist Enterprises:

1. State agricultural enterprises: (a) sovkhozes, (b) machine

tractor stations (MTS), (c) subsidiary agricultural enterprises (supplying laborers and employees with agricultural products), (d) forestry enterprises (for forestation), (e) experimental enterprises and other agricultural enterprises.

2. Kolkhoz-cooperative agricultural enterprises; (a) kolkhozes (Social production), (b) agricultural enterprises of cooperative associations: handicraft, forest, consumer, and other types of cooperatives).

b) Individual Subsidiary Agricultural Economy:

(a) of kolkhoz members, (b) of collectivized craftsmen, and (c) of workers and employees.

c) Small Private Economic Activity:

(a) of individual peasants, and (b) of non-collectivized craftsmen and other groups of the population.

Making a more detailed classification, the sovkhozes may be broken down according to the administrative authorities to which they are subordinate. Most sovkhozes are administered by the following People's Commissariats: of Sovkhozes, of Agriculture, of Food Industries, of Meat and Dairy Industries, and of Foreign Trade. Within each of the above commissariats (except for that of foreign trade), sovkhozes are classified according to whether they are directly under the administration of their respective all-union, top-level commissariat, or whether they are answerable to the union-republic level commissariats.

Into a separate group are classified the sovkhozes belonging to the trusts of suburban enterprises under the Council of People's Commissars of the Autonomous Republic, under the executive committees of the oblast (or kray) soviets and also the non-trustified suburban enterprises under the Council of People's Commissars of the Autonomous Republics and under the executive committees of the oblast (or kray) soviets.

4. Grouping of Agricultural Enterprises

For a statistical study of socialist enterprises, that is, kolkhozes, sovkhozes, and MTS, parallel with the computation of total amounts and averages, it is necessary to coordinate this work, using certain, previously collected data, based upon grouping the various units used in making observations.

In using agricultural statistics data up to the present time, the grouping method was not sufficiently used, and when used, this was a simple addition of units belonging to a certain group, i.e. in the form of a variable series.

As an example of such grouping may be used the breakdown of MTS into groups according to number of serviced kolkhozes, classifying tractor operators on the basis of annual earnings, grouping kolkhozes according to number of existing households, or according to sowing acreage, etc. Such breakdowns are very helpful, since they make it possible to consider separately large and small economic activity, since they present the achievements of agricultural shock workers, and uncover possibilities for increasing labor productivity. On the other hand, such subdivisions expose backward kolkhozes, animal husbandry farms, and lagging tractor drivers and combine operators, inefficient milkmaids, etc.

For a profound agricultural study however, much more important are those basic and combine groupings, in which each group appears in the chart and is given more or less detailed definition in the story told by the same chart.

Of great importance for such a grouping is the correct selection of group characteristics. In the first place, such selection depends upon the purpose of grouping. The most general considerations for grouping agricultural enterprises are those determining their size, i. e. the size of these enterprises. With respect to kolkhozes,

the basic indicator of their size is the number of kolkhoz households.

Other natural indicators to be used to show the size of kolkhozes are the amount of land assigned to kolkhoz, sowing acreage, and the number of the various kinds of livestock. When selecting the natural characteristics for grouping kolkhozes by size, consideration should be given to the type of agricultural output at the particular kolkhoz. For grain and vegetable producing kolkhozes, the most suitable basis for grouping kolkhozes by size is the extent of the sowing area. For kolkhozes which stress dairy farming the basis is the number of milking cows. For hog breeding kolkhozes it is the number of hogs. For specialized fruit orchard or vineyard kolkhozes, it is the area planted. For cotton growing kolkhozes it is the area of cotton plantations, etc.

In grouping according to particular characteristics, it makes sense to use a specified range. The same group interval should not be used, for instance, both for large grain producing kolkhozes and small vegetable growing kolkhozes.

Due to the fact that every kolkhoz in addition to its main production item, produces some other agricultural goods, therefore, any one of the natural indexes of the size of the kolkhoz is bound to be onesided. Therefore, the best characteristics for grouping kolkhozes according to size are cost of the gross output, total amount of gross income, and total money income. All of these indicators reflect the strength of the kolkhoz regardless of the type of its main output product. Another indicator of the same type is the general cost of means of production. In kolkhozes, however this index must not be considered apart from cost of means of production of MTS. In order to determine how well supplied the kolkhozes are with means of production, a calculation must be made of the average total cost of means of production per kolkhoz for all kolkhozes and MTS in the rayon.

The classification of sovkhozes according to their size, is to be done within their homogenous groupings by type (grain, milk, hog-breeding, etc.). When grouping according to material characteristics (land area, sowing area, number of cattle, etc.) it is even more important than with respect to kolkhozes, to use specific characteristics and special statistical intervals. In addition to other reasons for classifying according to natural characteristics, it must help and can help clarify as to whether or not a too narrow specialization of production continues. To find this out, for instance, it is worthwhile to group the kolkhozes of the People's Commissariat of Sovkhozes not only according to the size of sowing ares (particularly for areas sown to grain crops) but also by the number of cattle, or other kind of livestock.

Those group characteristics common to all types of farm production are the number of laborers, the cost of basic means of production, the volume of output, the commodity proportion of output, the extent to which production is mechanized, etc.

The basic indexes for showing the size of MTS are the number of kolkhozes' services, the size of the sowing area of those kolkhozes, and the power of tractors.

Grouping can be done not only in using the material from a group of agricultural enterprises, but also within individual large agricultural enterprizes (sovkhozes, subsidiary enterprizes, MTS, and large kolkhozes). Such classification is especially helpful in bringing out the achievements of agricultural shock workers (for instance, by grouping brigades on the basis of crop yield, grouping milkmaids according to the average yield from their cows, grouping cows on the basis of annual milk yield, grouping tractor drivers and combine operators on the basis of the annual amount of work performed.

5. Application of Group Averages in Agricultural Statistics.

The grouping method is directly connected with the method of

calculation group average. Application of averages in statistics is the basic way to generalize from the results of mass observations. This method, however, often was wrongly used, to cover up those differences and contradictions which exist within a heterogenius grouping.

In sharp criticism of malicious use of averages, Lenin showed that general and all-inclusive "averages" have entirely fictitious meaning. Averages have been used extensively to characterize qualitatively homogenius groups and especially the individual peasant class groups.

It means, that a correct application of averages requires the use of actual group averages rather than all-inclusive averages. Computation of group averages is the basis for studying changes in factors from which averages are being calculated, this in connection with changes in those factors which are at the basis of such grouping.

In the article by M. E. Vlasov entitled: "Statistical Grouping", published in issue No. 5, 1940 of the journal "Planned Economy", the following interesting data are given on the relationship between the degree of utilization of tractors and combines at the MTS, at the size of sowing area per kolkhoz. This relationship is shown up by using group averages. (The presented chart contains data on Krasnodar krai and Kalinin oblast).

Krasnodar krai			Kalinin oblast		
Sowing acreage per Kolkhoz (hectars)	Work Performed (ha) Per 1 Tractor	Per 1 Combine	Sowing Area per Kolkhoz (hectars)	Work Performed (ha) Per 1 Tractor	Per 1 Combine
Up to 700	419	200	75- 100	196	66
700- 1,000	535	319	100- 125	213	89
1,000- 1,500	574	356	125- 150	218	94
1,500- 2,500	690	417	150- 175	225	97
Over 2,500	653	404	Over 175	250	82

To get a correct idea of the average work done with tractors and combines, computation should be done separately for each of their

makes. It is very helpful, parallel with the computation of group averages, to show the achievements of individual tractor and combine operators, milkmaids, swineherds, etc.

Test Questions.

1. What is taken as the basic unit of observation in agricultural statistics, and of what importance is a correct selection of the observation unit?

2. On which basis is classification of agricultural enterprises done in a socialist country?

3. What is the purpose of grouping of socialist agricultural enterprises?

4. What are the basic natural and price characteristics fundamental for grouping kolkhozes, sovkhozes and MTS according to size?

5. Why do natural characteristics have to be specific and why do range intervals have to be specialized when grouping agricultural enterprises according to their size; and what common characteristics can be used in grouping these enterprises?

6. What is the concept of group averages, and what is their importance in a study of Socialist agriculture?

CHAPTER II

STATISTICS OF OVERALL AND SPECIFIC LAND UTILIZATION

Paragraph 1. Basic Objectives in Land Utilization Statistics.

Since land is the basic element in any type of agricultural production, it is necessary to determine its overall size by land areas, and also noting changes in the particular use of these areas.

With respect to kolkhozes, the problem of determining the exact size of the areas allotted to them and their division into various farming undertakings, has taken on special importance since the enactment of the Central Committee VKP (b) and the Council of People's Commissars, USSR, modifying the previous policy in the field of procurement and purchase of agricultural products. According to the previsions of the above directive, compulsory deliveries of kolkhozes are calculated per hectare of land area. For deliveries of field crops, the calculation is per hectare of plowed field. On hay deliveries it is per hectare of plowed fields and meadows. For animal husbandry products it is per hectare of plowed fields, including orchards, vegetable gardens, meadows, and pastures. A correct accounting of the actual land utilized is necessary, since according to the order of the Central Committee, VKP (b) and the Council of People's Commissars, of 8 July 1939, "On Measures to Develop Socialized Animal Husbandry in Kolkhozes", the minimum count of female reproducing livestock in Kolkhoz's animal husbandry farms is to be determined on the basis of the amount of land attached to respective kolkhoz. There is an order of 27 May 1939, of the Central Committee, VKP (b) and of the Council of People's Commissars, USSR, "On Measures to Protect Socialized Kolkhoz Land from Misappropriation." In accordance with this, a correct accounting of land use is of primary importance also in the fight against misapropriation and pilferage of kolkhoz land caused by illegal expansion of the household economies of the individual kolkhoz members.

The statistics of land utilization includes, in the first place the following statistical work:

1. Collection of data pertaining to the size of land area, broken down into basic groups of farming enterprises, and especially collection of data on land parcels attached to kolkhozes for their permanent use as provided by the Stalin' Constitution.

2. Collection of data on the composition of the land area, by uses.

3. Collection of data on dynamics of land parcels occupied by the various farming activities, and shifts from one use to another.

4. Collection of land utilization data instrumental in determining a number of agricultural economic and technical indexes (an index showing utilization; fodder supplies; existing possiblities for expansion of plowland and meadows; index for calculation of fertilizers needed; the extent of various agricultural projects; existing needs for traction force, etc.).

The accounting of land parcels is to be broken down into individual groups, according to users, in the same way as was already described in the classification of agricultural enterprises. Separately are to be accounted: state reserve lands; the extent of State forests; lands of individual towns and urban type settlements.

Paragraph 2. Concepts of Types of Agricultural Lands and their Use.

Rural land is usually accounted for in terms of individual farming uses.

By use of farm land we mean the particular productive use to which one or another parcel of land is put. Sometimes, natural-historical characteristics of certain areas predetermining the productive use to be made of the land (for instance, flood-level meadows, steepe pastures, peat bogs, etc.).

For study purposes, farming enterprises are broken down into the following groups:

1. Farmstead lands: (a) total acreage composed of: (b) various buildings, (c) vegetable gardens, (d) vineyards, (e) orchards and berry-gardens.

2. Lands located beyond the farmstead used for (a) building, (b) vegetable gardens, (c) vineyards, (d) orchards and berry-gardens.

3. Plowland: (a) total acreage, composed of: (b) utilized plowland (sowing area and fallows), (c) idle and unprepared fallow land.

4. Meadows: (a) total acreage, composed of: (b) flooded, (c) barren, (d) swamp and all other types.

5. Pastures: (a) total acreage, composed of: (b) plain pastures, (c) bushy pastures, (d) forest pastures, (e) all other types.

6. Brushwood.

7. Forests.

8. Forest fellings and burned areas.

9. Wind-breaking forestized belts.

10. Swamps:(a) total acreage, (b) of which, peat bogs.

11. Acreage occupied by roads, clearings for cattle passage, streets, alleys, and public squares.

12. Underwater (lakes, ponds, rivers)

13. Stony, pebbled and rocky alkaline areas, mountaings and other parts of the area not in agricultural use.

Farmstead land is used most sensibly as follows: one part is occupied by buildings; part by vegetable gardens, by an orchard, by a vineyard, and the remaining part may be used as a meadow or pasture.

The vegetable garden is a very intensively farmed piece of land, fortified with fertilizer, carefully tended, and meeting all the demands made upon the soil by the vegetables grown.

The vegetables are grown either on farmstead lands adjoining buildings, or else on special plots beyond the farmstead (usually on low ground near this land is not counted in the general field crop turnover); or finally, as is the practice in regions of industrial vegetable growing, the area growing vegetables is considered an integral part of the field area.

Plowland is one of the basic types of an agricultural land. It is a parcel of arable land subjected to periodic cultivation for the production of various crops.

Meadows are parcels of land which yield raw fodder for maintaining livestock in sheds. There are in general several types of meadows. The highest output and the best quality of hay is from alluvial meadows, located along rivers. These meadows are flooded every year and fertilized with silt.

There are also meadows watered solely by atmospheric precipitation. Such meadows yield less hay and of an inferior quality compared with alluvial meadows. Of a great importance are also the forest meadows located in forest areas. The poorest meadows are swamps, which are in low areas. They yield a course type of hay.

Pastures provide livestock with green fodder, which may be of various types. In forested locations, forest clearings and brushwood are widely used for providing fodder.

Paragraph 3. Concept of Conversion of Land Use

In studying the areas for differant agricultural uses, it should be borne in mind that the particular division of land for one or another particular use is not final and irrevocable. On the contrary, over a period of time, on a particular piece of land, one type of farming activity replaces another.

Changing one land use for another (converting) under our existing conditions, is aimed at the most worthwhile and expedient use of land (clearing brushwood and converting into plowland, reclamation of marshes changing them into meadows or plowland, etc.)

It is the task of statistics to follow changes in the use of agricultural lands by comparing the breakdown of lands by use over the years. Statistics also check up on the fulfillment of planned cultivation of virgin soil, clearing bushlands, and reclamation of marshes. Example: During the years 1935 and 1944 the distribution of land parcels of rayon "A" to basic farming activity was as follows:

Types of Farming Enterprise	Acreage (in hectares) in 1935	Acreage (in hectares) in 1944	Increase (+) or decrease (-) of area used for various farming activities in 1944 as compared with 1935
Overall area	81,150	81,150	
composed of:			
Farmstead land	3,100	4,500	+ 1,400
Vegetable gardens beyond Farmsteads	800	1,100	+ 300
Plowland	12,400	15,620	+ 3,220
Meadows	10,850	11,830	+ 980
Pastures	3,540	3,900	+ 360
Forest	35,600	36,250	+ 650
Brushland	7,960	3,100	- 4,860
Marshes	5,670	3,620	- 2,050
Peat bogs	1,820	2,200	+ 380
Other Farm Lands	1,230	1,230	± 0

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During the ten year period in the above mentioned rayon, there were claimed 2,050 hectares of marshes, and 4,860 hectares of brushland were cleared. Due to these achievments, the overall farmland area (farmsteads, vegetable gardens, plowed land, meadows and pastures) rose from 30,690 to 36,950 hectares, i.e. by 6260 hectares, or 20.4 percent. Particularly significant, 3,220 hectares or by 26 percent, the plowed land area increased. This represents that basic land use which accounts for a small part of the whole land area of the rayon.

Paragraph 4. Land Area Composition as a Basis for Determining the Obligation of Kolkhozes to the State.

The compulsary deliveries of kolkhoz output to the State are determined on the basis of land area. The basic unit of size however, varies depending on the type of output to be delivered. Thus, for instance, compulsory kolkhoz deliveries to the State of meat, milk, wool, and raw hides, are computed on the basis of each hectare of agricultural land used (Plowland, including orchards, vegetable gardens, meadows and pastures within the kolkhoz.

The same land basis is taken in working out the required minimum number of female producing livestock on a kolkhoz farm, in compliance with the order of 8 July 1939 of the Council of People's Commissars, USSR and the Central Committee VKP (b). This order is on ways to extend communal animal husbandry in kolkhozes.

Compulsory State deliveries of grain, rice, potatoes, vegetable oil seeds, and grass seeds, are taken per hectare of plowed land, which includes vegetable gardens, as well as new lands put into use in accordance with the State plan (plowing of virgin soil, reclamation of marshes, and clearing of bushland), starting with the second year after these raw lands have been in use. On the other hand, lands

growing indistrial crops are excluded, also fruit and berry orchards, vineyards and subtropical crops.

Illustrating Example: In 1944 kolkhoz "N" was using 450 hectares of plowland, of which area through the plowing of virgin soil, reclamation of marshes, and clearing of bushland, in 1943, 15 hectares in 1941 25 hectares were put into use. The breakdown of crops was as follows: hemp-10 hectares; sugar beet- 20 hectares. The area of vegetable garden (outside of plowing area) was 27 hectares, and 5 hectares were used for orchards. Meadows belonging to the kolkhoz amounted to 110 hectares, and pastures 35 hectares.

The compulsory deliveries of grain, rice, potatoes, vegetables, vegetable oil, plant seeds and grass seeds, for this particular kolkhoz are determined as follows:

$$450 - 15 + 27 - 10 - 20 - 2 = 430 \text{ hectares.}$$

The compulsory deliveries of animal husbandry output products are determined in the following way:

$$450 + 27 + 5 + 110 + 35 = 627 \text{ hectares.}$$

Paragraph 5. Initial Analysis of Land Utilization Data

The study of the composition of individual agricultural areas by land use is the first step to the analysis of agricultural production trends within a rayon or within an individual agricultural enterprise.

In order to facilitate the analysis of a certain area with respect to its agricultural land usage and to facilitate on the basis of the above characteristics, a comparison among individual sovkhozes, kolkhozes, sel soviets, and rayons, the breakdown of the total area by individual uses should be presented in terms of relatives (i.e. in percent).

A familiarity with land distribution by agricultural use is essential in calculating a whole list of statistical-economic indexes and planned accounts which reflect the status of the work of the agricultural enterprise. These indexes on the degree to which plowing has been

done (relationship between utilized plowland areas, i. e., the sum of sowed areas and unsowed fallows, and the total plowland area, also the relationship between sown area and plowed area) the extent of which is directly related to improved agricultural methods crop rotation, or rotation of fallows. This includes the indexes on the degree to which the enterprise is equipped with traction power, agricultural machinery, and equipment on the amount of both manure and chemical fertilizers needed, and indexes for calculating the scale of individual agricultural undertakings, etc.

The analysis of data on agricultural area uses should be done by seperate types of agricultural economy. Each group should be analysed to show changes over time and the process of redistribution of uses of the land area.

The acreage of the land attached to a kolkhoz may be considered as a useful guidepost in grouping kolhozes by size.

In grouping kolkhozes according to area of all agricultural uses, it makes sense to use a specific range interval. However, in order to facilitate eventual totalling of data on the whole USSR, it is essential to group first of all in terms of the smaller intervals, then combining them into larger intervals in the individual republics, oblasts and krags, for the purpose of local use.

The range intervals into which all different categories of kolkhozes may be placed on the basis of the size of their agricultural land uses, has been prescribed by the 8 July, 1939 order of the Central Committee, VKP, (b) and the Council of People's Commissars USSR, as follows: Kolkhozes with a total agricultural area of up to 120 hectares; from 120 - 200; 200 - 300; 300 - 400; 400 - 500; 500 - 800; 800 - 1,000; 1,000 - 1,500; 1,500 -2,000; 2,000 - 3,000; and over 3,000 hectares.

Paragraph 6. Sources of Data on Land Utilization

The basis source of land data and data of breakdown of land into individual uses, grouped according to their uses, is at present the land register of the People's Commissariat of Agriculture. This data is forwarded annually by rayons land offices to the krai (oblast) land administration. ("Annual Report on Distribution of Land, by Use and Users, as of 1 November, 19--.")

In addition, to this data on land area and the breakdown into basic uses is contained in the annual sovkhoz statements.

A strict initial accounting of kolkhoz land acreage was put into effect by the order of 27 May, 1939, of the Central Committee, and the Council of Ministers USSR "On Measures to Protect Public Kolkhoz land from Misappropriation."

In compliance with provisions of the above directive, there had to be established in every kolkhoz a special land registration book for registration of all common kolkhoz land, by uses and of the household plots of each kolkhoz household. In accordance with the same directive, all rayon land offices must have a State land registration book, with the following entries: (a) the single piece of land attached to each kolkhoz in accordance with the act of perpetuity, (b) the common kolkhoz lands (entered separately); (c) the household plots of the individual kolkhoz members; (d) land used by private peasants and others not members of kolkhozes.

Using the data contained in the State land register, the rayon land offices compile yearly on the form prescribed by the People's Commissariat of Agriculture USSR, "Annual Report on Distribution of Land by Use and Users." The above report is prepared in the form of a table, with column listing the types of agricultural economy and the breakdown giving land uses in detailed classification.

It should be mentioned also, that the administrative books maintained at the village soviets contain data on land areas and their agricultural uses. These books give a detailed breakdown of the household plots of the individual kolkhoz members, of private peasants, and of laborers and employees, grouped according to the way that they use their respective plots. These books give data on land parcels occupied by various buildings and farm-steads, vegetable gardens, orchards, etc.

Test Questions:

1. Of what importance are statistics on land utilization and on agricultural land uses; and what are the basic purposes of such statistics?

2. What is the concept of a particular use of farm land?

3. What are the basic types of agricultural land uses, indicating the production objectives of each of them?

4. In what respect is the land area instrumental in determination the kolkhoz obligations to the State?

5. What is the concept of conversion of farm land use, and what is the work of statistics in studying conversion of farm land usage?

CHAPTER III

STATISTICS OF BASIC FACTORS IN PLANT CULTIVATION

I. Computation and Statistics of Sowing Areas

(a) Purpose of Sowing Area Calculation and Statistics

Data on dimensions of the sowing area are indispensable elements in the quantitative determination of agricultural production. Sowing area statistics include the following primary statistical operations: (a) determination of dimensional data and composition of sowing areas by separate categories of agricultural units (sovkhozes, kolkhozes, and others), which are indispensable in checking progress of the sowing plan, as well as in estimating agricultural production; (b) collection of material to determine the characteristics of specialized agriculture; (c) collection of data to determine the degree of plowland utilization; (d) study of sowing area dynamics as one of the main factors in agriculture.

(b) Sowing Area Classification

The concept "sowing area" at first glance appears elementary: it is the productively utilized sowed part of plowland or of a farming area. In the computation of sowing areas the following basic categories must be listed: (a) seeded area, (b) spring crop producing area, (c) harvest area, and (d) area under cultivation. In order to avoid errors in computing dimensions of sowing areas, it is important to differentiate between the above categories.

A seeded area is that on which seeds have been sown. The lost crop part of the area is also included in the total, even though it had to be sown over again. Areas which are simultaneously sowed with two different crops (for example, cover crops of perennial grasses and sub-cover crops) are entered twice into the total. This applies also to areas which

yield two crops in one season (for example, vegetables). Such duplication in the computation of certain areas should not prove embarassing because, in defining this category of sowing areas, it is intended to treat that total area upon which seed, labor, tractive power, sowing tools and equipment were expended.

A seeded area can be computed either in terms of the crop in any one given year (such as 1944), or in terms of the area seeded in a given year, such as the year 1944. In the first example the computation of the seeded area includes the summer crop, sown during the given year (1944), as well as the winter crop, sown in the preceding year (1943). In the second example, the computation of the seeded area again includes the summer crop, sown during the current year (1944), but also includes the winter-crop sown during the current year for next year's harvest. Data on areas seeded during the particular calendar year are indispensable for a number of computations necessary to fulfill the production plan.

The spring-crop producing area is that which is actually occupied by a standing young crop at the time spring sowing is completed. Into this category fall areas bearing the winter crop sown during the fall of the preceding year, excluding areas ruined during fall and winter, but including all summer crops planted during the current year. An area sown under two crops is included in a computation only once - under either one of the two cultures. A spring-crop producing area is that area which is expected to yield a crop during the current year; its dimensions must be known in order to determine the degree of plowland utilization and size of the crop.

The harvest area is determined by excluding from the spring-crop producing area that part bearing crop lost during the summer, as well as

those areas under cultivation which will not be harvested during the current year (for example, non-cover perennial grasses), or those which will not be harvested at all (sown for green fertilizer). On the other hand, areas which will be harvested twice during the season are included in determining the harvest area. The harvest area defines that quantity of land which actually produces a yield during the current year and which will be harvested.

Finally, the area under cultivation must be listed in a separate category in cases when, for one reason or another, not all of the area which was lost to crop in fall and winter is resown for the summer crop. To compute dimensions of an area under cultivation, the area lost to crop during the fall-winter period, but not that of resown winter crops (except when in that area perennial grasses are sown), must be added to the spring-crop producing area. We clarify the calculation of the various categories of sowing areas by giving examples.

It is assumed that in the fall of 1943 one hundred hectares of winter crop were sown of which, as a result of unfavorable winter conditions, three hectares of crops were lost during the fall-winter season; only two hectares were resown with summer crop in the spring. In the spring of 1944, 502 hectares of summer crop were sown (this includes the area resown to replace the lost winter crop, but excludes planting of perennial grasses). In addition, 100 hectares of cover-crop perennial grasses and one hectare of non-cover crop perennial grasses were planted in 1944. There are 90 hectares of hayfields (that is, area under grass planted in preceding years). In the summer of 1944, 1.5 hectares of various cultures were lost. In the fall of 1944, 105 hectares of winter crop were sown (for harvesting in 1945).

Taking into account the special characteristics of perennial grass planting and assuming that non-cover crop perennial grasses are not mowed

during the year in which they were planted, we compute the areas by categories: The seeded area for the 1944 harvest equals 100 hectares of winter crop plus 502 hectares of summer crop equals 602 hectares (the 2 hectares of lost and resown winter crop are twice included in this total).

The area seeded in 1944 equals 502 hectares of summer crop plus 100 hectares of sub-cover crop perennial grasses plus one hectare non-cover crop perennial grasses plus 105 winter crop for harvesting in 1945 equals 708 hectares.

The spring-crop producing area in 1944 equals 100 hectares of winter crop minus 3 hectares of lost winter crop plus 502 hectares of summer crop plus 1 hectare non-cover crops of perennial grasses planted in 1944 plus 90 hectares of hayfields equals 690 hectares. The harvesting area in 1944 equals 690 hectares minus 1 hectare of non-cover crop perennial grasses minus 1.5 hectares of summer losses equals 687.5 hectares.

The area under cultivation equals 690 hectares of spring-crop producing area plus 1 hectare of lost but not resown winter crop equals 691 hectares. In actual practice, errors are most commonly encountered when areas of perennial grasses planted during the current year (cover crop and non-cover crop) are classified by categories. Some elaboration is therefore needed on that point. Cover crop perennial grasses are not mowed during the year in which they are planted and should, therefore, not be included in computation of the area seeded for harvest during the current year (in this example, the year 1944), nor should they be part of the computation of the harvest area. Nor can they be included in the computation of either the spring-crop producing area or the area under

cultivation, because a duplication in listing of areas under cover crop grass cultivation would result (they were included once in the computation of areas planted to basic crops, beneath which perennial grasses were sown - for example, underneath the winter-crop, underneath summer wheat or oats). Therefore, the sub-cover crop planting of perennial grasses must be included only in the calculation of areas seeded during the particular calendar year (in this case, the year 1944).

Non-cover crop perennial grasses, if they are not to be mowed in the year in which they were planted, are not to be included in the computation of area seeded for the current year's harvest, or in the harvest area. Non-cover crop grasses must be included in spring-crop producing areas an in sown areas since they occupy separate and independent plots. These plots will also be included among the areas sown during the current calendar year.

(c) Computation of Sowing Areas by Crops

Sowing areas are computed by separate cultures. Composition of sowing areas must be studied in order to determine crop production, to study agricultural trends, and to clarify the problem of introduction of new cultures, etc.

Special properties of some crops are reflected in the way accounting is done. For instance, crops of long-staple and curled flax should be accounted for separately. In cases of biennial crops, seed transplantation areas are considered separately. This applies to sugar beets and table beets, cabbage, carrots, onions, plants with edible

roots, etc., the seeds of which are obtained by transplanting wintered roots, cabbage sets, and onion bulbs. Areas planted for seeds are accounted for separately. In addition to that, there are separately handled areas for industrial belt crops, the production of which is slated for processing, and seed beets whose seeds are earmarked for seeding during the next year. In computing areas under perennial grass cultivation, non-cover crop plantings of the current year, should be accounted for separately. This applies also to hay fields (sown in preceding years) which should be accounted for in the order of the planting years (in terms of the total area) and in terms of sub-cover sowings.

Sometimes, after harvesting early summer crops, other summer cultures are sown in the same areas (the so-called repetitive or secondary planting); the crops which were harvested first are the basic crops and must be included in the total of all sowing area categories. Crops sown after harvesting the first crops - which are also harvested during the same year - must be included in the totals of seeded area and harvest area, but under no circumstances can they be part of the totals of the spring-crop producing area or the area under cultivation. If, for example, 2 hectares of a kolkhoz were sown with radishes in the spring and, after that area had been harvested, it was planted with turnips, only the 2 hectares of radishes should be included in the totals of the spring-crop producing area. The area under cultivation, and 4 hectares should be included in the total of seeded area and the area to be harvested.

In computing data on sowing areas, it is customary to group crops by kind: (1) grain and leguminous cultures, (2) industrial crops, (3) potato and cucurbitaceous vegetable cultures, (4) fodder cultures, (5) sowings for green fertilizer.

Grain cultures, in turn, are grouped according to differing characteristics: (a) according to time of sowing - winter grain crops (rye, wheat, barley); early summer grain crops (wheat, rye, oats, barley); late summer grain crops (buckwheat, millet, corn); (b) according to botanical properties oats are not strictly a spike grain crop and tufted grain crops (millet); (c) according to end-use - for bread (rye, and wheat), groats (buckwheat, millet, rice), and for feed (barley, oats, corn, etc.).

The group of industrial crops (that is, those which undergo a more or less complex processing) is quite varied and is usually divided into the following sub-groups: bast-fiber (cotton, long-stapled flax, hemp, China grass, and others); oil bearing (curled flax, sunflower, castor plant, soya, mustard, gold-of-pleasure, and others); sugar beets; tobaccos (Makhorka and regular tobaccos); aromatic herbs (coriander, mint, anis, and others); medicinal herbs; rubber-bearing plants.

Potatoes are classified, according to planting time, into early (spring planting) and late (summer planting). There are many different kinds of vegetable crops especially in industrial farming areas.

Cucurbitaceous cultures include watermelons, melons, squash, and pumpkins.

The fodder culture group includes: perennial grasses, annual grasses, edible root plants (fodder beets, turnips, fodder carrots, fodder turnips) cabbage fodder and crops grown for silage (sunflower and corn), and grain sown for pasture.

The breakdown of sowing areas will be expressed below in terms of basic culture group percentages of total area (1913 and 1938). This is based on data in the yearbook TsUNKhU Socialist Agriculture in the Soviet Union, Gosplan Press, 1939 (page 58).

The Importance of Basic Agricultural Crop Groupings in the USSR

Group Designation of Crops	1913		1938	
	Area (in millions hectares)	Percent of Total	Area (in million hectares)	Percent of Total
Total Sowing Area Includes:	105.0	100.0	136.9	100.0
Grain Crops	94.4	89.9	102.4	74.8
Industrial Crops	4.5	4.3	11.0	8.0
Vegetable and Potato Crops	3.8	3.6	9.4	6.9
Fodder	2.1	2.0	14.1	10.3
Of which Perennial Grasses	1.5	1.4	8.2	6.0

These figures reflect the substantial changes which have taken place in the make-up of the sowing area since the Great Socialist October Revolution, changes which have resulted in the improvement of our agriculture; namely, in the introduction of crop rotation (increase in the relative proportion of perennial grasses), expansion of the raw material base of industry (growth of the relative importance of industrial crops), expansion of vegetable farming, growth of the fodder base for expanding animal husbandry.

Of special interest is the study of that part of the total sowing area which is under winter grain crops and under perennial grasses, since the changes in the relative importance of these crops indirectly reflect changes in crop rotation. In studying that portion of the sowing area which is planted with winter cultures, we proceed with the following calculation: In the three field system, the sowing area consists of two parts - the winter grain crop field and the summer grain crop field. That is, the winter grain crop field occupies half the total sowing area. In the four-field system the winter grain cultures occupy one-third of the total sowing area, in the five-field system - one-fourth, etc. If, therefore, a decrease in

the proportionate share of the winter grain crop area from one-half to one-third is observed in any one region-- this reflects a change from a three-field system to a four-field system.

If it is known, for example, that in prerevolutionary times in the peasant farms located in what today is Moscow Oblast, the share of total sowing area devoted to winter crops was almost invariably about 50 percent (47.6 percent in 1914), and comparing this with the 1938 percentage which was 27.2, it can be concluded positively that exceedingly important advances have been made in the technology of peasant agriculture (in terms of crop rotation) over the years of the Soviet power. The reliability of such statistics can be distorted by the fact that in multi-field systems (seven-, eight-field systems, etc.) two fields sometimes are set aside for winter grain crops, which increases their proportionate share of the total sowing area. The proportion of area under winter crop cultivation is also changed by the use of fallow land. Proportionate growth in the size of areas under perennial grasses is also evidence of the changeover to improved crop rotation systems. Since varying crop rotation systems may be practised in different kolkhozes, and the average area occupied by winter grain crops and and grasses in all kolkhozes will not give a clear picture of marked imporvement in crop rotation, it is desirable to specify these conditions when presenting data on a group of kolkhozes.

By studying the composition of sowing area over time, an idea may be obtained indirectly of former changes. If there is an increase in the relative share of dig-up crops (for instance, potatoes or beets) or of grasses, while there is a diminished proportion of land under grain, then the conclusion is drawn that there has been a decreased sowing of grain for grain. The distribution of sown area by crop may be shown graphically (see illustration).

(d) Study of Sowing Area Dynamics

In the study of changes in the size of sowing areas, over time, the usual method should be used in calculating the indexes of change: This is, in finding out the changes in the size of the areas which have taken place over the year or over a period of several years, in absolute values (in hectares), and in terms of percent (taking the base-year as 100).

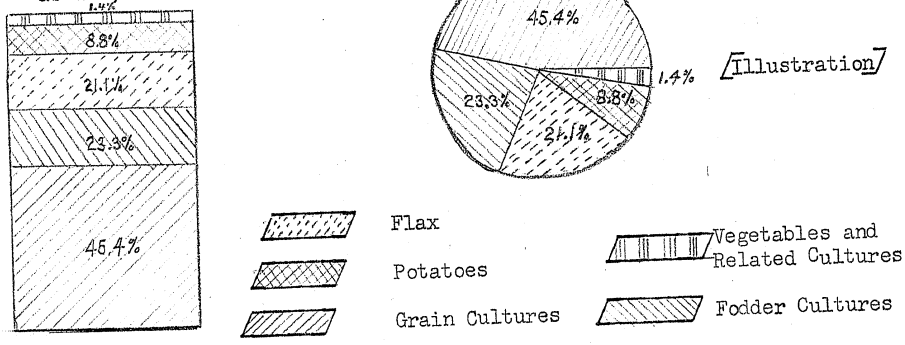

Fig 1. Composition of Sowing Area in Kolkhozes of the Bezhetskiy Rayon in 1934

(Left: Bar diagram; Right: Pie chart of same data)

Comrade Stalin has pointed out that one cannot be guided by rounded off indexes of the changes in sowing areas of large territories, without correcting these indexes by inclusion of data pertaining to individual rayons, since "the method of numerical averages if not corrected with data on the rayons, is not a scientific method" (J. Stalin Problems of Leninism, 11 edit., page 256).

Homogeneity of sowing area categories, over all the years, and the same territory must be observed as requisites for a true comparison of sowing areas.

Selection of the sowing area category depends on the objective which one establishes in studying changes in the size of sowing areas. If it is intended to get an indication of accomplishments of agricultural enterprises based on expansion of their planting, it would be more correct to compare planted areas, year for year (since their size does not depend on the winter losses). If, on the other hand, one is interested in sowing area changes as a factor in plant cultivation, then the spring-crop producing and harvesting areas must be compared. In practice, the spring-crop producing area is used most frequently. That category is the basis of most data published on sowing areas. In the study of sowing area dynamics, not only changes in area totals, but also changes in planting of individual crops are of interest. The direction and extent of changes in the size of areas (increase and decrease), planted with particular crops, gives an indication of the trends toward specialization in farming, and of the introduction of new crops; the development of which indicates progress of technology in agriculture. The indexes of change of areas under particular crops can provide an indication of the changes in crop rotation.

In his report at the 18th Party Congress VKP (b), Comrade Stalin presented the following data on sowing areas in the USSR over a period of years.

USSR Sowing Areas for All Crops

	In Millions of Hectares						1938 as a percentage of 1913
	1913	1934	1935	1936	1937	1938	
Total Sowing Area Includes:	105.0	131.5	132.8	133.8	135.3	136.9	130.4
(a) Grain Crops	94.4	104.7	103.4	102.4	104.4	102.4	108.5
(b) Industrial Crops	4.5	10.7	10.6	10.8	11.2	11.0	244.4
(c) Vegetables	3.8	8.8	9.9	9.8	9.0	9.4	247.4
(d) Fodder	2.1	7.1	8.6	10.6	10.6	14.1	671.4

Analyzing the data in this table, Comrade Stalin notes the large increase under fodder, industrial and vegetable crops and concludes: "Our agriculture is becoming more and more capable and productive, and crop rotation has been established on a sound footing." (J. Stalin, Report at the XVIII Party Congress on the Work of the Central Committee VKP (b), page 25).

In the study of the dynamics of sowing areas in terms of individual rayons, attention must be paid to all crops, even though some of them currently occupy only relatively small areas. It must be remembered that many crops which, at the present time, are considered second-rate, may undergo considerable development in the future.

The establishment of a wheat base area in the non-black soil belt may serve as a case in point. The following data thereon are found in the statistical collection of Central Administration of National Economy Accounting, Socialist Agriculture in USSR (page 60):

	Wheat Sowing Area in the Non-Black Soil Belt			Relative Importance of Wheat Production in Percent	
Years	Winter Crop	Summer Crop	Total	USSR Wheat Sowing	Sowing of all Grain Crops in non-black Soil Areas
1913	63.9	257.4	321.3	1.0	1.7
1928	106.2	238.7	344.9	1.2	1.9
1937	1,050.5	1,679.5	2,730.0	6.6	13.9

(e) Indexes of Sowing Plan Fulfilment

The degree of sowing plan fulfilment (by kolkhoz, rayon, oblast, etc.) is calculated both in terms of total area, as well as by particular crops. Care must be exercised in noting whether or not certain crops have been substituted for others in the sowing process. When determining the

plan fulfilment percentage of the total spring sowing area, the most accurate method is to compute the so-called active sowing area, which does not include the sowing of previous years (mowing area of perennial grasses, etc.).

(f) Index of the Degree of Plowland Utilization

The interrelationship between the plowland area and the sowing area must be looked into in the study of sowing area data. This interrelationship characterizes the degree of plowland utilization and is, therefore, an important quality level indicator of farming. It increases in direct proportion to advances in agricultural technology, introduction of improved crop rotation, the intensivied practice of using fallow lands, and the corresponding decrease in the area of unused plowland.

In determining the degree of productive plowland utilization, the ratio must be computed between sowing area (spring-crop producing area) of tillable land parcels (excluding the planting on farmsteads on isolated truck gardens and sowing of first crops in plowed meadows and pastures), and that of plowland areas.

Example: In the kolkhozes of rayon A, in 1944, the spring-crop producing area consisted of 10,350 hectares; this total included a sown area isolated truck gardens and farmstead lands of 2,700 hectares. In kolkhozes of rayon B, in the same year, the spring-crop producing area was 18,900 hectares, which included isolated truck gardens and sown farmstead lands of 820 hectares. There were 150 hectares in plowed meadows and pastures (sown to their first crops). It may be asked in which rayons the kolkhozes have utilized the plowland to a fuller degree, when it is known that the kolkhozes of rayon A had at their disposal 8,000 hectares, and those of rayon B - 25,200 hectares of plowland.

In the kolkhozes of rayon A, the plowland area is smaller than the sowing area, since sowing outside of crop rotation represents a considerable figure. Plowland sowing equals 10,350 minus 2,700 equals 7,650 hectares, and the index of productive plowland utilization equals $\frac{7,650}{8,000}$ x 100 equals 95.6 percent. In the kolkhozes of rayon B, sowing within crop rotation amounts to 18,900 hectares minus 820 hectares minus 150 hectares equals 17,930 hectares. The index of productive plowland utilization equals $\frac{17,930}{25,200}$ x 100, which equals 71.1 percent. Accordingly, the kolkhozes of the first rayon utilize their plowland to a much fuller extent than kolkhozes of the second rayon.

Of great significance, especially with regard to oblasts of the south-east, of Siberia, the Far East, and Central Asia, is the index which characterizes the over-all degree of tillable farmland utilization.

It is equal to the proportion of the total area occupied by sowing (excluding farmstead sowings, isolated truck gardens, and sowing of first crops in plowed meadows and pastures), plus unused fallow land area, to the total plowland area.

Example: If the sowing area equals 15,860 hectares, and farmstead sowing and isolated truck gardens comprise 1,960 hectares, and if sowing of first crops in plowed meadows and pastures equals 230 hectares, and unoccupied fallow land area is 3,180 hectares, with the entire total plowland area equal to 18,100 hectares; then the overall index of plowland utilization is:

$$\frac{(15,860 - 1,960 - 230 + 3,180)}{18,100} \times 100 = 93.1 \text{ percent.}$$

(g) Computation of Average Size of Sowing Area for One Farm

In analyzing data on sowing areas in the kolkhoz, the rural soviet,

and the rayon, it is customary to compute, in addition to other indexes, the average size of sowing area per farm. The degree to which the kolkhoz members are provided with sowing area is indicated by the average size per household of community sowing in the kolkhoz and also the farmstead sowing of the kolkhoz members.

(h) Sowing Technology Indexes

Sowing areas must be studied in conjunction with problems of sowing technology, since the yield received from sowing areas directly relates to observance of agricultural engineering sowing techniques. Of foremost significance in productivity increase is the sowing of selected seeds, whereby the seed species must correspond to the requirements of regionalization. This makes it necessary to determine, with regard to each culture, the percentage ratio of an area, sown with high-quality selected seeds, to the total area sown to a given crop. It is necessary also to compute the percentage of areas sown with selected seeds and seeds of other kinds to the total selective sowing area. This index must be studied in its geographic aspects in order to determine whether seed species are utilized to best advantage, whether seeds unsuited for local conditions are being used in a given area. An exceedingly important index is also that share of the total sowing area which is seeded with "protrierovannyi", vernalized seeds, as well as with seeds treated with copper sulfate or other fungicides.

In analyzing data on soil cultivation technology, the following indexes are computed: ratio (in percent) of the area of fallow land used for winter grain crops to the area in which winter grain crops were sown during the same year (which indicates the availability of fallow lands for winter grain crops); ratio of specific kinds of fallow land area (black soil, early - requiring short sprouting time) to the total fallow land area; proportionate share (in percent) of summer crop cultures sown in

areas which were plowed for spring planting (this indicates the quality of ground preparation for summer crop sowing).

Example: Kolkhozes of rayon N planted 1,200 hectares of fallow land with winter crop; and 7,600 hectares in the spring of 1944; in the fall of 1944 there were planted (~~spring frozen-ground plowing~~) 12,500 hectares of summer crop. For the 1945 harvest, 9,200 hectares of winter crop and 14,900 hectares of summer crop were sown (excluding cover crop perennial grasses, perennial hayfields and other perennial cultures planted in preceding years).

Based on these figures, it can be determined that the availability of fallow land for the winter crop of 1945 harvest in the kolkhozes of rayon N is equal to:

$\frac{(1,200+7,600) \times 100}{9,200} = 95.7$ percent. Then the black fallow land comprises:

$\frac{1,200 \times 100}{1,200\ \ 7,600} = 13$ percent of the overall fallow land area.

The availability index of summer crops plowed in the spring for the 1945 harvest equals:

$\frac{12,500 \times 100}{14,900} = 83.9$ percent.

Of significant influence on the level of productivity are the sowing periods. The best index of the fulfilment of sowing operations in limited periods is found in the percent of sowing plan fulfilment, which is computed from the accumulated total in terms of separate small time spans of the sowing period (for example, 5 day work week periods).

To determine the value of other methods of agricultural engineering in sowing, the following ratios are computed: the share of the fertilized area (separately for organic and mineral fertilizers) planted with winter and summer crops; the share of the area sown by tractor-drawn,

horse-drawn, and hand seeders; and the share of the area sown broadcast, in rows, crossrows, wide row seeding, etc.

(i) Calculation of Sowing Areas by Categories of Economies

The study of sowing area sizes and of the indexes listed in this section must be carried on in terms of individual types of economies (kolkhozes, sovkhozes). Separate treatment should be given for the farmstead sowings of individual kolkhoz members, for those of laborers and employees, and for those of the private individual peasants.

To the extent that the sowing area represents one of the basic elements of agricultural production, a knowledge of it (as well as of other elements) is necessary for a whole series of calculations which identify the individual types of economic structures. Such information is essential also in studying the redistribution of sowing periods among themselves.

In particular, the collectivization of the sowing area, together with the collectivization of peasant farms, represents the basic index, accepted in statistical practice for determining the agricultural collectivization level. This index is equal to the percentage ratio of the sowing area of the kolkhozes and individual kolkhoz members to the total area of kolkhozes, kolkhoz members and of private peasants.

(j) Data Sources on Sowing Areas

In studying data sources on sowing areas, a differentiation must be made between data on the progress of the sowing and the final accounting for areas sowed.

During the period of winter and summer crop sowing, sovkhozes and kolkhozes submit progress reports for every 5 day work week period.

The final accounting for sowing areas, starting in 1935, is made by government statistical agencies at the end of the spring sowing. As a re-

sult of evaluation of the final accounting, the following data are obtained: total areas, in terms of separate economic structures, under summer as well as under winter crops, sown during the fall of the preceding year; winter crop areas, abandoned during the fall and winter, and the resown part of those areas; the mowing area of perennial grasses, sown during preceding years. Irrigated sowing areas are listed separately, as are areas sown with vernalized seeds, and first crop areas sown in plowed meadows and pastures. During the final accounting, all data are collected in accordance with a detailed inventory listing of crops.

Kolkhozes, sovkhozes, and subsidiary farming enterprises submit their final accounting on sowing area totals for the current year harvest on kolkhoz accountability form number 4, and submit these statements to the sectional or rayon inspectors of the Central Statistical Administration of the Gosplan, USSR.

One of the essential differences between the 5-day-week accounting for sowing progress and the final accounting (in addition to the wider scope of content of the final accounting) is the difference in primary source.

The primary source of 5-day reports are the daily measurements carried out by the brigade leaders. These reports, however, frequently are inaccurate (resulting from a lack of familiarity with measuring devices, irregularity of shape of the area sown each day, etc.). The final accounting is accomplished on the basis of acceptance of work certificates issued to the brigade leaders after completion of the sowing of each individual crop. In these documents areas under individual crops are registered on the basis of the measurement of the total area sown to the particular crop. Such measurement gives incomparably more accurate results, than the daily measuring by the brigade leaders of comparatively small plots of ground (frequently measured inaccurately), throughout the entire sowing period of a given crop.

Accounting for sowing areas in the households of kolkhoz members,

of private peasants, workers, and employees, handicraftsmen, and other population is carried out by the rural soviets on rural soviet accounting form 17a. The material gathered, after examination and entry of data in the agricultural record books, is turned over for detailed evaluation to the section inspectors of the Central Statistical Administration.

In towns and workers' communities, accounting of individual sowings is carried out by specially selected registrars. The accounts of sowing area totals must be carefully checked by the inspectors.

In particular, special attention should be paid to the correctness ~~ness of~~ accounting for mowing areas of perennial grasses, for here most mistakes are made. In order to check the correctness of accounting for mowing areas (which are carried according to individual years of sowing) it is necessary to compare them with last year's data for the same farming economy. A check method is illustrated in the following example.

In the final accounting for 1943 for kolkhoz N there were listed: 62 hectares of cover- and noncover-crop of clover sown in the given year (1943), 50 hectares of clover sown in 1942, 15 hectares sown in 1941 and in earlier years. Obviously, in the accounting for the 1944 clover, sown in 1943, the clover must be included in the total for the first mowing year, and the total area, if no loss or plowing has taken place, must equal 62 hectares. If one hectare of clover was lost, then the total should read 61 hectares. The mowing area of the 1942 sowing cannot exceed 50 hectares in the 1944 accounting, but it can occupy a somewhat smaller area if there was abandonment or plowing.

If the tie-up indicated does not work out, it must be determined where the mistake lies and when it was made - whether it was in the accounting for the current or the preceding year. When the mistake is discovered it must, of course, be corrected.

Simultaneously with submission of final accounting reports on the total sowing for harvest in the current year, the sovkhozes and kolkhozes must submit to the district or regional inspectors of the Central Statistical Administration an accounting of sowing by category (on kolkhoz accounts form number 5).

The correctness of data on the grade of sowing must be affirmed by one of the following documents: certificate of type of seed received

through inter-kolkhoz exchange from State Grade Supply, Grain Collection (Zagotzerno), etc. The certificates of approval of sowing categories, statements issued by the senior agronomist of the RayZO for local and highly productive kinds of seed which are not supplied with an approval document. One of the main tasks in approving sowings, which is done by agronomist personnel is establishing the authenticity of the kind of grain and its particular qualities.

Based on the totals received from evaluation of final accountings on sowing areas and the accountings on sowing of different kinds of seed, a number of indexes can be arrived at (discussed above). These include the area sown for harvest during the current year, the spring-crop producing area, and the area under cultivation; indexes on fullfillment of the sowing plan; indexes on the breakdown of the sowing area by crops and groups of crops; incexes of change (to what extent is a supply of a given culture built up over a given number of years); indexes on fulfillment of sowing plan by kinds of seeds; the share of the area sown to sorted seeds, the breakdown of sowing by kinds of seeds, the geography of individual kinds; the share of sowing with vernalized and with soaked seeds.

Based on the analysis of accounting totals for sowing areas, the progress of the fulfillment of individual orders of the Party and State with regard to sowing areas, can be checked (for example, with regard to developing potatoes and vegetables in the vicinity of large cities, with regard to making more fodder available, or introducing new crops, etc.)

Special attention must be paid to sources of data on areas under gardens, vinyards, berry crops, and subtropical cultures. The last accounting report on garden planting together with the final conclusive report on sowing areas was carried out in 1937. In 1940 an all-union inventory was taken of vineyard planting in all categories of farm economy. In government economic structures and in kolkhozes, during the period of

this inventory, information was collected on the size of vineyard areas, the makeup of these plantings by age and kind, the size of vineyard nurseries and on the gathering of grapes in 1939. Based on farm economy of kolkhoz members, of private peasants, workers, employees and other population groups, information was collected on the quantity of grape-vines set out, and their distribution by age and kind.

In the kolkhozes, inventory was carried out by special brigades, headed by experts in viniculture. In cases where the kolkhozes had documents on the actual state of vineyard planting, the brigades filled out the inventory forms on the basis of these documents, after preliminary examination by measuring and counting the vines in not less than 10 percent of all plots in the particular farm economy. If no documents were available, the brigades filled out the forms after inspection of all vines, determination of age and kind, counting the number of vines of each kind, and measuring the area planted with vineyards.

Carrying out of the inventory in State agricultural organizations has been the responsibility of the administrative staffs of these. In the farm economy of kolkhoz members, private peasants, workers, employees and other population groups, inventory was carried out by registrars who counted the number of vines.

In 1941 an inventory of mulberry plantings was carried out. Beginning with 1937 and up to the present time the only source of data on areas under garden and berry plantings in sovkhozes and kolkhozes have been the annual reports of these farming economies. For new plantings, current accounting is practiced. The overall area given to orchards planted in the farmstead plots of kolkhoz members, of private peasants, workers and employees is entered annually in the economic household books where, in addition, entries are made on the quantities of orchard roots (by species), and of berry crops and vinyards (accounting separately the fruit-bearing plants).

In the annual accountings of the kolkhozes, areas under fruit and berry cultivation and vineyards are listed under individual species, in hectares, with the exception of the area under plants of fruit-bearing age. Kolkhoz accounting form 17 contains data on the planting of orchards, vineyards, and berry crops (in hectares). Accounts are submitted twice a year: for spring and fall plantings.

The kolkhozes of the Georgian and Azerbaidzhan Soviet Socialist Republics and the Krasnodar Kray submit reports on the progress are submitted on the 10th, 20th, and 30th day of each month.

In 1945 the Central Statistical Administration Gosplan, USSR together with the People's Commissariat of Agriculture USSR and the USSR People's Commissariat of Food Industries conducted the first special all-Union census of fruit and berry plants. This census included all sovkhozes subsidiary economies, as well as other government and cooperative enterprises, kolkhozes, household farm economy of kolkhoz members, of private peasants, workers, and employees and other population groups having fruit and berry plants in rural and urban communities. This census covered all plants of fruit and berry crops, in the common orchards and also individual trees outside of the orchard.

The census was conducted between 1 August and 1 September. In all government and cooperative farm enterprises and in the kolkhozes, a card index system was adopted. For each farm establishment there was drawn up a census form for fruit and berry plants in State establishments and in kolkhozes (form number 1). In the farm establishments of the kolkhoz members, private peasants, workers and employees and other population groups, the census was conducted in a listing system (form number 2: Census list, by household, of fruit bearing and berry crop plants).

The census program in government farming enterprises and kolkhozes envisioned the determination of the number of fruit trees which died from frost in the years 1939/1940 and 1941/1942. It called for determining

the areas and number of roots of fruit and berry crops by their species grouping (seed-bearing - apples, pears, quince; pit, stone-bearing cherry, plum, and others; nuts - walnut, almonds, pistachio, chestnut, and others; citrus fruits - tangerine, orange, lemon, and others; berries - raspberries, currants, gooseberries, strawberries, etc.; tea plants). These data are classified according to the pattern of planting (row planting, systemless planting, inter-row planting, isolated single trees - their number). The collection of further data was envisioned by the census program as follows: the species and age breakdown of all fruit cultures - by tree count, listing separately those trees of all ages which are actually fruit bearing; the breakdown, by variety, of fruit trees planted (by tree count); breakdown by berry cultures, nut citrus and other subtropical fruit plants, information on fruit and berry nurseries (the plot for propagation, plots for forming and planting the mother stock).

The propagation plot is designated for growing uncultivated plants (wild stock to which cultivated sorts are grafted) and of grafts. The formation plot is further subdivided into four fields; the first one for growing wild root stock plants, which are engrafted in the second half of the summer (this is one type of grafting). The second field is occupied with yearling seedlings; the third and fourth fields with seedlings of two-years and older. Mother plantings are divided into seed plantings and graft plantings.

All nursery plantings are accounted for both by hectares and in physical units. The census program for the households of kolkhoz members, for private peasants, workers, employees and other population groups is considerably less expensive. The following were accounted for: number of fruit trees (in individual orchards as well as of individual trees) by varieties, indicating those trees actually bearing fruit, as well as the

area (in strawberries, or raspberries) or the number of bushes (currants, gooseberries) of berry plants. Accounting also covered the quantity of fruit plantings, planted in the years 1940/1945, the area of the farmstead plot and the area of the individual orchards.

In sovkhozes, subsidiary economies and various government and cooperative farm enterprises, carrying out the census was the responsibility of the respective administration of these establishments. In the listing of documented data on the breakdown of fruit and berry plants (by species, variety and age), the census forms were filled out on the basis of this information. In the absence of data or in cases of inaccuracy, the age and variety of the plants were established by personal inspection in the field by experts.

In the kolkhozes the census was conducted by brigades under the leadership of experts in the cultivation of orchards. They included a registrar, member of the kolkhoz management, and the kolkhoz brigade leader in charge of fruit growing. Forms were filled out on the basis of the documented data of the kolkhoz (inventory and registration material, etc.) on the state of fruit and berry plantings. In cases of inaccuracy of the documents, and also when there were no documents at all, the forms should have been filled out on the basis of area measurement and tree count.

In households of kolkhoz members, private peasants, workers, employees, and other population groups, the census was conducted by registrars with the participation of representatives from the rural soviet (or town soviet) by questioning representatives of the enterprise and also by adding up te trees and bushes on the spot.

After the census was completed, in order to check on its completeness and accuracy, a sample was taken of no fewer than 10 percent of the registered enterprises of the kolkhoz members, of private peasants, of workers and employees, and of other groups of the population.

This sample inspection was done by controllers with the cooperation of the community, at control points which were selected mechanically so that the number of farm enterprises in each would be not less than 10 percent of all such enterprises being studied.

Selection of control areas in each rayon was made from the register of populated areas, in geographical order. If errors were found during inspection, the census was again taken in the given populated areas.

Census totals were added by categories of farm enterprise. In computing areas under fruit and berry cultivation difficulties arise in connection with the infinite variety of plant species, distinguished by differences in their distance apart in planting, and also by the fact that, in addition to orchards with row planting of trees and bushes, everywhere there are orchards with systemless planting, without the necessary distances between roots and individually fruit trees.

In conducting the 1945 census, the central Statistical Administration, Gosplan USSR refused to consider in area units, those fruit trees which stand alone and refused to determine areas by individual species of plants in orchards belonging to individuals. In these cases, only a tree count was taken.

In order to determine areas under individual species groupings of fruit and berry crops in orchards of the State, of cooperative enterprises, and of kolkhozes orchards with mixed plantings, according to the 1945 census, the following methods were recommended in the instructions:

(1) If in a given farm enterprise there are plots under mixed cultivation in row planting, the distance between the rows must be measured, and within row the space between roots is measured. An auxiliary table was appended to the instructions which listed the number of roots per hectare for different distances between rows, and between plants within the rows.

(2) To determine the areas under each particular stock when there are mixed plantings set out without any system, it was recommended to use data on the average density per hectare of individual varieties, in terms of the norm which had been determined beforehand for each rayon starting with available materials and based on the expert advice and information of fruit cultivation specialists. As, however, the actual planting density in individual enterprises may vary from the norm in one direction or the other, and since even in individual plots of the same enterprise the density may not be the same, therefore, the total of the areas calculated on the basis of the norm under individual varieties of cultivation may not add up to the over-all area of the plot, determined by measurement. In such cases the parity of areas was obtained by using an abstract method - by increasing or decreasing the area under the predominating variety group by the difference between the sum total of computed areas and the area of the plot which was measured.

Example: On a 4 hectare plot (by measurement) there are planted at random various fruit and berry crops:

Indexes	Apples	Pears	Total seed fruits	Plums	Cherries	Total pit fruits	Raspberries	Currants	Total Berry crops	Total area in hectares
(1) number of roots per hectare according to the norm	150	200	--	300	400	--	--*	2000	--	--
(2) Roots present:										
(a) of preserved plantings	320	80	--	92	135	--	--	280	--	--
(b) drop-outs (plants died)	20	10	--	8	15	--	--	--	--	--
(3) Total (a + b)	340	90	--	100	150	--	--	280	--	--
(4) Converted to area in hectares (line 3 divided by line 1)	2.27	0.45	2.72	0.33	0.37	0.70	0.20	0.14	0.34	3.76
(5) The same with correction	--	--	2.96	--	--	0.70	--	--	0.34	4.00

* In government, cooperative enterprises and kolkhozes, the size of plantings of currants and gooseberries is listed by area and number of bushes. The size of plantings of strawberries, raspberries and miscellaneous berry cultures are recorded only by area in hectares occupied.

The difference between the area of the plot which was measured and the sum total of the computed areas in the example given, equals 4 minus 3.76 equals 0.24 hectares. This quantity is added to the total of the area which in this example has the predominant group of seed plantings (2.72 + 0.24 equals 2.96).

(3) The width of the area of vines in the between-row plantings, when planting bushes in one row (gooseberries, currants, raspberries), is established at 2.5 meters. If in the between-row plantings there were planted berry bushes in several rows, the width of the plot occupied by berry bushes was determined by the distance between the end rows (measured from the roots of the bushes) and, in addition, one half the distance between rows was measured from both sides of the end rows.

The size of the plot under strawberries in between row planting was determined by actually occupied area (by width and length of the beds).

Example: In accordance with the methods discussed above, the following problem is to be solved.

Sowing Area (in hectares)

Designation of Crops	Sovkhoz A		Sovkhoz B
	1943	1940	1943
I. Winter Crops Sown in Fall of Preceding Year			
1. Wheat	250	80	-
2. Rye	150	120	-
3. Of the above, there were abandoned, before end of summer grain crop sowing:			
(a) Wheat	8	12	-
(b) Rye	4	3	-

Designation of Crops	Sovkhoz A		Sovkhoz B
	1943	1940	1943
II. Summer Crop Sown in the Current Year			
1. Wheat	80	55	50
2. Oats	200	120	75
3. Barley	10	2	25
4. Buckwheat	10	-	-
5. Vetch	30	28	-
6. Potatoes	160	150	180
7. Vegetables	75	44	420
8. Planting for Silage	10	-	-
9. Fodder Root Plants	20	4	-
10. Annual Seed Grasses	20	15	-
11. Perennial Grasses of the Current Year's Sowing on a separate area (non-cover crop)	2	1	-
12. Perennial Grasses Sown during the Current Year in areas already occupied (bespokrovnie)	200	200	75
13. Lupine for Green Fertilizer	28	-	-
III. Perennial Grasses Sown During Preceding Years (mowing area)	400	400	150
IV. Winter Crops Sown During Fall of Current Year (for next year's harvest)			
(a) Wheat	280	100	-
(b) Rye	130	110	-

In Sovkhoz A, five hectares of various crops were lost during the summer of 1943, and seven hectares in the summer of 1940.

In addition, there are the following data on the same sovkhozes (in hectares):

Designation of Crops	Sovkhoz A		Sovkhoz B
	1943	1940	1943
1. Out of the over-all area, summer crops were sown replacing winter crops lost (re-sowing):			
Oats	7	5	-
Fodder Root Plants	3	4	-
2. Plowland area	1600	1200	900
3. Area of summer crop sowing on farms and separately located garden land	35	10	-
4. Out of the total of summer crop area, first crops sown on plowed meadows and pastures	2	5	-
5. Summer crop sowing plan (active sowing)	600	425	745

Based on the data given, the following is to be calculated:

(1) Size of sowing area in sovkhozes A and B in 1943, by individual accounting categories.

(2) Percentage breakdown of sowing area for both years given for sovkhoz A and for the year 1943 for sovkhoz B; determination, based on the area breakdown, of the basic productive trend of the field cultivation of both sovkhozes, and the change in the composition of the area of sovkhoz A in 1943 as compared to 1940. Express the composition of the sowing area for each sovkhoz with the help of diagrams, having first decided the problem of what type of diagram to use in the given case.

(3) Calculate the indexes of the dynamics of the sowing area size in sovkhoz A for the period 1940-1943. (the absolute increase, speed of growth, increase per hectare represented by a one percent gain) with regard to overall total area (having first decided tentatively which category of the sowing area would be most suitable in the example given), by area sown under oats, by barley area, by fodder root plants, under non-cover crop perennial grasses. What are the special features of the

indexes of change of areas under these crops?

(4) Compute index of the degree of productive utilization of plowland in sovkhoz A (for both years) and in sovkhoz B. What is the meaning of the change in this index in Sovkhoz A for the years given?

(5) Compute the index of sowing plan fulfillment of summer crops for sovkhoz A (for both years) and for sovkhoz B.

NOTE: In computing the size of sowing area for individual accounting categories (answer to question 1 in the example given), it is recommended to first add up areas under those crops which homogeniously distribute themselves on sowing area categories (winter crops, summer crops without perennial grasses and without sowings for green fertilizer).

2. Statistics on Yield Capacity

(a) Definition of "Yield Capacity" and Overall crop Yield

Determination of capacity, like determination of the sowing area, is important in the computation of overall production in plant cultivation.

Yield capacity level is one of the basic qualitative indexes of agricultural production which reflects all methods for the improvement of agricultural organization and for raising the agricultural technology level --such as mechanization, the introduction of advanced agricultural technology, and the effective organization of labor. The yield capacity or the actual yield of agricultural crops is the green crop per hectare.

In contrast to this definition of yield capacity, the so-called "net storage yield" is considered to be the per hectare quantity of farm produce which is brought in by the agricultural enterprise. This does not include the loss of grain as a result of bad harvesting, pilferage, or of grain which has (for community feeding, for livestock and poultry feeding, etc.) unaccountably been expended.

That is why the net storage yield is lower than actual yield capacity of agricultural crops, and use of that index results in withholding grain from compulsory deliveries in pilferage and squandering.

Another concept in yield statistics is the "overall crop yield" which is computed by multiplying the average yield capacity of one or another culture by the sowing area of that culture in accordance with final accounting data on sowing areas. Overall crops yield gives an indication of the gross agricultural production which is received from the planted areas, plantings, as well as from certain other use agricultural lands (haying, pastures) which are used by individual farms enterprises and by them together (for a rayon, oblast, kray, etc.)

(b) Objectives of Yield Capacity Statistics

Yield capacity statistics has before it primarily the following objectives: (1) Collecting of data necessary for checking fullfilment of the yield capacity increase plan; (2) collection of data necessary for determining raw materials, and fodder resources; (3) collecting material of real importance in the campaign against losses in agricultural crop harvesting; (4) collection of material necessary for development and study of achievements of leaders in agriculture on increasing yield capacity and increasing potential reserves for the purpose of increasing yield capacity and overall crop yield.

(c) Area for Which Yield Capacity is Computed.

Which of the sowing area categories must be considered in determining yield capacity? On the hectares of what specific area should yield be computed?

Computation of yield based on the relationship to non seeded areas and to sown areas has practical disadvantages and ordinarily this is not the practice.

Of the two remaining sowing area categories (the spring*crop producing and harvest area), the spring-crop producing area should be given preference.

Computation of yield capacity per hectare of harvest area gives a distorted picture of the index of yield capacity fullfilment and incorrectly characterizes the quality of the work of agricultural enterprises.

In proving the necessity to compute yield capacity per hectare of spring-crop producing area when determining the fullfilment index of the yeild capacity plan, it must be remembered, that the level of yield capacity (in centners per hectare), the size of the sowing area, as well as overall crop yield are values which are functionally interdependent. Therefore, there cannot be a situation where the sowing and yield capcity plan would be fullfilled while the overall crop yield plan would not;

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but precisely such an incongruence results when the yield capacity is computed per hectare of harvest area.

Assuming that according to plan, 1,500 hectares of a given crop were to be sown and that plan had been fullfilled. The yield capacity plan equals 14 centners per hectare and, consequently, the overall crop yield plan=14 centners x 1,500 = 21,000 centners. Let us assume that (1) during the summer the crop on an area of 75 hectares was lost and (2) the actual harvest was 19,950 centners; that is, five percent below the plan estimate. If the yield is computed per hectare of harvest area, it will in this example be equal to $\frac{1,995}{1,500 - 75} = \frac{1,995}{1,425} =$ 14 centners, that is, equal to the value foreseen in the plan.

In this manner the sowing and yield capacity plan will have been fullfilled, and the overall crop yield- in effect, the value which is of most interest to us will be lower than that in the plan by 1,050 centners, or by five percent.

Such an incongruity will not result if the yield is computed per hectare of spring-crop producing area. In that case it will equal $\frac{19,950}{1,500} =$ 13.3 centners, lower than that in the plan by five percent, that is relatively lower by an amount equal plus that by which the overall crop yield plan turned out to be under fulfilled.

In order to prove that only by computation of yield capacity per hectare of spring-crop producing area a correct reflection of the quality of work of agricultural enterprises can be obtained, the following example will be used. It is assumed that two kolkhozes sowed equal areas with the same crop in the spring. It is further assumed that one of the kolkhoz worked less carefully and, as a result, part of the crop was lost during the summer. Such a difference in the quality of the work of the two kolkhozes must find expression in the capacity level yield which is illustrated in the following table:

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Determination of Yield per Hectare of Spring-Crop producing and Harvest Area

Kolkhoz Designation	Sown in spring (hectares)	Losses during summer (hectares)	Harvest area (hectares)	Overall crop (centners)	Yield capacity (in centners per hectare)	
					Spring	Harvest
Kolkhoz A	180	-	180	2,520	14.0	14.0
Kolkhoz B	180	10	170	2,397	13.3	14.1

In appears that, in determining the yield per hectare of harvest area the second kolkhoz which, having started with a sowing area equal in size to that of the first kolkhoz, obtained a smaller overall crop yield, having worked less diligently than the first kolkhoz. The second, however still will obtain a higher index of its work quality (the yield capacity is 0.1 centner higher).

Computation of yield per hectare of spring-crop producing area furnishes a true picture of the work of agricultural enterprises (the first kolkhoz obtained a yield, per hectare of spring-crop producing area, of 14 centners, while the second kolkhoz received only 13.3 centners).

(d) Sources of Capacity Data Yield

Prior to 1942, the agrarian authorities and the Central Statistical Administration used basic sources for capacity data yield, the accounts of kolkhozes and sovkhozes on quality of grain milled. Accounts were submitted twice during the period of threshing. These accounts indicated the area which produced one or another crop for threshing, as well as the overall quantity of threshed grain.

In view of the incompleteness and inaccuracy of these data which gave no picture of the overall size of the yield capacity (excluding losses), the agrarian authorities of the Central Statistical Administration had been using spot check methods in determining losses during harvesting and treshing, as well as unaccountable losses in the field. On the basis of data thus

obtained, they had been making corrections in the average quantity of grain threshed per hectare.

In its decree of 6 December 1942, the USSR Council of People's Commissars and the Central Committee of the Party forbade the Central Statistical Administration, Gosplan, and the People's Commissariat of Agriculture USSR to "collect data on the actual milling of the yield in the kolkhozes as misrepresenting the actual state of affairs with regards to yield capacity." Accounts based on milling produced largely inaccurate indications of the actual yield capacity (not including losses during harvest, threshing, and transport unaccounted for expenditures of the new crop in the field; for livestock fodder, for community feeding, reflecting various reasons for the incompleteness of the accounts of grain obtained in the farm enterprise. Frequently, the entire sowing area figured in the accounts, and not the area which yielded the grain which was threshed. That also resulted in lowering the average amount threshed per hectare.

A source which distorted the actual facts as considerably could not be taken as the basis in determining yield capacity. Data from the source of such obvious shortcomings was not noticably improved by such corrections as were made in the accounts by authorities of the Central Statistical Administration, as a result of spot checking deficiencies, losses, and unaccounted for expenditures. Frequently such corrections were incorrectly based, especially since losses were determined incompletely (for example, the study did not include losses in the transport of sheaves and grain, which sometimes reach considerable proportions). In view of the inconsiderable extent of spot checking to determine loss deficiencies, and unaccounted for expenditures, the inadequacy of the above described system for determining yield capacity was reflected especially in the rayon indexes.

The same decree made it incumbent upon the Central Statistical Administration and the People's Commissariat of Agriculture, to make use in future harvest evaluation only of visual evaluation data, obtained by organs of the Central Statistical Administration before the start of the harvest.

Visual evaluation is also called evaluation of yield estimates. After the above decision of the Party and the government, the responsibility of kolkhozes and sovkhozes for yield estimates assumes an especially important governmental significance, since it becomes the sole source of mass data on the yield capacity of agricultural crops.

In addition to the basic work in determining yield capacity, checking activities are carried out in order to check the correctness of evaluations of the yield estimate.

Such control work is currently being carried on in the form of spot checking the accounts of kolkhozes, sovkhozes and rayon land offices on yield estimates and taking sample measurements in order to determine yield capacity.

Each of these tasks will be discussed in detail.

(e) Evaluation of Yield Estimates

Yield estimates are reports on yield capacity which are collected for some time before the harvest and are based on the outside appearance of the fields (proximity of plants in the field, condition of the ears of grain, density of stand and plant growth for plowed crops, and the amount of weeds). Considering the grade of seed, fertilizer used, observance of required agricultural technology with regard to the sowing and care of plants, etc.

Work in determining yield estimates has been carried on for a long time in order to establish a plan for the distribution of agricultural production by territories of the country, to plan for necessary transportation, for storage, and to plan harvesting operations, etc.

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This work has assumed special significance in connection with the order of 25 May, 1939 of the Central Committee of the Party VKP(b) and the Council of People's Commissars USSR, on placing kolkhozes into yield capacity categories for computing payment in kind for the work of the MTS, based visual evaluation.

At the present time, the basic significance of this work is that yield estimates of kolkhozes and sovkhozes are (as has been stated above) the sole source of mass data on yield capacity.

The actual yield of agricultural crops is considered to be the standing crop, determined primarily by evaluation of estimates on yield during the week before harvesting a given group of crops.

In mass determination of yield estimates the subjective generalized method of evaluation is employed. It is called the subjective method because these evaluations are vased not on exact measurements, but on the personal (subjective) impressions of the person making the evaluation. And it is called the generalized observation method in determining yield estimates because, as a result of the observations, one generalized evaluation is given for the entire field area under cultivation for a given crop, even though the breakdown of individual plantings in separate parts of the field may be far from homogeneous. In order to get a more correct generalization, it is recommended to tentatively divide the sowing area of the crop which is being evaluated into plots with more or less homogeneous plantings. The evaluation is made by individual plots, and only after that the weighted average evaluation for the whole field is given.

Example. After inspection of the field, three plots of more or less homogeneous composition were selected. One plot of 15 hectares, which was estimated to yield 10 centners per hectar, a second plot of 25 hectares with an estimated yield of 15 centners per hectare, and a third plot occupying an area of 20 hectares, with an estimated yield of 18 centners per hectare. The average estimate for the whole field in this case is equal to:

$$\frac{10 \times 15 + 15 \times 25 + 18 \times 20}{15 + 25 + 20} = \frac{885}{60} = \begin{matrix} 14.8 \text{ centners} \\ 14.8 \text{ centners} \end{matrix}$$

Yield estimates are expressed in centners per hectare. When evaluating yield estimates, the full yield value must be considered (green crop) without making any allowance for losses. The evaluation throughout the entire period of observation must be related to the spring-crop production area. If, therefore, a part of the planting was lost during the summer, that fact must be expressed in the estimate per hectare of spring crop producing area.

Example: An area of 200 hectares was sown with oats in the spring. On 18 July a hailstorm ruined the crop on an area of five hectares. In an estimate made on 1 August, the crop on the unaffected area is estimated to yield 17 centners per hectare. Since the estimate relates to the unaffected area, the overall size of the crop yield expected will equal 17 x 195 = 3,315 centners, and a yield estimate in relation to the spring crop producing area will be expressed as follows: 3,315 : 200 = 16.6 centners.

Crop yield estimates are prepared for periods determined by the Central Statistical Administration of the USSR, Gosplan, the USSR People's Commissiarat of Agriculture, and by the USSR People's Commissariat for Procurement (separately by individual zones of the USSR, and by individual groups of crops).

The land offices collect information on crop yield estimates of all kolkhozes on kolkhoz accounting form number eight. In this form, the sowing area for each crop (based on the final accounting) and the anticipated yield per hectare, determined by the kolkhoz manager are indicated . The last column of the accounting form is reserved for the estimate of anticipated yield per hectare as determined by the chairman of the rural soviet who receives all estimates from kolkhozes and transmits them to the Rayon Zo.

The Rayon Zo, upon receipt of the estimates must examine them carefully (by comparing estimates of neighboring kolkhozes, considering the familiarity of agricultural personnel with the composition of the crops in the kolkhozes, making field trips to individual kolkhozes when necessary). As a result of the check, the Rayon Zo forms its own crop yield estimate for each crop and forwards the estimates to the rayon inspectors of the Central Statistical Administration, Gosplan, USSR.

The rayon inspectors evaluate the estimates and determine the average yield capacity index for the rayon for individual crops, based on the estimates prepared by the kolkhozes as well as estimates determined by Rayon Zo. In this case the average weighted crop yield capacity must be computed (for sowing areas of each crop)

Sovkhozes of the basic systems, People's Commissariat of Sovkhozes, People's Commissariat of Food Industries, and People's Commissionat Meat and Dairy Indurtries must submit estimates on crop yield to their superior organization, as well as to the competent representatives of Oblast (Kray) of Gosplan USSR, or to statistical administrations.

In order to check crop yield estimates, each regional inspector of the Central Statistical Administration carries out a personal inspection in three kolkhozes, selected by the mechanical selection method, Rayon inspectors. The regional inspector enters his estimate for each crop, as well as the estimate of the kolkhoz on special forms. The rayon inspector enters the estimates accepted by the Rayon Zo form.

Based on evaluation of data collected from all kolkhozes and on computation of average estimates from each source and for each crop, information is assembled in the light of which the estimates of kolkhoze and the Rayon Zo can be analysed and compared to the estimates of the regional inspectors. Since determination of the inter-relationship

between evaluations prepared by different sources is the sole objective of this work, average evaluations for each source are computed as simple arithmetic means (since the weights for all the different sources are the same).

The computed interrelationships (ratios) are used by the rayon inspectors, as well as by appropriate representatives of the USSR Gosplan (or by the Statistical Administrations) in working outthe final indexes of crop yield (along with personal observation on the condition of the crop). Spot checking of crop yield estimates is carried out also in sovkhozes of the principal administrations.

In order to obtain more accurate visual estimates, it is necessary to carry out regular observation of agricultural crops. In particular, the condition of winter grain crops, in addition to evaluation shortly before harvest, is estimated at two basic moments of growth: - before the winter snow, and after the spring thaws. These estimates are given by the regional inspectors for several kolkhozes in terms of qualitative characteristics (excellent, good, satisfactory, as well as crops which have failed to sprout, and crops which were a total loss), indicating the area which each estimate applies. The condition of the winter grain crop may be studied during the winter period by taking samples (several times during the winter) of the crops, transplanting them in a warm space, and determining the percentage of crop losses.

Selection of Control Areas Before Harvest

The basic task in selective measuring of yield capacity of the green crop at the moment of ripeness of agricultural crops is the compilation of objective and accurate information in order to check the accuracy of crop yield estimates determined by the kolkhozes and rayon land offices.

In addition, the difference between the results of measuring

(not counting losses) yield capacity from the green crops in the field and the actual crop yield in those kolkhozes in which this work is being carried out (computed per hectare), gives a summary indication of the extent of all losses, the extent of underestimating and unaccounted-for losses in the field. This information is utilized in the fight to reduce losses.

Measurement of green crops to estimate yield capacity is done on two or three basic grain crops, as well as for potatoes, sugar beets, long-fibred flax, and hemp. With a few exceptions, depending on special characteristics and differences in the growth of crops, the techniques applied with regard to individual crops are basically the same for all crops.

Use of the selective method in measuring yield capacity applies equally to all crops. This work is not done in all kolkhozes, but only in a relatively small number of them. Kolkhozes are chosen by the mechanical selection method. The yield capacity measuring of individual grain and industrial crops is carried out in rayons where these crops are widespread. In individual kolkhozas, yield capacity is not measured in terms of the entire field. Special samples are taken and processed. Compensation then is made for the yield capacity per hectare of a particular crop in a given kolkhoz.

In applying this procedure whereby deductions on yield capacity of an entire field are made on the basis of examination of crop sample yield capacity, it is necessary to solve several basic questions first : (1) how many samples must be taken, (2) how the samples must be distributed throughout the entire field, and (3) of what each sample consists. The first two questions are solved in like manner when yield capacity of a crop is measured. The answer to the third question depends on the distribution of the crop on the sowing area under consideration.

The number of samples to be taken is determined by the theory of selective observation: the less uniform that the crop appears over the entire area, the higher the degree of accuracy desired, the larger must be the number of samples.

Since the variation in yield capacity increases with the increase in the field, a larger number of samples is taken in farms establishments with large crop areas, than in those with a smaller crop area. The number of samples however, does not necessarily increase in proportion to the increase in area. The number of samples is determined by the Central Statistical Administration on the basis of information collected on the degree of yield capacity fluctuation.

In order to obtain a correct indication of the yield capacity, it is important to take samples uniformly from the whole field. To attain such uniformity, samples must be taken at regular intervals. In order to determine the size of this interval, the field under the crop in question is assumed to have been divided into a number of squares equal to the number of samples to be taken. A sample must be taken from the area of each of these squares. A side on each of these squares is designated as X. The area of each square will be equal to X^2. If it is assumed, that the entire area consists of 45 hectares, and that 300 samples are to be taken from it, the entire 45 hectare area must be divided into 300 squares, and a sample must be taken from each.

The area of each square is equal to $\frac{45 \text{ hectares}}{300}$, that is $X^2 = \frac{45 \text{ hectares}}{300}$. In order to express X in meters, the 45 hectares must be converted into square meters or, 45 multiplied by 10,000.

Then: $X = \sqrt{1,500} = 38$ meters.

The interval, then, is 38 meters, and it is the distance at which samples are to be taken in order to have the determined number of samples distributed uniformly across the whole field.

In actual operation it is seldom necessary to make such computations, as there is a table appended to instructions of the Central Statistical Administration on the selection of controle areas, which gives interval computations for areas of varying size and differing numbers of samples.

The third question is about what each sample should represent. This depends upon the distribution pattern of the crop on the field in question. In measuring yield capacity of grain crops sowed in the customary rows, as well as in measuring yield capacity of flax, until recently, samples were taken from an area of one square meter, using a special frome for that purpose, built of thin but strong slate (measuring frame: "metrovka"). The inside measurement of the frame must be exactly one meter. To facilitate using the frame in taking samples, three of its sides are permanently fastened together, while the fourth one can be freely slipped in and out. The frame looks as follows:

/Illustration Figure 2/

It was proved that, when placing the frame correctly (so that the sides of the frame form a 45 degree angle with the planted rows, the quantity of plants which are within the frame very closely approximates true averabe number of plants per square meter.

In wide-row planting, when the interval between rows is significant, the actual yield capacity cannot be determined by use of the square frame, because the quantity of plants which are then found within the frame does not correspond to the actual average number of plants per square meter. Therefore, the results of the measurements,

in this case would give the wrong impression with regard to yield capacity.

Planting of corn and sunflower, for example, are made at intervals of 60 to 90 centimeters between rows, and the intervals within the rows, between the plants are 30-40 centimeters or, there are an average of 1-1,7 rows per running meter, and in each row there are 2 to 3 plants. In this case it is impossible to place the frame in cuch a manner as to include in it a small number of plants (3-5) which actually correspond to the true average growth per square meter. Enlarging the sample area is connected with a seri series of practical difficulties.

Therefore, in measuring the yield capacity of grain crops in wide-row planting of corn, potatoes, sugar beets, etc., a sample is taken not on the basis of the square meter unit, but based on the running meter, usually per five running meters. In order to convert yield capacity into square meter units, it is necessary, in this case to determine the average number of rows per running meter. In sowing with a standard seeder, the number of rows per running meter is determined by the distance between rows; in other sowing methods corresponding methods of measurement are applied.

With the exception of these basic conditions of conducting yield capacity measurements of green crop, the dollowing requirements must be strictly observed in order to obtain accurate results; Measurements must be started only when the crop in question has ripened. Samples must be taken accurately at definite intervals, without any purposeful selection. All ears of grain must be cut off. Without fail all potatoes or beet roots in the sample area must be dug up. All samples must be carefully preserved and processed, avoiding all losses. The main objective must at all times be remembered -- the determination of crop yield capacity without losses -- and also the fact that a small mistake which is made in measuring the yield of one sample

area, is multiplied many times in the computation of yield capacity per hectare and can greatly distort the estimate of actual yield.

In carrying out measurements of yield capacity, the persons me measuring walks along the rows, at a distance from each other which is equal to the interval which is predetermined (in measuring yield capacity of potatoes, sugar beets, the persons measuring walk across the rows at right angles. In order not to make any mistakes in the direction, markers are placed at distances equal to the length of intervals along the sides of the area, in which the person is walking, and which serve as points of orientation.

Samples are taken accurately at the determined intervals, without pre-selection of the space from which the sample is to be taken (otherwise the mechanical aspect of the selection method is destroyed and results received will be inaccurate).

When taking samples of grain crops, the frame is not placed from above, but is slid in along the base (with the fourth side removed). After the frame has been put in place, the fourth side is inserted, all plants which are not framed by it are pushed aside if their roots are not within the area covered by the frame.

In measuring the yield of potatoes (or sugar beets) a five meter long measuring pole is laid lengthwise (longitudinally along the rows in such a way as to mark off about 2.5 meters on either side of the path. The extension of the ends of the pole will delineate the area from which the sample is to be taken. All potato plants or beet roots which fall within that area must be carefully dug up.

When checking a land parcel used for cultivation of any crop being measured, the lavorer reaches its end after the last range has been checked, there is always a certain distance leftover shorter than the measuring range (for instance there is a leftover of 23 meters, whereas the range in this case is 33 meters) In such a case, walking back, this leftover and additional 10 meters of the parcel's

length (making a complete range of 33 meters) are checked as the first range.

For the sake of clarity, we are giving below a chart presenting the way of checking a crop parcel 700 X 300 meters, i. e. 22.4 square hectars, on which 200 check measurements are to be made. The checking range in this case would be:

$$\sqrt{\frac{22.4 \times 10,000}{200}} = 33 \text{ m.}$$

[Figure 3 (see page 44 of the original)]

Direction of Movement

Under diagram Caption:
Check Frame

Surveying Rod

It is necessary to keep strict track of all sample checks for we have to know their exact number to determine the mean weight of one check.

Even if there would not be any plants on some spots where the check was supposed to be made (due to oversight or damage) such samples nevertheless must be counted in the overall survey.

In order to determine the average number of rows per running meter when checking potatoes output, the potato field is measured (in meters) from one end to another in a direction perpendicular to the rows. While measuring, the number of rows is counted.

The direction line perpendicular to the potatoes is determined by means of a simple device for erecting a perpendicular. This device is constructed in the following way: a post approximately 1.5 meters long is taped on one end, at the other end of it a cross is fastened at right angles. This is made of two wooden planks (measured about 0.5 meter long). The plank ends are nailed ~~equal distant~~ equidistant

from the ends and at right angles to their surface (see drawing 4)

/ Trace sketch from p. 45 of original /

To determine the direction line perpendicular to potato rows, the above device is placed at the edge of the field of potatoes (at the point where it is planned to start with the measuring). One of the planks is faced in the direction of the row of potatoes (to get this direction, the cross is turned in the desired direction until the visual line connecting both nails on the plank would fall into that of the row of potatoes. This achieved, the other plank would give us direction perpendicular to the potato rows. Once the above direction is established, the surveyer's assistant marks it with a surveying rod at the other end of the field. In this procedure it is necessary to bring both nails on the plank perpendicular to the potato rows, and the surveying rod into one vertical line).

For the sake of better accuracy usually two measurings are taken. One on each side of the field, and based on the results received computation is made of the average number of rows per one long meter of the field.

Example: Measuring results along one edge of the field gave 548 ~~958~~ meters and 959 potato rows. On the opposite edge of the same field the corresponding values are: 530 and 885. Accordingly, the average number of rows per one running meter is

$$\frac{959 + 885}{548 + 530} = \frac{1844}{1078} = 1.71$$

In cases when there are in a kolkhoz several land parcels under the same culture, the number of check samples to be taken and the length of range are determined on the basis of the entire area taken as a whole

For example, if rye is planted on 3 lots 20, 15 and 30 hectares, then 300 control area samples should be taken from all the lots; the same distance interval is used for each lot equal to : $\sqrt{\frac{650,000}{300}} = 47$ m. Under these conditions the total number of control areas is distributed among the individual lots in proportion to their area.

Assume, for purposes of illustration, that a lot has the following shape:

/ Figure 5 goes here_/

With a contour like this we endeavour to reduce the problem to a rectangular lot and for this purpose enclose our irregular lot into a rectangle.

The following method is used: from one of the terminal points of the lot, for example E, we mark the line AE D (i.e. we mark it with stakes at points A, E, D).

At right angles with the help of a device for erecting a perpendicular, mark a line then the other terminal points --K (line AKB) and G (line DGV). To accomplish this, place the instrument at point D (marked with a stake). The sharp end of the pole is sunk into the ground to a point when the cross head is at eye level. Rotate the cross head (it turns easily on the pole) until the nail of one of the planks and point E are in one straight line; then the other plank determines the direction, perpendicular to line DEA.

To fix this direction on the opposite side of the lot, opposite the person with the measuring instrument at point D, an assistant with a stake should be stationed.

The person at poing D, directs his assistant with the stake, until such time as the plant nails and the stake are in a straight line; then he is directed to drive in the stake. A line perpendicular to line AED (at point D) is thus fixed, marked. This line may and may not pass through point G, but it is immaterial.

In the same manner, line AKB is drawn, at right angles to line AED, and finally a perpendicular to line AKD (at point B).

Obviously, line BLV will be perpendicular to line DV and parallel to line Ad. Marking perpendicular lines is diagramically illustrated in figure 6.

In this case the number of control areas and length of intervals is determined, based on the actual seeded area, in the same manner as with a rectangular lot.

Stakes will be driven in at specified intervals along lines AD and BV. The central areas are established as follows: If we start from point M toward stake R, then as long as we are in unplowed and unseeded area (up to point N) no account is made. At the very beginning of the seeded area, we establish the first control area, cut the pegs, put them in a bag and proceed, establishing central areas at definite intervals. On reaching unplowed areas, interrupt the interval count and take it up again only after reaching seeded areas being sampled, at point P. Proceed with calculations as if there were no interruptions. If for example the interval is 52 meters and from the last sampling area in the segment number to the end of the plot to poing O --there are 39 meters left, then the next sample area should be established 13 meters beyond point P.

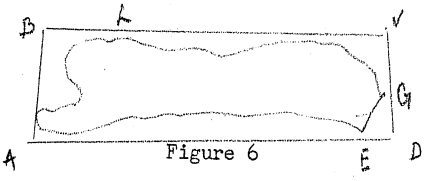

Figure 6

Next we move and establish sample areas in the usual manner. If 28 meters after marking off the last area in this row, we reach the end of the seeded area, then we should proceed in the direction of stake S, placed in this example 52 meters from stake R, to stake U; then the first sample test area will be established 52-28 = 24 meters from the end of the

seeded area (from point T). From then on we proceed as already described. Similarly, if an unplowed plot is located within a seeded area (swamp, gully, wood, etc) it is disregarded entirely and the measurements are resumed only after reaching the area seeded with crops under study.

The parallel lines AD and BV may be drawn at points other than terminal points of the lot and may bisect the lot. It may be necessary to resort to this method in cases where some obstacle makes it impossible to walk thru the unplowed places. (rivers, swamps, forests, etc.).

Further analysis of the samples taken in the field depends on the crop under study. For example, seed crops must be dried to a normal moisture-content, threshed (so that not a single grain remains on the spike); the resulting grains should be winnowed and accurately weighed, determining the average weight of grain per sample, i.e. for 1 square meter. Yield per hectare is then computed. For potato samples all earth is removed and the potatoes are weighed, their total weights divided by the number of samples, multiplied by 5, and the result is the average yield per linear meter. The result is multiplied by the average number of potato rows per linear meter and the product of multiplication is the yield per square meter. It is then simple to make the conversion for one hectare.

Let us illustrate with an example, the method of computing yields after the samples are processed and weighed.

Seed crops: from 298 samples (including empties) we received 57 kilograms 514 grains of wheat grain. Average weight of the first sample (from 1 square meter) $\frac{57,514}{298} = 193$ grams

Since there are 10,000 square meters in one hectare, to compute per hectare yield, multiply the yield per square meter by 10,000. To convert into centners, divide the product of the multiplication by 100,000. Standing grain yield per hectare in centners is equal to:

$193 \times \frac{10,000}{100,000} = \frac{193}{10} = 19.3$ ts

Potatoes: from 200 five-meter control areas 1,140 kilograms of potatoes were collected.

Average number of potato rows per linear meter 1.71 Compute yield in centners per hectare.

Yield per 1 linear meter $\frac{1,140}{200 \times 5} = 1.14$ kilograms

Yield per 1 square meter $1.14 \times 1.71 = 1.949$ kilograms

Yield per 1 hectare in centners $\frac{1.949 \times 10,000}{100} = 1.949 \times 100 =$ 194.9 centners.

Determining losses during harvesting and threshing of agricultural plants

An important function of agricultural statestics is to determine production losses due to inefficiency or delay in harvesting as well as poor threshing. Resultant data may be used in combatting losses.

Directive for determing grain yields, confirmed by the Economic Council of the Council of Peoples Commissars USSR, provide that the following should be considered as losses:

(a) grain lost when the crop is allowed to stand too long, also during harvesting, binding, shocking, stacking and transportation from the field to the threshing place.

(b) quantities of grain in the cut and uncut spikes, remaining on the stubble during reaping.

(c) quantities of grain remaining in the straw due to incomplete threshing.

(d) quantities of grain remaining in the chaff after winnowing.

Many of these loses do not occur in combine harvesting, as several operations which are separate phases of harvesting with reapers are performed by the combine.

Amount of loss by each operation mentioned is determined in cer-

tain kolkhozes (chosen by mechanical selection) also by the selective method -- segregation and processing of a number of samples. The number of samples and types of tests conducted differ in determining each of the above mentioned losses, but the principle in all cases is the same: by processing the samples determine the quantity of grain lost as an average per sample and then compute it for one hectare.

Harvesting losses may be determined not only for grain crops but also for other crops (potatoes, sugar beet and cotton).

Data sources on orchard crop yields

For some time garden crops were included in kolkhoz yield estimates together with yield and truck garden crops and estimates were given separately for seed, (seed fruit) pit varieties, vineyards and berries.

During the past few years estimate yields for orchard crops were not made: Only vineyards were included among the crops for which sovkhozes and kolkhozes submitted visual yield estimates.

Following the exclusion of orchard crops from among the crops, for which agricultural enterprises were obliged to supply crop estimates, the only remaining data sources on fruit and berry crop estimates have been annual sovkhog and kolkhoz reports.

In the annual kolkhoz reports we find data on the planned and actual total harvest of fruit, berry plants and vineyards by varieties. Since planted area is also noted, it is possible to compute average harvest per hectsre.

However, we do not obtain the full standing yield, but rather "grain elevation" yield, with all losses deducted.

Kokhoz reports also show the distribution of total fruit and berry harvest (sale to government procurement agencies and cooperatives, sale on kolkhoz markets, allocations for kolkhoz-members by work-days, etc). In the annual sovkhoz reports, area and yield data of orchard crops

is given as a total, without a breakdown by type, and this considerably reduces their worth.

Determining Yields of a "mottled" Hectare

Yield per hectare is determined for each separate grain crop and as an average for all grain crops. Total yield of all grains (or as is sometimes said, yield of a "mottled" hectare) is the weighted average from each grain crop, the weight being the area under cultivation for each crop.

Example:

Yield of Winter wheat per hectare is 18 centners; area 1,200 hectares.

Yield of Winter rye per hectare is 16 centners; area 1,000 hectares.

Yield of summer wheat per hectares is 14 centners, area 400 hectares.

Yield of oats per hectare is 13 centners; area 600 hectares.

Average grain yield per hectare =

$$\frac{(18 \times 1{,}200) + (16 \times 1{,}000 + (14 \times 400) + (13 \times 600)}{1{,}200 + 1{,}000 + 400 + 600} = 15.9 \text{ ц}$$

Qualitative Indexes of Grain

In determining the crops yield we are interested not only in the quantity of the product but also in its quality. Basic qualitative indexes of grain, besides its most important index-grade, are: cleanness germination, suitability characteristics, specific weight, moisture content.

By index of grain cleanness, we mean the proportion (in percent) of sound grain of a given crop to the total weight of the grain sample under study. This sample, in addition to sound grain contains diseased grain of the crop, grains of other cultures and all kinds of extraneous matter (earth, pebbles, weed seeds, insects, mushroom spores, E etc.).

In contrast to the cleanness of grains, there is the index of grain impurity, i.e. percent of diseased grain of this culture, grains of other crops, and all kinds of extraneous matter. In certain instances we determine only the non-grain impurities, i.e percentage of extraneous matter, excluding grains of other crops.

Germination, in analysing a given grain sample is called that proportion of grains out of this sample, that sprouts. As a rule germination is also expressed in percent.

By farm fitness of grain, we mean the product of multiplication of the index of cleanness by the index of germination. If, for example in a sample there are 0.96 (96 percent) sound seeds, and germination is 91 percent, then farm fitness is equal to 0.96 × 0.91 = 0.8736 or 87.4 percent.

This means that out of 100 kilograms of seeding material we have only 87.4 kilograms of actually sound seeds. We must orient ourselves on this proportion in determing screening norms (screening per hectare).

By the characteristics of grain we mean the weight by volume of a unit of grain (the unit accepted by us now is 1 liter of grain). This characteristic expresses the degree of full weight and consistency of the grain. To determine these characteristics other methods are also used--weight of 1,000 grains. This weight is known as the "absolute weight" of the grain.

Grain always contains some dry matter and water. The percentage relationship of the wiight of water to the weight of the whole grain (i.e. total of dry matter and water all together, is known as the moisture con tent of grain. Grain moisture content is of great practical importance, influencing the quality of threshing, length of storage possible, etc.

Moisture content as well as the natural characteristics of grain is determined by means of special apparatus. By dry grain of spike-grain crops we mean grain with a moisture content up to 14 percent average dryness is 14-15.5 percent (for oats 14-16 percent of moisture content.

grains with a moisture content of 15.5-17 percent is considered moist (for oats 16-18 percent). Finally, grain with an even higher moisture content is considered damp. In drying grain, its moisture, and consequently its total weight diminishes. One should know how to compute this weight less due to lowered moisture content.

We approach the solution of problem as follows:-- Let G stand for grain before drying, c for percentage of moisture content before drying. C for percentage of moisture content after drying, X for weight of grain after drying is equal to $\frac{G \times c}{100}$ and consequently the weight of dry matter is $G - \frac{G \times c}{100}$

The weight of grain after drying (X) is equal to the weight of the dry matter (which does not change in drying) plus c. percent of the new grain weight i.e. of X. We can now write the following equation:

$$X = G - \frac{Gc}{100} + \frac{C}{100} \times X$$

$$100X = 100G - Gc + CX$$

$$100X - CX = 100G - Gc$$

$$X(100 - C) = G(100 - c)$$

$$\therefore X = G\,\frac{100 - c}{100 - C}$$

drying is equal to the weight of grain before drying, multiplied by the fraction the numerator of which is the difference between 100 and percentage of moisture content before drying, while the denominator is the difference between 100 and the percentage of moisture content after drying.

Example: If 200 centners of grain with a moisture content of 18 percent is reduced to moisture content of 13 percent, then the new weight of grain is equal to:

$$200 \cdot \frac{100 - 18}{100 - 13} = 200 \cdot \frac{82}{87} = \frac{16400}{87} = 188.6 \text{ centners.}$$

Elementary Analysis of Crop Yield Data

One of the main objectives of the analysis of crop yield data is to check on the fulfilment of yield quotas. Determining the percentage of plan fulfillment for each crop is not difficult. If, for example, the plan calls for a wheat yield of 15 centners per hectare, while the actual harvest was equal to 17 centners per hectare, then the plan has been met by $\frac{17 \times 100}{15} = 113.3$ percent i.e. the plan has been surpassed by 13.3 percent.

In exactly the same manner we determine the percentage of plan fulfillment in cases where the yield plan is established not by separate crops, but as an average for a group of crops ("mottled" hectare) -- for example, for all grain crops taken together.

In this case we calculate, by the above mentioned method, actual average yield per hectare for all grain crops and compare the gigure thus obtained with the quota (expressing the result of comparison in percentage). One should bear in mind that in some instances the plan may be over or under-fulfilled, simply by planting crops other than foreseen in the original plan (for example, if more than planned high yielding crops are planted at the expense of low yield crops, then the yield may be overfulfilled only for this reason).

If the plan is established for separate crops then to check the fulfilment of yield plan for a group of crops it would be best to use the index method. Then there are several different possiblitiies in computing these indexes. Let us illustrate the computation of indexes with the following example:

FULFILLMENT OF YIELD PLAN

Types of Crop	Seeded Areas		Yield (centners per hectare)		Total Crop Yield (Centners)		
	Planned	Actual	Planned	Actual	According to planned yield and area	According to planned yield and actual area	According to actual yield and area
Winter Wheat	3,000	3,100	16	17	48,000	49,600	52,700
Oats	1,000	900	14	13	14,000	12,600	11,700
Buckwheat	200	250	9	9.5	1,800	2,250	2,375
Total for all crops	4,200	4,250	--	--	63,800	64,450	66,775

Let us intorduce the following symbols:

y_1 -- actual yield of individual crops in centners per hectare

y_o -- Planned yield of individual crops in centners per hectare

n_1 -- Actual seeded area under separate crops in hectares

n_o -- Planned seeded area under separate crops in hectares.

Using the figures in the table for total crop yield we may compute the following variation of average yield for a "motted hectare".

Average yield based upon actual yields of individual crops and of actually planted areas by crops:

$$y_A = \frac{\sum y_i n_i}{\sum n_i} = \frac{66775}{4250} = 15.71 \text{ centners/hectare}$$

Average yield based upon planned yield by individual crops and planned composition of seeded areas by crops:

$$y_{Pl} = \frac{\sum y_o n_o}{\sum n_o} = \frac{63800}{4200} = 15.19 \text{ centners/hectare}$$

Average crop yield based upon planned yield and actual composition of seeded areas:

$$y_{Pl\text{-}A} = \frac{\sum y_o n_i}{\sum n_i} = \frac{64450}{4250} = 15.16 \text{ centners/hectare}$$

On the strength of data in the table it is possible to compute the following indexes.

Index of plan fulfillment of crop yield

In computing this index one should disregard the influence of changes in the varieties of crops planted, on the increase or decrease of yield for a "motted" hectare compared with the plan. (i.e. compute the actual yield on the assumption that the seeding quota by individual crops had been fulfilled or compute the anticipated yield, weighing it with actually seeded areas). Let us agree to denote this index by Iy.

$$I_y = \frac{\sum y_i n_i}{\sum n_i} : \frac{\sum y_o n_i}{\sum n_i} = \frac{\sum y_i n_i}{\sum y_o n_i} = \frac{66775}{4250} : \frac{64450}{4250} = \frac{66775}{64450} = \frac{15.71}{15.16} = 1.036$$

As weights in determining this index one way use either absolute values of seeded areas under individual crops or proportion of area under each individual crop in the total area under all crops of this group.

Crop composition of the area expressed in percentage of the total in this example, is characterized by the following indexes:

Nomenclature of Crops	Percent of area under individual crops in relation to overall total of area under all grain crops.	
	Planned	Actual
Winter wheat	71.4	72.9
Oats	23.8	21.2
Buckwheat	4.8	5.9

Going a few steps ahead of ourselves, let us point out that the stationary structure of sowing area is used potentialy in group crop studies of the movements of crop yields, as an index of the quality of work performed by agricultural enterprises.

It has been mentioned above that actual overall sizes of crops by crop groups (in this case, grain may differ from planned figures due to non-fulfillment of the planned breakdown seeded areas. Consequently it is of particular interest to compute the index of fulfillment of the structure of seeded areas, Issa. In computing this index, the value to be indexed is the seeding area, while as weights we use the planned crop-yields of individual crops.

The index may be computed by two technical methods, giving the same result. Using the first method, we take the relationship of the average crop yield of a "Mottley hectare based on actual areas and planned yields to the same average based on planned areas and planned yield of each crop

$$I_{ss} = \frac{\sum n_1 y_0}{\sum n_1} : \frac{\sum n_0 y_0}{\sum n_0} = \frac{64150}{4260} : \frac{63800}{4200} = \frac{15.16}{15.19} = 0.998$$

In the second method we weight by the planned yield, the relative proportions (in percent) of area under individual crops based on actual structure of seeded area, On the one side, and based on planned structure on the other. The relationship of the products will give us the required index.

$$I_{cn} = \frac{\sum \frac{n_1 \times 100}{\sum n_1} \times y_0}{100} : \frac{\sum \frac{n_0 \times 100}{\sum n_0} \times y_0}{100} = \frac{\sum \frac{n_1 \times 100}{\sum n_1} \times y_0}{\sum \frac{n_0 \times 100}{\sum n_0} \times y_0} = \frac{\sum n'_1 y_0}{\sum n'_0 y_0}$$

$$n'_1 = \frac{n_1 \times 100}{\sum n_1}$$

area under each crop to the total area under all crops, while

$$n'_0 = \frac{n_0 \times 100}{\sum n_0}$$

or the same relationship based on planned areas.

In our example we have:

$$I_{cn} = \frac{72.9 \times 16 + 21.2 \times 14 + 5.9 \times 9}{71.4 \times 16 + 23.8 \times 14 + 4.8 \times 9} = \frac{1516.3}{1518.3} = 0.998$$

If the value of this index is more than one, this shows an increase against the plan of relative sizes of areas under crops with high crop-yield, or in other words--a more favourable diversification of crop from the point of view of yield level. In instances when the value of this same index is less than unity, we have to state the reverse effect.

In our example the crop composition turned out less favourable (from the view point of yield level) than the planned, which resulted in the decrease of crop-yield as compared with the plan by 0.2 percent.

Of practical importance is the index of crop-yield from a "mottled" hectare, i.e. the relationship between actual and planned crop yield, computed by corresponding (actual for the first named average, planned for the second average) area structure by crops Ing.

$$I_{ng} = \frac{\sum y_1 n_1}{\sum n_1} : \frac{\sum y_0 n_0}{\sum n_0} = \frac{66775}{4250} : \frac{63800}{4200} = \frac{15.71}{15.19} = 1.034$$

This index may be expressed by 2 primary indexes, or in other words, index of crop yield from a "mottled" hectare (Ing) is the derivative of the index of crop yield (iy) multiplied by the index of the structure of seeded areas. (Isp)

$$I_{sp} = I_y \times I_{ng} = 1.036 \times 0.998 = 1.034$$

One may compute an index of the overall proportions of seeding area under a group of crops in which we are interested (in this example under grain crops.)

$$I_n = \frac{\sum n_1}{\sum n_0} = \frac{4250}{4200} = 1.012$$

Finally, of practical importance is the index of the overall size of crop yield of this crop-group (Isp)

$$I_{sp} = \frac{\sum y_1 n_1}{\sum y_0 n_0} = \frac{66775}{63800} = 1.046$$

The index system may be used in comparing crop yields for a group of crops between individual kolkhozes, between rayons, oblasts, and republics. A base unit should be decided upon in advance for each individual case.

A significant part in the analysis of data on yields is the study of crop-yield index movements for individual crops and group of crops. Two groups of factors influence yearly changes in the yield: introduction of up to date techniques and agricultural engineering and meteriological conditions of a given year. In pre-Soviet times, yields of individual peasant enterprises with a very low level of agricultural techniques, were determined practically exclusively by weather conditions, with resultant sharp variations in yield for particular years and yet an almost constant average level. Present day growth of up to date techniques more and more serves to limit the influence of natural factors, but nevertheless they play an important role in determining the size of the harvest.

Further introduction of up to date techniques is leading in one definite direction--it furthers a gradual increase in productivity. Favorable weather conditions in one year or another along with benefiting results of applied agricultural measures and the achieved degree of mechanization, are instrumental for the sharp increase in yield in the particular year. Some unfavorable natural conditions through a year may cause a delayed crop ripening and even a certain temporary decrease in yield. The crop output therefore through a period of several years is never on the same level, but is fluctuating. In order to eliminate with the study of crop dinamics, the influence of yearly meteorological conditions, one or another method is used to level off the moving average of yield. Most common is the method of computing an average crop output over a period of several years.

The average USSR overall grain output in 1928-1938 period was as follows (in centners per 1 hectare)

1928 - 7.9	1932 - 7.0	1936 - 8.1
1929 - 7.5	1933 - 8.8	1937 - 11.1
1930 - 8.5	1934 - 8.5	1938 - 9.3
1930 - 6.7	1935 - 8.9	

There was considerable crop increase after complete collectivization; through in the second half of the above period the crop becomes more stabilized.

To show yield increases quickly, let us calculate the average output through the periods of the first and second Stalin five years plan, and let us compare these averages with crop yield data for prerevolutionary years.

Years	Average annual output (in centners per hectar)
1900 - 1904	7.0
1905 - 1909	6.6
1910 - 1914	7.3
1928 - 1932	7.5
1933 - 1937	9.1
1938	9.3

Over the 15 years of the prerevolutionary period, there was practically no increase in crop output. It has grown considerably, however over the period of two Stalin five years plans.

In order to get a correct picture of a certain crop output dinamics (for instance for all grain crops), in determining average yield to use as weights a constant structure of sowing area, appropriate for the particular group of crops for all years of the period under review. In this way we will eliminate influences toward a high average yield caused by possible changes of area under various grain cultures through the period under reviews.

Computation of indexes is done by application of the above described methods used for computating indexes of crop plan as shown above.

3. Of great importance is the study of geographical distribution of crops. Based on the results of such a study, we are able to determine the high and low output regions, and as a result we can note those where a particularly energetic fight should be waged for high yield. In this respect, it is helpful to make use of map-diagrams.

4. In order to get an idea of fluctuations of individual kolkhozes crop outputs within an administrative rayon, it is advisable to group kolkhozes according to their yield of basic crops and their overall grain output.

Such a study by kolkhozes permits us to ascertain the leading and lagging kolkhozes, to determine measures for increasing output, which shows up in studying the first group. It helps us to take steps to overcome the backwardness of the second group.

On p. 44 of the statistical collection, Socialist Agriculture in USSR, the following data pertains to the grain crop yield of the leading kolkhozes:

Year	Number of kolkhozes with yield of all grain and bean crops per hectare:			Percentage of kolkhozes with yield of all grain and bean crops per hectare:		
	12-14 cent.	14-16 cent.	Over 16 cent.	12-14 cent.	14-16 cent.	Over 16 cent.
1936	6,505	3,118	2,627	2.8	1.4	1.1
1937	25,998	13,452	9,259	11.0	5.7	3.9

In a study of relationship between the crop output and various influences, compilation of group charts may prove very helpful. Using data from the above charts, there may be determined the average winter crop output from early plowed fertile soil fallows, from replowed and disced fallows, and from late plowed fallows; output from sections with different amounts of fertilizer; output from weeded and unweeded areas; of summer crops cultivated on winter and spring fallows; from early and late sowed plots, etc.

On p. 48 of the same statistical collection, we have the following interesting group chart, compiled from data received by a special selective study of kolkhozes. It gives an idea of the tremendous difference between leading and average kolkhozes in their agrotechnical level and in yield. The chart reads as follows:

	For 370 kolkhozes in 9 krays and oblasts	For 45 leading kolkhozes of the same kray and oblast
Sowed winter crops on fallows (hectares) per 100 hectares of sowed area	54.7	79.1
Cultivated, replowed and disced winter fallows (hectares) per 100 hectares of sowed area	124.4	286.6
Sowed summer grain crops on Winter fallows (hectares) per 100 hectares of sowed area	65.3	88.7
Cultivated, replowed and disced winter and spring fallows (hectares) per 100 hectares of sowed area	60.8	120.9
Fertilized grain crop area (hectares) per 100 hectares of sowed area	44.5	53.2
Weeded winter and summer grain crop parcels (hectares) per 100 hectares of sowed area	51.8	139.2
Grain output (in centners per hectare)	10.1	23.8
Labor consumption per hectare of grain sowed (man-days)	10.02	13.09
Labor expended per centner of grain (man-days)	0.96	0.55

It can be seen that the higher by 1.3 times labor expenditure per hectar of sowing in the leading kolkhozes has been fully compensated by a higher yield (2.4 times higher). This is so since labor productivity in leading kolkhozes is much higher (almost doubled).

And finally, the study and information on crop yield by individual leading kolkhozes, working brigades and squads is of great importance.

Computation of the Overall Crop Output

There are two methods to determine the overall crop output: computation of total outputs received by individual enterprises, and the so-called computing method. Using the first method we may determine the total individual outputs of all enterprises, compiling annual statements (sovkhozes and kolkhozes) only after the year's end. For a practical number of purposes however, we must know the overall crop output much earlier than that. The basic disadvantage then, of the first method is that it gives only credited output, and not the full volume of yield. Therefore, the second method normally is used.

Using computing method, overall crop output is determined by multiplying the average output of each culture per hectare by the number of hectares used for the particular crop.

Computation of the overall crop output may be done either for the basic, or for by-product output. The grain is the basic output for all grain cultures, and the side-line output is straw; for root and tuber type crops, roots and tubers are the basic output, and the by-product output would be their tops (may be used for silage).

In the analysis of crop volume data, we are primarily interested in the development of cultivation which is indicative of the rising level of our food, fodder and raw materials supplies. In studying individual crops and homogenous groups of crops, we follow the overall changes in volume of yield in physical terms (in centners and in tons).

In his speech at the XVIII Party Congress VKP(b), comrade Stalin gave the following data on the development of grain crops and industrial crops:

	In million centners						In 1938, in percent of 1913 output
	1913	1934	1935	1936	1937	1938	
Grains	801.0	894.0	901.0	827.3	1202.9	949.9	118.6
Cotton (raw)	7.4	11.8	17.2	23.9	25.8	26.9	363.5
Flax (threads)	3.3	5.3	5.5	5.8	5.7	5.46	165.5
Sugar Beets	109.0	113.6	162.1	168.3	218.6	166.8	153.0
Oil bearing plants	21.5	36.9	42.7	42.3	51.1	46.6	216.7

Making an analysis of the above chart, comrade Stalin notes that "despite the great damage caused by the drought in 1936 and 1938, in eastern and south-eastern areas, and despite an unusual high crop yield in 1913 our gross output of grain and industrial crops through the reported period, compared with 1913, was steadily increasing". (I. Stalin, Problems of Leninism, 11th Edition, p. 582).

Due to its heterogeneour components, a study of the overall crop yield developments may be made only in momentary terms. Since prices for the different years vary, we can get a true picture of yield changes over the time only in using base-year prices. Until the present, the base-year prices used have been the prices of 1926, 1927.

In the statistical collection "Socialist Agriculture", on p. 86, the following data on agricultural output is given (in millions rubles in 1926/27 prices).

1913	8,028.1
1932	9,779.2
1937	15,069.5
1937 in percent of 1913	187.7
1937 in percent of 1932	154.1

Computing the output in mometary terms, we are able to study the breakdown of the output by individual crops in percent, as well as the breakdown of these crops by the basic categories of agricultural economy.

Very important is the regional breakdown by size of individual crop in the various parts of the territory studied. Such analysis helps to determine those rayons and kolkhozes requiring special attention in making organized purchases of agricultural products from the kolkhozes.

Making an analysis of the overall crop output, we eventually compute the average per capita yield of grain, potatoes, vegetables, etc.. It is necessary to follow the fluctuations of these indexes from year to year.

In his speech at the XVIII Party Congress VKP(b), comrade Stalin has pointed out that "the kolkhoz-sovkhoz grain commodity output question is a very interesting one". Commodity output is the name for the entire amount of output realized outside of the producing enterprise. Specifically, the commodity output of kolkhozes includes the compulsory produce deliveries to the State, payment in land to the MTS, goods sold to State procurement agencies, sold to cooperatives, sold on the kolkhoz market and other sales. Products distributed to kolkhoz members as payment for work-days earned, seeds used, contributions to aid invalids, for nurseries, etc., are not to be considered as commodity output.

A knowledge of the amount of commodity output makes it possible to determine the commodity output index (the percent of commodity output to gross output, and also the amount of commodity output per hectare of plowland or of the entire agricultural area).

Commodity output indexes may be computed for individual products (like wheat, potatoes, etc), and for particular branches of agriculture (for instance for field crops, for orchards, for vegetable crops, or for plant cultivation as a whole. In this connection, it is evident that if in calculating the commodity output indexes of individual products, physical units may be used on the volume of both commodity and gross output,

NAME OF CROP	SOVKHOZ A in 1943									SOVKHOZ B									
	Planned		Fulfilled Actually on Sovkhoz Lots							1940					1943				
			No 1		No 2		No 3			Planned		Actually Fulfilled			Planned		Actually Fulfilled				
	Spring crops (in hectares)	Yield (in centners per hectare)	Spring crops (in hectares)	Yield (in centners per hectare)	Spring crops (in hectares)	Yield (in centners per hectare)	Spring crops (in hectares)	Yield (in centners per hectare)	Output realized outside of sovkhoz (centners)	Spring crops (in hectares)	Output (in centners per hectare)	Spring crops (in hectares)	Output (in centners per hectare)	Perished during summer (in hectares)	Spring crops (in hectares)	Output (in centners per hectare)	Spring crops (in hectares)	Output (in centners per hectare)	Perished during summer (in hectares)	Output realized outside of sovkhoz (centners)	Base-year, constant prices per centner
Winter Wheat	100	22	51	23	30	19	47	26	2,744	65	18	60	18.5	-	70	21	68	20.5	-	1,200	686
Rye	143	17	48	18	42	16	25	19	1,820	35	16	39	15	-	38	16	39	16.5	-	570	515
Summer Wheat	60	15	37	15	10	13	22	16	915	40	13	38	13	-	70	15	69	14.8	5	900	686
Barley	35	14	12	14	5	15	13	12	280	10	12	11	14	-	12	13	11	13.8	-	90	473
Oates	135	14	60	16	45	14	31	15	1,030	87	13	85	13.5	2	90	14	88	13.9	-	490	432

NOTE: It has been determined that barley's moisture content after threshing in sovkhoz A was 15 percent; in sovkhoz B, 18 percent.

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then in order to obtain summery indexes of commodity output for a group of products, then the volume of their production (gross and commodity) should be expressed in a single unit of measure. (Usually yield or output is calculated in terms of money.)

The following data is given on sovkhozes A and B (see following table). On the basis of this data, the following is to be solved:

(1) Calculate the average yield per hectare for all given crops taken together (from a "mottled" hectare).

(2) Determine the index of crop yield fulfillment for all grain crops in sovkhozes A and B (for both years mentioned in the table).

(3) Derive for both sovkhozes the index; showing degree of fulfillment of planned composition of sowing areas for grain crops.

(4) Calculate for both sovkhozes the index of crop yield plan fulfillment from a "mottled" hectare.

(5) Derive the index of the overall size area sown to grain drops.

(6) Determine the index of crop yield fulfillment for all grain crops by both sovkhozes.

(7) Determine the same indexes for purposes of comparing grain crop yields as between sovkhoz A and sovkhoz B (taking the yield of sovkhoz A as a base).

(8) Determine the indexes of the dynamics of yield from 1 hectare as well as from the overall area of sovkhoz B for the period of 1940-1943, in terms of individual crops and in terms of all grain crops taken together.

(9) Determine variations in the composition of the overall grain crop for sovkhoz B in 1943 and 1940.

(10) Calculate the indexes showing the commodity proportion of the individual as well as the overall grain crops for 1943 for sovkhozes A and B (on the basis of production data expressed in physical units, as well as on the basis of comparable base-year price computations in terms of production costs).

(11) Compare the barley yield in sovkhoz A and sovkhoz B in 1943 at normal moisture content (14 percent).

Direction 1 Before proceeding with the solution of the example, the yield for each individual crop is to be computed for sovkhoz A as a whole.

Direction 2 (Pertaining to question 9) The composition of the total crop is to be expressed in percent of the overall crop output for the individual crop with relation to the grand total of the combined crop output (in physical units).

Check Questions

(1) Into what categories is the accounting for sowing areas to be divided, and what is the practical significance of each of these categories?

(2) What are the particular features of accounting for areas under certain crops - perennial grasses, sugar beet and other biennial cultures?

(3) How is the index for the fulfillment of the plan for spring sowing determined?

(4) How is the index for the utilization of a plowed area calculated?

(5) How are the indexes for the agricultural technique of sowing determined - as related to the use of selected seeds, tractor operated seeding, vernalized seeds, graded seeds, copper sulfate-treated seeds, seeds in fallow ground, and seeds in frozen ground?

(6) What is the source of data on sowing areas; how is the final accounting for sowing areas organized; what is the basic difference between the 5 day accounting of sowing progress and the final accounting of same; what is the source of data for the areas of orchards, berry fields and vineyards?

(7) What is the source of data on selected sowings?

(8) What is the definition of the concept of "crop yield" and of "general crop output"?

(9) For a hectare of which area is it necessary to determine the crop yield?

(10) What do we call "crop outlook" and what is the importance of its evaluation?

(11) How is the evaluation of crop outlook to be determined?

(12) What are the control procedures in determining crop yield?

(13) What methods are used in the sample measurement of crop yield, and what is the significance of sample measurement at the time of crop maturity?

(14) What is the signifcance of determining losses sustained in harvesting and in threshing?

(15) How is the total crop output determined?

(16) What is basic and what is subsidiary production?

(17) How is the variation in the weight of grain calculated with changes in its moisture content (in the process of drying grain)?

(18) How does one determine the indexes of plan fulfillment for crop yield, sowing area composition, crop yield from a "mixed crop" hectare, total sowing area acreage, and of total crop output?

(19) How are indexes worked out to show the commodity part of plant cultivation output?

CHAPTER IV

ANIMAL HUSBANDRY STATISTICS

1. Basic Problems of Animal Husbandry Statistics

The basic problem in animal husbandry statistics is determination of the count and composition of livestock and determination of production figures in this branch of agriculture.

The subject matter falls into two parts, the statistics of animal population and the statistics of animal husbandry production. Inasmuch as the proper organization of livestock feeding is the decisive factor in the productivity of animals, it becomes necessary to include a third subdivision of the subject, into statistics of fodders and animal feeding.

Animal husbandry in the USSR faces the all-important problem of effecting an accelerated increase in the numbers of all types of livestock and the growth of commodity output to an extent that will fully guarantee the realization of objectives.

Particular attention must be given to the development and enlargement of the commodity farms of the kolkhoz. The 18th Congress of the VKP (b) introduced the problem of raising productivity standards in animal husbandry by breed improvement, a radical improvement of breeding methods in general, correct area distribution of breeds, the improvement of feeding methods and general livestock care.

Accounting and statistics in the field of animal husbandry are to furnish the data for planning animal husbandry development by areas, regions, sovkhozes and kolkhozes on a yearly basis - as per assignments of the Party and the Government. These sources are also to furnish control data on over-fulfillment of the plan as a whole, and on the decisions of the Party and the Government pertaining to individual objectives.

Animal husbandry statistics provide data on overall output.

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2. Livestock Population Statistics

a) The Grouping of Livestock

In dividing the herd into types of domestic animals by use, there are two basic groups - working livestock and producing livestock. In the category of working livestock, as a source of motive power, there are horses, oxen, camels, buffaloes, donkeys, mules, and deer. Producing livestock, which is bred and maintained for the production of milk, wool, meat, hides, and other commodities, includes cattle, sheep, pigs, goats. Small animal husbandry, such as rabbit breeding, poultry raising, bee keeping, fur-bearing animal breeding, service-dog breeding, fisheries, silk-worm breeding, are subdivided into separate categories.

Individual kinds of livestock are categorized by sex and age groups, which is necessary for an overall planning of the herd, calculating its rate of reproduction, computing its output, and also for working out control figures, by which decisions of the Party and Government can be checked, on the preservation of livestock, increase in their numbers, and on the extension of animal husbandry.

This breakdown may not be very thorough. At any rate, it is at least necessary to draw a distinction between breeding stallions, reproducing females, breeding colts (replacements of mature livestock), and the very young. In the case of early-maturing livestock such as pigs, age groupings cover shorter periods (in terms of months) than is the case with slower-maturing livestock such as cattle and horses. Generally, age groupings indicate the number of years these animals have lived or their year of birth.

b) Determining the Livestock Head Count for the Animal Average and for Its Group Average

In many livestock calculations it may be necessary to know the average annual, or else the group average head count (the latter being calculated when a given age group covers less than a period of one year). The average age of livestock within an age group can be best arrived at by keeping a daily count by age. Adding up the total available head of livestock of a certain group, covering all the days of the year, we arrive at a figure known

as "feed-days" for the given age group of livestock over a given time interval (in this case, one year). Upon dividing the general number of "feed-days" by 365, the average count over the year within the given age group is obtained.

When necessary to calculate the average age for a group (which includes livestock remaining in this group less than a year), the yearly number of "feed-days" is to be reduced commensurate with the duration of the period.

Example: The number of "feed-days" for piglets from 2 to 4 months old by the sovkhoz count in 1943 was 100,766; the group age average count in this case is -

$$\frac{100,766}{60} = 1,679$$

The age group average count may be computed not only in yearly terms, but also in semi-annual, quarterly, and monthly terms.

Computation of the age group average count on the basis of "feed-days" is possible in keeping with existing sovkhoz and kolkhoz records, only within individual enterprises (and is done in the yearly sovkhoz reports). In computing average age groups of livestock from overall data (all kolkhozes of a given area), it becomes necessary to apply other methods, taking into account the periodicity of the existing records. For example, when dealing with sovkhoz and kolkhoz monthly records, in order to arrive at the yearly age averages for a given livestock group, it is necessary to add the livestock count of this group at the beginning and at the end of each month, and then divide the total by 24. In computing quarterly averages from monthly reports, the above total sum is divided by 6, etc. When dealing with quarterly reports, yearly age averages are arrived at by dividing the above general sum by 8.

Example: As per monthly reports of all kolkhozes of a given area, the count of sows over 9 months old at the first of each month in 1943, beginning with January, stood at -

190; 205; 220; 235; 240; 225; 230; 250; 260; 265; 255; 245

(on January, 1944).

Assuming that the count on the first day of each month can at the same time be considered as the count on the last day of the preceding month, the yearly age average count for sows, based on the above figures, is determined by the following computation:

$$\frac{(210+190)+(190+205)+(205+220)+(220+235)+(235+240)+(240+225)}{24}$$

$$\frac{(225+230)+(230+250)+(250+260)+(260+265)+(265+255)+(255+245)}{24}$$

$$= \frac{5605}{24} \simeq 234$$

The average sow count for the first quarter is:

$$\frac{(210+190)+(190+205)+(205+220)}{6} = \frac{1220}{6} \simeq 203$$

If existing records were quarterly instead of monthly, the sow count as of 1 January, 1943 would stand at 210; as of ~~the~~ 1 April at 220; as of ~~the~~ 1 July at 225; as of ~~the~~ 1 October at 260, and as of ~~the~~ 1 January, 1944 at 245. /Note: The sow count on these days clearly in no way depends upon the time interval used in the moving averages./ The yearly average age group would be computed as follows:

$$\frac{(210+220)+(220+225)+(225+260)+(260+245)}{8} = \frac{1865}{8} = 233$$

c) Indexes for the Organization of Kolkhoz Collective Farms, for their Stocking-up and Replenishment, for their Expansion, and for the Fulfilment of the Required Minimum Count of Reproducing Females (as per the Decision of the Central Committee of the VKP (b), and the Council of People's Commissars, USSR of 8 July, 1939)

The simplest information for organizing the above farms is: The number of farms to be in operation on pre-determined dates, the number of newly organized farms by time-periods (as, for instance, by months), and the average number of animal farms per kolkhoz. This, however, is insufficient data.

Inasmuch as the decision of July, 1939 makes it desirable that each kolkhoz have 3 animal farms, and ~~is~~ mandatory that it have at least two (including one cattle farm), it becomes necessary to group the kolkhozes by various types of animal farms, as follows:

The number of kolkhozes with one animal farm for breeding cattle, pigs, and sheep; the number of kolkhozes with two animal farms, including one for cattle; the number of kolkhozes without animal farms. The percentage of kolkhozes in each group is to be calculated.

Pedigreed animal farms are to be handled separately with a special count by types of animals bred.

It is further necessary to study procedure in stocking-up, and replenishing and expanding by buying animals from the outside. The buying plan is to be followed up currently (monthly reports), indicating separately those "rayones" and kolkhozes which lag behind.

Of particular importance is the fulfilment by the kolkhozes of the minimum count of reproducing females for the animal farms. The decision dated 8 July, 1939 establishes this minimum with relation to the kolkhoz land area, with the tentative date of fulfilment by the end of 1942, including not less than 60 percent fulfilment by the end of 1940.

In determining the count of reproducing females (by types of animals), when the complete minimum requirements are reached, it is necessary to group all the kolkhozes by land areas, with the groups arranged in conformity with the decision of ~~the~~ 8 July, 1939 (groups arranged by the separate "oblasts", territories and republics). By multiplying the number of kolkhozes in each group range by the minimum count of reproducing females for one kolhoz of the given group, the overall minimum count of reproducing females (by separate animal types) for all the kolkhozes of each group and for the entire "rayon" is established. For each of the land groups on a given date the actual count is taken of reproducing females, as well as the actual count of kolkhozes with complete minimum requirements, and 60 percent of minimum requirements fulfilled, - by three, two, or one animal type of reproducing females. This computation

will results in determining within each land area group the percentage of available reproducing females relative to the overall required minimum. It will at the same time determine the percentage of kolkhozes, which fulfilled the complete minimum, or else 60 percent of the minimum requirements - by three, two, or one type of animal. By the end of 1940 only kolkhozes that fulfilled 60 percent of the minimum by three or two types of livestock simultaneously (including cows), will be considered as having complied with the decision of the 8 July 1939.

Example: For one of the rayons of the Moscow oblast a census of the livestock and poultry population was taken as of 1 January 1941. Kolkhozes were grouped by land areas. Within the groups were tabulated: The complete minimum requirements, the available cow count, also the ratio (in percentages) of the available cow count to the full minimum requirement - as per table below.

TYPES OF DATA	UP TO 150 HECTARES	150 - 400 HECTARES	400 - 800 HECTARES	800 - 1500 HECTARES	OVER 1500 HECTARES	ALL GROUPS
Number of Kolkhozes	6	42	43	16	2	109
Required Minimum Count for cows (as per Decision 8 July 1939)	8	16	28	45	60	-
Required Minimum Count for All Kolkhozes of Each Group	48	672	1,204	720	120	2,764
Actual Cow Count as of 1 January 1941	35	467	1,066	1,624	415	3,607
Percentage Ratio of Actual Cow Count to Full Minimum Required	73.0	69.5	88.5	225.6	345.8	130.5

On the average for all kolkhozes, as of 1 January, 1941, the available cow count was above the required minimum by 30.5 percent. As a result of group tabulation it became evident that behind the general average there are hidden significant variations between individual groups of kolkhozes. In 91 out of a 109 kolkhozes with a relatively small land area, the required minimum was not met. It was only due to the fact that the 18 largest kolkhozes far exceeded their quotas, that the minimum overall requirements for all the kolkhozes of the "rayon" were fulfilled.

Simultaneously, it became evident that as of 1 January, 1941, the following quotas were reached by:

Full minimum count by 3 types of reproducing females	5 Kolkhozes
From 60 to a 100 percent of full quota	5 Kolkhozes
60 percent and somewhat higher than 60 percent of the full quota of cows and sows simultaneously	11 Kolkhozes
Same as above for cows and ewes	13 Kolkhozes
Total:	34 Kolkhozes

Only these 34 kolkhozes constituting 31.2 percent of the overall number of kolkhozes in the Moscow "rayon", have complied by [redacted] 1 January, 1941, with the decision of 8 July, 1939, insofar as it relates to the stocking-up and replenishment of the reproducing female count by the end of 1940 (to be not less than 60 percent of the full minimum required).

Of practical importance are individual studies of the kolkhozes, which over-fulfilled the quota, those which fulfilled between 60 and 100 percent of the quota, and those which did not come within 60 percent of the quota.

As an example, two extreme groups of the same Moscow "rayon" with relation to the minimum quota for cows, were taken. The group of kolkhozes, which by 1 January, 1941, fulfilled the minimum quota for cows, amounted to 26.6 percent of the overall number of kolkhozes, with 74.5 percent of the

overall number of cows. On the other hand, 50.5 percent of the overall number of kolkhozes were short of the 60 percent minimum quota of cows. The full minimum quota called for 1,307 cows. Actually the count stood at 549 cows, 228 calves and heifers over one year old, and 300 heifers less than one year old. If until the end of 1942 not one cow was rejected, and all the calves and heifers on hand on 1 January, 1941, survived and grew to be cows, even then the given group of kolkhozes could not through internal reproduction alone develop the full minimum quota of cows required by the end of 1942. The said group of kolkhozes had to be taken under special observation, and the purchase of heifers and cows on the outside had to be arranged.

Thus, the construction of group tabulations and the computation of group averages was instrumental in establishing the fact, that there was a serious lag in stocking-up and replenishing some of the animal farms to comply with the minimum quota, in spite of the fact, that the quota average was overfulfilled.

d) Indexes for Improvement of the Livestock Breed

The very best and most graphical indexes for improving livestock breeding may be obtained by classifying livestock by breed, with the segregation of thoroughbreds and half-breed animals by generations (degrees of pure-bloodedness). By analyzing complete data on the count of breed animals, the percentage of thoroughbreds and half-breeds is determined relative to the overall count (by individual types, sex, and age groups of livestock). Thoroughbreds and half-breeds are placed in their respective categories in percentage terms, with due consideration to the relative importance of the breed planned for the given "rayon" (particularly reproducers), and underscoring the "rayons" where individual breeds are dominant.

e) Indexes of State Plan Fulfilment in Developing Animal Husbandry

To compute these indexes (usually expressed in percent), the overall census or count of livestock is compared with the planned count of offspring for the year under review from stock bred during the same year, and preserved

to the end of the year. It is also compared with the planned count of mature livestock for the end of the year (the so-called "outgoing livestock").

If during the accountable year there were meat deliveries to the State for next year's account as planned ("advance" deliveries), it becomes necessary, in reviewing the control figures for the fulfilment of the plan, to add to the overall census of livestock population the number of head delivered to the State to the account of next year's plan.

Example: According to the plan for 1943, the kolkhozes of a certain "rayon" were to have by 1 January 1944, a count of 3,200 sheep. The census for 1 January 1944, counted 3,120 sheep. 130 sheep were delivered in advance to the State to the account of meat deliveries for 1944. Under these conditions the index for plan fulfilment by the count of sheep in the kolkhozes will be:

$$\frac{(3{,}120+130) \times 100}{3{,}200} = 101.6 \text{ percent}$$

When the livestock expansion plan is not fully completed by any group or groups of animals, or, for that matter, if there is a substantial over-fulfilment, the causes of this must be clearly ascertained.

f) How to Indicate Changes in the Livestock Population

In studying changes in the livestock count, it is necessary to bear in mind that in addition to variations due to the general expansion of industry, there are seasonal variations in the size and composition of the herd. Selective livestock rejections are made mostly in the fall, prior to assigning stalls to the animals for the winter, while the appearance of offspring cattle and sheep takes place mainly during the late winter months. As a result, the count of livestock in the winter is smaller than in the summer.

Cows, subject to rejection, are mostly counted out also at the end of the grazing period, while the replenishing of the herd, as a result of the appearance of the offspring, takes place mostly during the latter half of the winter.

Thus, the cow count toward the middle of the winter, let us say on

1 January, is the lowest, while it is highest toward the summer. To avoid erroneous conclusions in the analysis of the dynamics of herd expansion on shrinkage, it is necessary to take account of these seasonal fluctuations, by making comparative studies of the available livestock count in terms of comparable periods of time.

It is essential also to make a comparison over time of the results of the livestock registration and count, making corrections for undercounting (based upon the results of sampling surveys made after the count is completed).

In the statistical symposium of TsUNKhU (Central Administration of National Economy Accounting) of GOSPLAN, USSR - Socialist Construction in the USSR (1933 - 1938), GOSPLAN Press, 1939, page 103, the following data is given on the available livestock count of the USSR, as of 1 January, 1934, and as of 1 January, 1938 (in million head):

YEARS	CATTLE	HOGS	SHEEP and GOATS	HORSES
1934	33.5	11.5	36.5	15.4
1938	50.9	25.7	66.6	16.2
1938 in percent of 1934	151.9	223.5	182.5	105.6

g) Indexes for Herd Reproduction

The most important factor in animal husbandry expansion is the provision for the growth of the livestock population (expanded reproduction of the herd). Since, due to rejections and waste, there is a yearly decrease in the numbers of mature livestock, the necessary reproduction rate of the herd can only be assured by having enough young animals ("replenishment stock") to more than replace the old mature animals which leave the herd.

If the aggregate of all agricultural enterprises is considered as a whole, the only source of replenishment stock will be the raising of the offspring. Each individual enterprise can also obtain replenishment stock from other units, as, for example, a kolkhoz from a sovkhoz, or from another kolkhoz, or, as is now mostly the case, from kolkhoz members, workers, and employees. At present, where kolkhozes of "rayons", that were occupied temporarily by the

fascist German aggressors, are busy with rehabilitation, the acquistion of livestock from outside sources is particularly important for stocking-up and replenishing herds. Very often the replenishment stock from the offspring of the current year is acquired by entering into preliminary contracts on pre-determined conditions.

As a result of this, the study of the problem of providing the herd with replenishment stock must be preceded by a calculation and analysis of information on the incoming offspring, and in some cases (mostly for the kolkhozes), also information on the acquisition of replenishment stock from outside sources. The birth of offspring, in turn, is the result of the mating campaign and propagation of female reproducers.

A more reliable index for the mating campaign is the ratio (usually in percentage) of the number of coverages and artificial inseminations of female reproducers, to the overall count of female reproducers to be covered in a given year, as planned (the so-called planned mating contingent). In a herd of cattle, the mating contingent consists of cows (except those due for rejection this year), heifers, and calves over 6 months old belonging to the herd at the beginning of the given year, as well as those acquired from the outside during the same year.

When no complete data on the mating contingent is available, it is worked out on an approximation basis in terms of the information on hand. In the case of cattle, a mating contingent usually includes cows, heifers, and calves over one year old at the beginning of the year, or possibly only cows and heifers (in cases where calves over one year old were not segregated). In the case of pigs, the possible mating contingent takes in all sows over 9 months old. In the case of sheep and goats, all the reproducing females, ewes, and lambs over one year old are included. In the case of horses, this includes all the mares over 3 years old at the beginning of the year.

Such a determination of the mating contingent is only a conditional one, and can lead to distorted indexes, particularly, relative to fast-maturing animals such as sheep and hogs. In these categories, with the rapid herd expansion now taking place in the liberated areas, the number of reproducing

females covered during the year may be considerably higher than the number available at the beginning of the year.

When there is a large degree of variation in the count of hog and sheep reproducing females, it is appropriate to consider the mating contingent by the average count of reproducing females for the given mating period.

The most suitable way to indicate the utilization of female reproducers is the ratio of the count of calves, piglets, lambs, and foals to the count of reproduction-capable females, available at the beginning of the year plus the number acquired from the outside during the year. In the case of cattle, it is the ratio of the count of the offspring to the number of cows, heifers, and to the portion of calves marked for coverage in the first quarter of the year. In the case of livestock other than cattle, it is the ratio of the count of offspring to the number of female reproducers in groups comparable with these which are used in working out the indexes for the mating campaign.

When complete data is not available, in this case, as before, approximate indexes for the utilization of female reproducers are computed. For instance, in the case of a herd of cattle, the basis of computation is usually the count of cows and heifers at the beginning of the year.

When the basis for computation is incomplete, the ratios obtained are for computation only, but they do not furnish detailed characteristics of the noted phenomena.

Example: In the kolkhozes of "rayon" "N" on 1 January 1944, the livestock count stood at 1,200 cows, 500 heifers, 600 sows over 9 months old, and 980 ewes and lambs over one year old.

During 1944, 1,600 cows and heifers, 960 sows, and 1,120 ewes gave birth to young.

The computation data for the utilization of reproducing females in this case are as follows:

$$\text{For Cattle} = \frac{1,600 \times 100}{1,700} = 94.1 \text{ percent}$$

$$\text{For Pigs} = \frac{960 \times 100}{600} = 160 \text{ percent}$$

For Sheep = $\frac{1,120 \times 100}{980}$ = 114 percent

Results in terms of the young which are born depend upon the use made of the reproducing females and upon their fertility. The offspring yield is expressed by the ratio of the number of offspring born in a given year to the count of reproducing females. This is taken as a basis for calculating the degree of utilization of the reproducing females. The index for the offspring yield, by types of reproducing females which usually give birth to one young (mares, cows), closely approximates the indexes for calving and foaling.

As an indication of how much livestock is gotten from outside, (particularly yearlings), it may be useful to take the percentage of fulfilment of the yearling procurement plan, also the number of acquired yearlings relative to the overall number of yearlings (propagation and acquisition).

For the propagation of the herd, the production of offspring and the acquisition of yearlings from outside sources, are not enough. It is necessary to raise the offspring and the acquired yearlings to an age when they enter replenishment groups, from which the mature and producing part of the herd is directly filled.

Thus, survival of the young becomes a decisive factor in expanding animal husbandry. This is particularly true immediately after birth, when it takes the greatest amount of care to keep the animals alive.

The most important negative index characterizing the quality of the work in preserving the young, particularly, immediately after birth, is the percentage ratio of the number of offspring perished to the overall number of offspring for a given period of time. For foals, calves, lambs, and kids it is customary to calculate the percentage ratio of offspring perished to the overall number of offspring born during the time intervals, from the beginning of the year (for the first month, for two months, for a quarter of year, for 4 months, etc.), and finally for the whole year.

For the mortality of offspring, obtained by reproduction within a given

economy or within an agglomeration of economies, plus offspring for the given year acquired from outside sources, it is most appropriate to compute two indexes: (a) Mortality index for offspring born within the economy unit (percent of the number dead to the number of the newly born), and (b) The same index relative to the total number, i.e. the offspring born within the economy and the offspring acquired from the outside.

In addition to mortality, the livestock young may leave the particular economy for other reasons: Compulsory deliveries to the State, sales or distribution to kolkhoz members, mutual-aid transfer to kolkhozes that suffered under enemy occupation, transfers to the defense fund, sales to State procurement agents and sales on the kolkhoz market, also on account of interruptions in the economy, etc. By a decision of the Central Committee of the VKP (b) and the Council of Peoples' Commissars USSR, 13 April 1943 ("On measures for increasing the number of livestock in kolkhozes and sovkhozes, and on increasing their productivity"), the kolkhozes were forbidden "for the duration of the war to slaughter and sell young cattle less than one year old, with the exception of obvious rejects, and only after the actual rejection was made by veterinary zoo-technical personnel and with the approval of the "Rayon".

More interesting and actually more appropriately indicative, as compared with indexes for the mortality of the offspring as well as losses through other causes, are the direct data on the numbers and percentages of the offspring that survive. Such data for a group of economies may be obtained by special accounting, special examination, or by herd turnover reports (to be discussed below). When these sources are not available, the index for the rate of preservation of the young may be computed from the available periodical reports.

In accordance with such data (for a kolkhoz or a group of economies), the number of newly born animals for a part of the year or for the entire year is known. Also, the number is known of young animals up to the age of one year, that were purchased on the outside, and the number of these at the end of the year. Then, the survival rate of offspring for a given period will be the

number of those which live, divided by the overall number of offspring (born within and purchased from without).

Example: In the kolkhozes of some "rayon" ~~(district)~~ during 1943, there were born 5,430 calves. During the same period, 720 calves were acquired from the outside. By 1 January 1944, the cattle herd contained 5,930 yearlings up to one year old. If all the young animals (those born within and those acquired from the outside) had survived, there would have been available by the end of the year 5,430 + 720 + 6,150 calves. Thus, the index for the rate of survival for calves in this example will be:

$$\frac{5,930 \times 100}{5,430 + 720} = 96.4 \text{ percent}$$

The raised young livestock enter into the category of replenishment stock upon reaching a certain age which varies with different types of livestock. As underscored above, expansion of the herd is made possible only when the count of replenishment stock is in excess of the count of rejections.

The calculations for propagation of the herd can best be illustrated by a study of cattle herd.

The productive use of a cow runs for a period of a certain number of years, depending upon her breed, her individual characteristics, and the care she receives. On the average, this period fluctuates between 10 and 12 years, i.e. until the cow reaches the age of 14.

Thus, it is necessary to reject yearly 1/12, or somewhat over 8 percent, of the cows. In addition, a certain number of cows is lost to the herd during the year through sickness or other causes (1 percent). In this case, to keep the herd at a constant level, it is necessary that it have from 9 to 10 percent heifers and calves, which will be covered [mated] during the year.

When it is desirable to increase the size of the herd, it becomes necessary to have a greater proportion of young animals than is required for keeping the herd at a constant level. The part of young livestock, in excess of the number needed for the contemplated herd expansion, is called the "reserve replenishment stock". This serves as the source of meat; and it is necessary always to be on guard against premature slaughter from this group.

In calculating the ratios between the available count of replenishment stock and the available count of mature livestock, using census and accounting data (for example, the number of heifers and calves over one year old per each 100 cows), the actual possibilities for reproduction of the herd are understood.

Below is an example showing how to calculate the replenishment stock for a herd of cattle.

REPLENISHMENT STOCK PROVISION FOR THE CATTLE HERD OF KOLKHOZES AND KOLKHOZ MEMBERS AS OF 1 JANUARY 1941

Names of "Rayons"	Number Of Cows	QUANTITY			PER EACH 100 COWS		
		Heifers	Calves Over 1 Year Old	Total	Heifers	Calves Over 1 Year Old	Heifers And Calves
A	4,480	160	200	360	3.6	4.4	8.0
B	5,700	866	950	1,816	15.2	16.7	31.9

It is obvious that "rayon" "A" is not sufficiently provided with replenishment stock, while "rayon" "B", on the contrary, is fully provided for an expanded reproduction of the herd. By taking into consideration the number of calves up to one year old, it becomes possible to judge not only the immediate, but the more distant prospects for propagation of the herd.

Similar calculations can be made regarding horses. It must be remembered, however, that the useful life of a horse (normally up to 17-18 years) is more than that of a cow.

It is understood that such computations are applicable only to larger economy units, as, for instance, all kolkhozes of a given "rayon". For individual kolkhozes, in which, for instance, the livestock farm has been recently organized, and the entire herd consists of young cows, the above computations are not applicable, since no rejections are expected for several years.

In addition to replenishment stock, the herd requires for its reproduction the availability of an appropriate number of mature male reproducers. A shortage in fully matured males and their substitution by partially matured ones

leads to the sterility of the female reproducers, which, in turn, not only decreases the birthrate of the offspring, but reduces the milk production as well (due to the fact that sterile cows give less milk). The normal ratio between the number of reproducing males and the number of reproducing females depends upon whether the mating takes place in the common herd (males and females grazing together), or the males are kept separately, and the mating is effected under the observation of an attendant (so-called supervised mating).

The index of male reproducers is the number of female reproducers (cows and heifers in cattle herds, female sheep, and ewes over one year old in sheep herds) per one mature male reproducer. The adequacy of the number of male reproducers is judged by comparing the indexes obtained with the normal ratios between the numbers of male and female reproducers.

The Central Committee of the VKP (b) and the Council of People's Commissars USSR in their decision of 13 April, 1943, "On measures to be taken to increase the count of livestock and its productivity" made the following obligatory for the kolkhoz managements.

In order to do away with livestock sterility, animal farms are to be provided with one bull per 30-40 cows, one boar per 10-12 sows, and one ram per 20-30 female sheep.

In analyzing the indexes for providing the kolkhoz herd with male reproducers, the fact must be taken into account, that these males cover not only the female reproducers of the general herd, but also those belonging to the personal herd of a kolkhoz member.

h) <u>The Concept of Herd Turnover</u>

The livestock population in individual agricultural enterprizes is subject to fluctuations, by the overall count, as well as by the type of livestock, and particularly by age groups. These fluctuations are continuous, practically from day to day. Some of the variations are in the nature of an increase in the livestock count (offspring, acquisition from the outside, etc.;

also, young maturing into higher age groups), or a decrease in the livestock count, overall or by age groups, such as deliveries to the State, sales, unavoidable slaughter, special slaughter for internal needs, passing into a higher age group, straying, plague casualties, sickness, or accident.

Linking-up the items of increase and decrease in the livestock count for a given period of time, i.e., preparation of the livestock count balance control of the debit and credit items, the study of herd propagation, and determination of the volume of production, all this is embodied in a distinct statistical operation, known as the "herd turnover".

The herd turnover for a given period is determined by the following basic requirements:

(1) The livestock count at the beginning of the period;

(2) Incoming livestock for the period (such as newly born offspring, purchases, growing out of younger age groups, etc.);

(3) Outgoing livestock for the period (such as deliveries to the State, slaughter, plague, passing into older age groups, etc.);

(4) The livestock count at the end of the period.

These divisions of the herd turnover have to be in mutual balance. For example, if to the livestock count available at the beginning of the period is added the count for all the incoming livestock for the period, the result must equal the sum of all the outgoing cattle for the period and the available count for the end of the period.

If, for instance, at the beginning of the year, the count of cattle is given as 200, the incoming count from all sources during the year 100, the outgoing count due to all causes 80, and the available count at the end of the year 220, then the herd turnover was constructed correctly, since:

$$200 + 100 = 80 + 220$$

Figures for the herd turnover by separate economies for a period passed

can be arrived at on the basis of accountable data (offspring count, purchase count, slaughter count, losses due to plague, etc.).

In addition, the turnover for planned herds is constructed for a period depending upon the animal husbandry assignments of a particular kolkhoz, or of all of them collectively within the limits of a territorial unit (a "rayon" or an "oblast").

In studying the herd turnover, a series of essential indexes can be computed. Computation methods are shown for a sample herd turnover in one of the sovkhozes in the Moscow "oblast".

(Table follows.)

RESTRICTED

CATTLE HERD TURNOVER AT A SOVKHOZ OF PEOPLE'S COMMISSARIAT OF STATE FARMS 1939

Name Of Livestock Groups	Available Count as of 1/1/1939	Offspring Count	INCOMING FOR YEAR: Transferred From Other Groups	Purchased And Obtained From Other Sovkhozes	Purchases And Other Arrivals	Incoming Total	OUTGOING FOR YEAR: Deliveries To State: Head	Deliveries To State: Live Weight In Centners	Passed Into Other Groups	Delivered To Breed Control Office	Sold To Kolkhozes And Kolkhoz Members	Slaughter For Meat: Head	Slaughter For Meat: Slaughter Weight In Centners	Unavoidable Slaughter: Head	Unavoidable Slaughter: Slaughter Weight In Centners	Losses By Death And Plague	Sold And Transferred To Other Sovkhozes	Outgoing Total	Remained As Of 1/1/1940
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 Bull-reproducers	4	X	1			1													5
2 Cows	170	X	33			33	17	75	4					1	1	1		23	180
3 Heifers	25	X	34			34			33					1	1			34	25
4 Bullocks born in 1937	8	X	X						1	5							2	8	
5 Bullocks born in 1938	53	X	X				4	2		34		2	1.5			1	11	52	1
6 Bullock born in 1939	X	90	X			90	23	15		5		4	2	1	0.6			33	57
7 Calves born in 1937	32	X	X	3		3			27	5								32	3
8 Calves born in 1938	76	X	X		2	2	1	1	7	19						1		28	50
9 Calves born in 1939	X	81	X			81						1	0.5	1	0.4			2	79
10 Mature Cattle in Grazing		X	4			4	3	12.6				1	2					4	
Total Number of Cattle	368	171	72	3	2	248	48	105.6	72	68		8	6	4	3	3	13	216	400

RESTRICTED

Unavoidable slaughter is the slaughter of animals that are sick, weak, ugly, or those that sustained serious injuries and have thereby become worthless as productive units. When the unavoidably slaughtered animal does not pass the health inspection for meat, it is set aside as "perished".

In all columns of the herd turnover sheet, the items "incoming" and "outgoing" must balance. Thus, the available count for the beginning of the year (item 1) plus the total incoming count (item 6) must equal the total outgoing count (item 18) plus the count for what animals remain at the end of the year (item 19).

It should be noted that the figures for offspring count are given not by age, but by year of birth. Therefore, the above turnover sheet reflects in its items "passed into other groups" and "transferred from other groups", merely the movement from the yearling group into other productive groups (such as bull-reproducers, cows, heifers), or heifers which become cows. There is also reflected the transfer to grazing of all age groups. Thus, under the items "calves born in 1939" and "bullocks born in 1939" there are no figures. Out of the 76 calves born in 1938, there were already 7 head (obviously, born in the beginning of 1938) that passed on into the group of heifers. Out of the number of calves born in 1937, by far the greater part of them (27 out of 32) available at the beginning of the year passed on into the group of heifers. Accordingly, on the line for heifers under the item "transferred from other groups", we find 7+27=34 head. On the same line for heifers, under the "outgoing" item "passed into other groups", we find 33 head which are listed on the "incoming" side, on the line for cows, under the item "transferred from other groups". Since on 1 January 1939 the Sovkhoz had a total of 25 heifers, and during the year one heifer was "unavoidably" slaughtered, it is obvious, that 33 - (25 - 1)=9 head, entered into the count of 33 head which at the beginning of the year were counted under the item "calves". These were covered (or mated) during the first months of the

year, and brought forth offspring /calves/ within the same year. From out of the count of cows, 4 head were transferred to grazing.

When the herd turnover sheet is properly constructed, the cattle counts on the line "cattle totals" under the items "passed into other groups" and "transferred from other groups" have to tally, as can be seen from the above example (72 and 72).

On the basis of the herd turnover the following basic indexes may be completed, which describe the qualitative aspects of animal husbandry, essential for any kind of accounting:

1) Yield of calves to the number of cows;
2) Percentage of cows rejected;
3) Herd reproduction indexes;
4) Percentage of slaughter for internal consumption;
5) Percentage of loss through death and plague.

If the turnover sheet gives (as in this example) figures on the weight of livestock delivered to the State and also of that slaughtered within the economy, it becomes possible to compute the average live-weight per head of livestock delivered, and the average slaughter-weight per head of livestock slaughtered.

The yield of calves per year (as indicated above) is usually calculated per 100 cows and heifers as of the beginning of the year. It is an indicator of use, however, only for purposes of computation. When in addition to it, the overall figures for the available cows and heifers for the beginning of the year are known, the yield of calves can be computed.

In the example on page 115 the yield of calves per 100 cows and heifers for the beginning of the year, is computed as follows:

$$\frac{(90 + 81) \times 100}{170 + 25} = \frac{17100}{195} = 88 \text{ calves}$$

The percentage of cows rejected is a figure needed for various kinds of calculations, for building up the planned herd turnover. Cows are rejected on account of over-age and non-productivity. Rejections are made almost ex-

clusively from the count of cows, available at the beginning of the year. Expressed in percentage, this would be:

$$\frac{(17 + 4 + 1) \times 100}{170} = \frac{2,200}{170} = 12.9 \text{ percent}$$

To determine the reproduction indexes for the herd, it is necessary to calculate the provision of the herd with replenishment offspring and reproducers. In the given example supplying the herd with replenishment offspring at the end of the year is shown as follows:

$$\text{Heifers per 100 cows} = \frac{25 \times 100}{180} = 13.3$$

$$\text{Calves born in 1938 per 100 cows} = \frac{50 \times 100}{180} = 27.8$$

In the sovkhoz, expanded propagation of the herd is provided for, as confirmed by the internal growth in the number of cows during 1939.

The sovkhoz is also provided with an adequate number of reproducers: For each reproducing bull at the end of the year there were available 41 cows and heifers.

The index for the slaughter of livestock (excepting unavoidable slaughter) relating to the yearling group born before the current year (the group being fluid), is usually calculated on the basis of available data on the yearling count at the beginning of the year. It would be more appropriate, however, to compute this index with relation to the count of yearlings "in the turnover" (the available count at the beginning of the year plus the count of all yearling arrivals during the year).

Both indexes can be computed on the basis of the turnover chart given.

The percentage of slaughter of bullocks born in 1938 within the economy and available at the beginning of the year is:

$$\frac{2 \times 100}{53} = 3.7 \text{ percent}$$

Inasmuch as there was no addition from outside the herd of bullocks born in 1938, in this instance the index corresponds with the slaughter index relative to the number of bullocks in circulation. The first of these is a computation index only.

For calves born during the current year, the percentage of slaughter is calculated relative to the part of the livestock, from which slaughtering may be done during the year, i.e. the number of calves born during the particular year within the economy plus arrivals from the outside. In this case this index for all calves born in 1939, is:

$$\frac{(4+1) \times 100}{90 + 81} \approx 2.9 \text{ percent}$$

When adequate data is available for a given type of animal husbandry, the above index is calculated not only for all the calves born during the year, but is broken up into a separate index for calves, and an index for bullocks:

Slaughter percent of calves born in 1939 $= \frac{1 \times 100}{81} = 1.2$ percent

Slaughter percent of bullocks born in 1939 $= \frac{4 \times 100}{90} = 4.4$ percent

The mortality indexes for mature livestock, (a count which remains most stable throughout the year), is calculated with relation to the average yearly count for yearlings over one year old - with relation to the count of those in circulation. When this is not possible, then in order to get an indication of the count at the beginning of the year, for the young born during the year, this is expressed relative to the number of calves born and bred in the economy plus the number received from outside.

Let us calculate the mortality indexes from our example:

Percentage of cow mortality $= \frac{1 \times 100}{(170+180) \div 2} = \frac{100}{175} = 0.6$ percent

Percentage for the mortality

of calves born in 1938 $= \frac{1 \times 100}{76 + 2} = \frac{100}{78} = 1.3$ percent

There was no mortality amongst calves born in 1939.

It is not correct to calculate the livestock mortality index for the entire herd as a whole, since the mortality level varies with individual age groups, particularly as between yearlings born during the current year and yearlings born before the current year.

The herd turnover for other types of livestock is constructed and analyzed in the same manner. Specifically, when calculating mortality, slaughter and other indexes for a group of hogs 4-9 months old, these indexes are related to the average count of hogs of the given age for a five-month period.

A herd turnover sheet constructed by age groups will sometimes back the items on "passing or transferring from one age group into another". In this case the turnover must be fully balanced by the totals for each livestock type, but can also be checked by linking up data as between individual groups. This method can be shown by applying it to the same turnover, as illustrated above, by postulating the absence of the items "transferred from other groups" and "passed into other groups".

Linking together items in this case is to begin with the younger age groups. By the items "calves born in 1939", "bullocks born in 1939", and "bullocks born in 1938" a complete balance is obtained: The available count for the beginning of the year, plus the incoming count, minus the count for deliveries, sales, slaughter, unavoidable slaughter, and mortality, equals exactly the available count for the end of the year. The conclusion can be drawn that during the current year there was no passing from one group into another from the above mentioned age groups.

Under the item "bullocks born in 1937" for the beginning of the year, the count stood at 8 heads. The outgoing count (except for animals passing into other groups) was 8. At the end of the year there should have remained in this group one head. Actually none was left, from which the conclusion is drawn that one bullock born in 1937 passed into another age group, the

group of reproducing bulls. Turning to the latter, it is verified that this indeed is the case, since at the beginning of the year there were available 4 reproducing bulls, there were no arrivals from the outside, and at the end of the year the count stood at 5.

The count of calves born in 1938 stood at the beginning of the year at 76, there were 2 arrivals from the outside, the outgoing count plus mortality stood at 21. There should have remained in the group 76 + 2 - 21 = 57 head. Actually, the remaining count stood at 50, which means that 7 head passed during the current year into an older age group. By the same sort of calculation it is established that from the group of calves born in 1937, 27 head passed into older age groups. The total count of calves passed into older age groups stood at 27 + 7 = 34 head. At first they could only pass into the group of heifers. By adding to the available count of heifers at the beginning of the year the count of 59 (25 + 34), ~~the count of 59~~ heifers is obtained for the year's turnover. During the year one heifer was "unavoidably slaughtered", which should have left the count in this group at the end of the year (except those animals which have passed into other groups) at 58 head. Actually, there were left only 25 heifers, from which the conclusion is drawn, that 58 - 25 = 33 heifers which became cows. Adding this count to the available count of cows on 1 January of the year, under review, a complete balance is obtained on the line of the table marked "cows". Thus, the conclusion can be made that the herd turnover was properly developed.

In certain cases such detailed information on herd turnover, as given in the above table, is not available. Instead, there is overall data on the available livestock count for the beginning and the end of the year (or parts of the year, such as quarters, months), and on the count of the offspring born within the economy and the livestock obtained from outside sources during the current year. An example was given for such data applied to the calculation of indexes for preserving the yearling group born in the current year. Analogously, the indexes for the preservation of the livestock count during the year for the entire herd can be determined.

Example: In all the kolkhozes of a given rayon on 1 January 1943, the available count of cattle stood at 7,268 head. The number of calves born during the year within the kolkhozes was 3,940. The number of cattle purchased from outside sources in 1943 (from kolkhoz members, sovkhozes, workers and employes, private peasants) was 1,752. If the full count of the cattle were maintained, the kolkhozes of this rayon would on 1 January 1944 have a cattle count of 7,268 + 3940 + 1,752 = 12,960 head (the count in the turnover). Actually, this count stood at 11,353 head. The outgoing count for the year was 12,960 - 11,353 = 1,607 head, which is 12.4 percent of the count in the turnover. Thus, the index for the preservation of the herd is expressed as (100 - 12.4) = 87.6 percent.

Indexes for the actual rejection of cows and adult horses can be arrived at with a simplified computation.

Example: On 1 January 1943 all the kolkhozes of a rayon counted 2,504 cows and 549 heifers, which during the year became cows. Outside purchases accounted for 30 cows. Presupposing full preservation, the count for cows at the end of 1943 would stand at 2,504 + 549 + 30 = 3,083 head. Actually, the count stood at 2,840. The difference (3,083 - 2,840 = 243 head) accounts for rejections and mortality.

Inasmuch as rejections are made from the number of cows available at the beginning of the year (without counting the mortality figures, which are insignificant in this case) the percentage of rejections is determined relative to the count of cows at the beginning of the year, i.e.,

$$\frac{243 \times 100}{2,504} = 9.7 \text{ percent}$$

If the offspring yield and the count of female reproducers for the beginning of the year are known, it is possible to compute the yield percentage without considering the complete herd turnover.

3. Basic Indexes of Animal Husbandry Production

a) Basic Types of Animal Husbandry Production

For a correct understanding of what is meant by the volume and contents of animal husbandry output, it is necessary to realize the dual significane of livestock in the agricultural economy.

Based on this premise, animal husbandry output as a branch of agricultural production, is composed of two basic parts.

(1) Non-processed products, obtaining which is not contingent upon the slaughter of cattle and poultry, and which, in their primary form or after processing, are routed for consumption by the populace or for manufacturing purposes. Such products are milk, wool, down, hair, eggs, comb honey, and manure as a fertilizer.

(2) Output expressed in terms of offspring, increment in the live weight of animals (in the raising of yearlings as well as in the increase in the live weight of adult animals), and weight added as a result of fattening.

The products of slaughter (meat, animal fats, hides, etc.) are relegated to the industrial rather than to agricultural output, particularly since the tendency is to slaughter and then process the meat outside the kolkhozes and sovkhozes, in a special branch of the food industry.

In this case, the assignment for agricultural statistics is to account for the numbers of livestock raised and fattened for slaughter, as well as for the products, which go into meat processing.

The inclusion of meat production into overall animal husbandry output does not correspond to the dual significance of livestock in an agricultural economy, as noted above.

Should the products of livestock slaughter (meat, hides, etc.) be included in the agricultural output, it will result in a distorted picture for

the animal husbandry output in the years of increased livestock slaughter, when the livestock count will be at its lowest, and the output, in terms of the slaughter products, will be at its highest, at the expense of a decrease in capital assets. By the same token, during the years of upswing, when the numbers of livestock are on the increase, the output would show decrease, if only the products of livestock slaughter were reviewed, without including all the other components.

This method would create a contradiction in the records for animal husbandry output, inasmuch as a positive index for the increase in output would be the result of a negative index for the decrease in capital assets (livestock) and vice versa.

In order to avoid this, all the following items are relegated to animal husbandry output: (1) the count of the offspring; (2) yearly increment in the live weight as a result of the increased weight of adult animals, the raising of yearlings, grazing, and fattening; (3) milk; (4) wool, down, and hair; (5) poultry products (eggs), bee-keeping products (honey); (6) manure.

The indexes for livestock productivity, such as the milk yield per head, wool sheared per sheep, the live weight, etc., are of great importance in the qualitative rating of animal husbandry enterprises conducted by sovkhozes, kolkhozes and kolkhoz members, since they reflect the accomplishments in improving the breed, in feeding, maintenance and housing of livestock.

b) Methods for Determining the Yield of Animal Husbandry Products

The general yield of products of animal husbandry may be determined by economic categories within one or another territorial breakdown, just as the general crop yield in plant cultivation. This may be determined in two ways - directly and by computation.

Using the direct method, the general annual yield of a certain product (for example, milk) is extracted from the annual report of an economy (for example, a kolkhoz). Summing up these individual yields within the limits

of a given territorial unit (let us say, a rayon), the general yield of a given product (milk) is obtained for a given category of economies (kolkhozes) and within the limits of a given territorial unit.

In the case of economies, where no annual reports are available, the computation method has to be applied. First, the components that make up the output are determined, and then the general yield. Such components are: the average productivity index for a given type of output, and the average livestock count for the given period of time, from which this output was obtained. The general output for this given period is the mathematical product of these components.

c) Determination of the Milk Yield of Cows and the Overall Milk Output

Milk is one of the basic products of animal husbandry. In determining the milk output, the following basic indexes are essential: the count of milking cows and forage cows, and the average milk yield.

Forage cows are all the cows in an economy, including those in run-down condition before calving and the sick, all of which are not giving milk at the particular time. Milking cows are all the cows in an economy, which at the given period produce milk. Both of these groups are significant for calculations. The number of forage cows must be known in order to estimate fodder requirements, the number of stalls in the corral, the manure output, etc. The number of milking cows must be known in order to determine the productive part of the herd.

The ratio between the counts of milking and forage cows at a given moment is the index for the productivity of the cow herd at the moment.

In each economy maintaining daily registration of the number of forage and milking cows, this index can be computed for any desired period of time, as for 10-day, monthly, quarterly, and yearly periods. It equals the ratio between the number of milking cow-days and forage cow-days, which values are determined exactly in the same manner as the number of feed-days (see sub-paragraph 2-b of this chapter).

If, for instance, in January there were 2,213 forage cow-days and 1,484 milking cow-days, the productivity index for the cow herd for January equals $\frac{1,484 \times 100}{2,213} = 67.1$ percent. During the mass gestation of cows, this index varies abruptly for short time periods, being the highest during the summer and the lowest by the end of the fall and the beginning of winter.

The indexes for milk productivity are the average milk yield per one forage cow and per one milking cow.

The last of these two indexes determines the productivity level of the cow herd, while the first one gives a generalized concept of the production activities of economies, since it is a result of the milk productivity of cows and of the degree to which they are used to produce milk. It is easier to determine the average milk yield per forage cow. This simpler method usually is applied in all calculations with mass data, particularly, in view of the fact that the computation of such yield indexes simplifies calculating overall milk production.

The average milk yield of a forage cow for the calendar year, or for any other time period, is the general amount of milk obtained during the period for a particular economy, or an agglomeration of economies (for a rayon, oblast, territory, etc.) divided by the average number of forage cows for the given economy, or agglomeration of economies, for the same period of time. The general milk yield is determined on the basis of initial reports within the economy and established accounting procedure. To obtain a correct index for the average milk yield, it is necessary to include as part of overall milk production all the milk actually obtained. This calls for including milk consumed by calves and piglets, milk lost for various reasons, milk spoiled in storage, milk supplied to anyone whatsoever, etc.

The method for determining the average cow count for given periods of time was discussed above. When the average milk yield per one forage cow is learned, let us say, on the basis of a selective study of cow herds in kolkhozes, and data is also available as to the general number of cows in all

kolkhozes of a given rayon for certain dates (for example, the first of each month) then it is not difficult to determine the overall milk output. It, obviously, is equal to the mathematical product of the average yield per cow multiplied by the average annual count.

In each separate economy, where a daily cow count record is kept, it is possible to compute the average milk yield per one feeding and per one milking cow-day. The average 24-hour milk yield, computed per one milking cow over the individual monthly periods, determines the seasonal fluctuations of milk yield.

A cow does not yield milk continuously, but through a certain period only, which runs from the moment after the calf has been delivered until the so-called let-down period before the next delivery. This is known as the lactation period (when milk is formed and discharged by the milk glands of the cows). The time from the let-down to the actual delivery of the calf is known as the dry period (no milk produced). This period runs on the average from 60 to 65 days, and in any case for no less than 45 days. Subsequent attempts to reduce this period result in the cow being unable to accumulate the necessary strength for the new lactation period, which in turn causes a reduced milk yield and weaker offspring.

In properly run economies the duration of the above periods is to be calculated for each cow individually.

The milk yield level depends on a series of factors. It is worth while to analyze in detail the milk yield fluctuations for a lactation period in connection with the age of the cow. The milk yield rises up to a certain age, after which it is gradually diminished. Usually, the maximum milk productivity of a cow develops between the third and seventh calving, dependent on the breed, hereditary qualities, individual peculiarities, feeding, care, and maintenance methods. Based on observations, a conventional average age (measured by the number of calvings) by various breeds, is

established as the maximum milk yield age. Results of such observations, for example, show that the maximum amounts of milk upon the sixth calving are yielded by cows of the following breeds: Kholmogorsk, Yaroslavsk, Krasuo-Gorbatovsk, Shvits, and other breeds; upon the seventh calving - by the Siberian breed; upon the fifth calving - by the Simmentalsk breed. Cultured breed cows (Kholmogorsk, Yaroslavsk, Simmentalsk, etc.) have an annual yield of 70-75 percent of the maximum milk yield.

As an example tabulations are made of milk yield fluctuations by age. These are brought out from observations made on a group of Yaroslavsk cows. If the milk yield after six calvings (maximum yield) is taken as a 100 percent, the ratio in percent of the milk yield levels for cows of other age groups (in terms of calvings), as a result of observations, will be in percent:

Cow after one calving	71 percent
Cow after two calvings	84 percent
Cow after three calvings	92 percent
Cow after four calvings	96 percent
Cow after five calvings	98 percent
Cow after six calvings	100 percent
Cow after seven calvings	92 percent
Cow after eight calvings	84 percent
Cow after nine calvings	78 percent

Thus, the milk yield of a cow after one calving is 29 percent below that of a cow after six calvings. The milk yield of a cow after two calvings is 16 percent below that of a cow after six calvings, and so on. Upon reaching the age of nine calvings, the milk productivity of a cow is practically the same as that of a cow after the first calving.

It must be noted that these results are averages. In individual cases, particularly, when good care and maintenance methods are the rule, the milk yield may rise even above the maximum.

As already mentioned above, the milk yield level is affected by the

duration of the dry period. The shortening as well as the lengthening of this period, as against its normal duration, may cause a lowering of the milk yield during the following lactation period.

This circumstance must be born in mind, when the milk yield of various cows is compared.

Miscarriages, particularly when they occur before 8 months of pregnancy have passed, will also result in lowering of the milk yield. Sterility, too, will reduce the milk yield. A sterile cow (a cow that did not calve during the current year) will yield 40 percent less milk, than otherwise.

After calving, the milk yield is not continuously the same from month to month. During the first month the yield rises somewhat, reaching its maximum in 20-30 days. At times the rise continues for 1 1/2 -2 months after calving, then begins to come down at the rate of 5-8 percent per month until the eighth lactation month, and will then descend at a higher rate as a result of a new pregnancy. If the milk yield for each month of the lactation period is computed in percent, relative to the yield for the first month, and the data plotted on a graph, the result will be a line known as the lactation curve.

However, the above noted characteristics of the lactation curve (the short period rise with subsequent gradual descent) can be maintained by strict adherence to feeding standards, which is possible only by the method of stall maintenance. A change in feeding standards will upset the normalcy of the lactation curve. When calving occurs in the late winter months, and feeding conditions are not too satisfactory, then, after the cows have been switched to grazing, the milk yield may rise again, and the lactation curve will have two [maximum values] instead of one.

After proper stall maintenance, the switch to grazing may at first (while the pastures are still inadequate) cause a more abrupt lowering of the milk yield, than the normal lactation curve calls for, with a subsequent new rise (as the grasses grow higher on the more adequate pastures).

Of essential interest is the index for the degree of stability of milk yields during the year. This index can be computed when data is available on the average 24-hour yield for each month of the lactation period, which is the case in each individual sovkhoz and kolkhoz.

Suppose the 24-hour yields by lactation period months are as follows:

MONTH	24-HOUR YIELD (KILOGRAMS)
1st Month	13
2nd Month	12.1
3rd Month	11.3
4th Month	10.4
5th Month	9.5
6th Month	8.8
7th Month	7.9
8th Month	6.9
9th Month	5.8
10th Month	4.3

The milk yield variations in percent relative to the yield for the first lactation month, taken as 100 percent, can be computed. Also, the yield stability index (ratio in percent of the yield of each individual month to the yield of the preceding month), can be computed, as follows:

	LACTATION MONTHS									
	I	II	III	IV	V	VI	VII	VIII	IX	X
Yield Variations in Percent (taking the 1st Month's Yield as 100 Percent)	100	93.1	86.9	80.0	73.1	67.7	60.9	53.1	44.6	33.1
Ratio (In Percent) of Each Month's Yield to the Yield of the Preceding Month (Yield Stability Index)		93.1	93.4	92.0	91.3	92.6	89.8	87.3	84.1	74.1

Such tabulations can be used in milk yield planning.

Yield must be recorded for each individual cow, since this will allow for individual care, will bring out the causes for lowered yields (such as inadequate feeding, sickness), will separate out individual cows with exceptionally high yields, will help establish the most suitable food rations for each individual cow, etc.

All yield records, of incoming and outgoing milk, are in liters. Liters, however, when necessary, are easily convertible into kilograms, since one liter of fresh warm milk at a temperature of 15 degrees Centigrade weights 1,032 grams.

In addition to quantity, the quality of the milk is to be studied. The basic qualitative index for milk is its fat content in percent. This is dependent on the breed, individual characteristics, and on the age of the cow. The fat content gradually lessens with age until the cow is ten years old; then it remains constant. Fat content also depends upon feeding methods (the degree to which concentrated fodders are used, also the change from stall feeding to pasture grazing).

The composition of milk is determined, particularly the content of fat, with special chemical and bacteriological sample tests, taken from morning, midday and evening milkings.

When the fat content of the milk is known, by individual cow, or for a group of cows, it is possible to compute the average fat content, for the entire herd. First, the entire yield is converted into so-called one percent milk (the mathematical product of the entire milk yield by the fat content). This product is then divided by the actual milk yield. For clarification we submit an example.

DETERMINING THE AVERAGE FAT CONTENT IN MILK

Names of Milkmaids	Amount of Milk (In Kilograms)	Percentage of Fat	Converting the Amount of Milk Into 1 Percent Milk
Smirnova	80	3.4	3.4 x 80 = 272
Fedotova	90	4.1	4.1 x 90 = 369
Kazanskaya	70	3.7	3.7 x 70 = 259
Michailova	100	4.2	4.2 x 100 = 420

DETERMINING THE AVERAGE FAT CONTENT IN MILK

	Amount of Milk (In Kilograms)	Percentage of Fat	Converting the Amount of Milk Into 1 Percent Milk
For the			
Entire Kolkhoz	340	3.88	1,320

The average percentage of fat content in milk from the milking of all cows of the kolkhoz is obtained by dividing the total units of 1 percent milk by the total quantity of the milking:

$$1{,}320 : 340 = 3.88$$

Since the fat content of milk varies considerably, it is appropriate to express milk production in terms of fat (by multiplying the milk yield by the percentage of the fat content, and dividing the product by 100), or in terms of butter, that can be churned from the milk yield.

In making butter, the first step is to separate the cream, in other words, practically the entire fat content. In well equipped dairies, this is done by separators. What remains is known as skimmed milk. In churning butter from cream a by-product (buttermilk) is obtained. It ordinarily still contains a small amount of fat (0.3 to 0.5 percent). When the cream is properly separated from the milk, and the buttermilk contains the correct amount of fat, it will take:

29.9 kilograms of milk containing 3 percent fat to produce 1 kilogram of butter;
25.4 kilograms of milk containing 3.5 percent fat to produce 1 kilogram of butter;
22.0 kilograms of milk containing 4 percent fat to produce 1 kilogram of butter;
19.5 kilograms of milk containing 4.5 percent fat to produce 1 kilogram of butter;
17.4 kilograms of milk containing 5.0 percent fat to produce 1 kilogram of butter.

By applying these factors, a milk yield can be expressed in terms of butter. For example, 3,500 kilograms of milk, having a 3.5 percent fat content, can be

expressed in terms of butter, by dividing 3,500 by 25.4. The quotient (137.8 kilograms of butter) is the milk yield in terms of butter. To reduce the milk yield to a homogeneous quality, it is only necessary to re-compute the milk yield in terms of an established standard fat content.

(d) Computing the Average Shear and Total Wool Output

Depending on the breed of sheep, shearing takes place either in the spring only, or, in addition to that, in the fall, and sometimes also in the summer.

In the spring (with the coming of warm weather) all breeds of sheep are shorn. In the fall (before cold weather sets in) coarse-wool breeds and the coarser of the semi-coarse half-breeds are shorn. Sometimes, coarse-wool sheep are also shorn in the summer.

In addition to adult sheep, coarse-wool lambs and half-breed yearlings born during the current year are shorn. Lamb's wool is called felt.

The quantitative index for the utilization of sheep for wool output is the percentage ratio of the number of shorn sheep to the total count of sheep before shearing.

The basic qualitative index is the average shear of wool per one shorn sheep. This value alone is the correct technical index for the wool-bearing capacity of sheep.

However, in calculating the total wool output, complete data on the count of shorn sheep is not always available. In that case, use is made of the wool output index, which is of computation value only; the wool output index is the average yearly wool yield per one sheep for the beginning of the year.

It is important to know the wool yield by fleece characteristics (coarse, semi-coarse, fine) and age of shorn animals (adult sheep and lambs).

Since the sources of continuous data on sheep raising (such as kolkhoz reports) do not classify the wool by fleece characteristics, it becomes necessary to utilize data from selective studies of kolkhoz animal husbandry.

Let us assume that the data from such a study gave the following results:

GROUP OF SHEEP BY FLEECE CHARACTERISTICS	WOOL PER YEAR (IN KILOGRAMS)	PERCENT OF TOTAL
Fine	2,300	23.7
Semi-Coarse Adults	5,400	55.8
Semi-Coarse Lambs	50	0.5
Coarse Adults	1,630	16.9
Coarse Lambs	300	3.1
Total:	9,680	100.0

Suppose, all kolkhozes of a rayon produced a total of 30,200 kilograms of wool. By applying the above ratios, the total yield of fine fleece wool is determined as $\frac{30,200 \times 23.7}{100} = 7,157$ kilograms. By the same method, the yield of semi-coarse wool is determined to be 16,852 kilograms; felt from semi-coarse wool lambs, 151 kilograms; coarse wool, 5,104 kilograms; and felt from coarse wool lambs, 936 kilograms.

In calculating the wool output, it is always necessary to know whether the wool is unwashed or washed. The yield of washed wool varies with the breed of sheep and fleece characteristics. For instance, for wool obtained from merino sheep, the yield is 25-30 percent. In the case of Russian coarse wool, the yield is 80 or even 90 percent.

Between unwashed wool and washed wool there is a partly washed wool, obtained from sheep driven through water (a river or pond) before shearing.

In our statistical practice, the wool from sheep who have died or been slaughtered (so-called "sour wool") is not counted.

(e) Computation Indexes for the Count of Offspring and Accretions in Age and Weight

In studying the fertility of livestock, the following are taken into

account: the total number of females in the herd, the number of females coered, the number of females aborted, the number of females giving birth; the number of calvings, farrowings, foalings, etc, during the year per female reproducer, and the distribution by months; the number of offspring born alive; percent of stillborn, etc.

The number of reproducing females covered, the number of same giving birth, and the number of same giving birth prematurely are the basic indexes for the mating campaign mentioned above and for the offspring yield.

The fertility index for sows and female sheep is the number of live piglets (or lands) per one farrowing (or lambing).

Hogs are the most rapidly reproducing livestock (with the exception of rabbits) due to the fact that one female can have two farrowings per year, with a sizeable litter each time, and also because of the rapid growth of the piglets to sexual maturity. It is possible to obtain within the year the offspring from a sow, born at the end of the preceding year. On account of the large yield of the reproducing females in the hog herd, it is necessary to differentiate between the basic female reproducers (with prior farrowings to their credit) and the female reproducers subject to check, that is, those who after the first farrowing are switched into the category of replenishment stock for the basic female reproducers, or to fattening. Thus if hog raising is unduly disorganized (as it was by the temporary occupation of the German fascist aggressors), it can, under favorable conditions, be rehabilitated very rapidly.

The offspring yield (particularly, in the case of piglets) is expressed not only in head count, but in weight.

A negative factor in the propagation of livestock is the yield of stillborn offspring. Statistically, the number of stillborn is not included in the total count of offspring yield. Nor is it included in the count of dead livestock. It must be remembered that this category belong only offspring actually dead at the moment of birth, and not those that lingered on for a few hours.

Progress of growth of the yearlings is expressed statistically in terms of weight. The weight of the yearlings is determined at the time of passing from one age group into another. For calves these time points are: at birth, upon reaching the age of 6 months, one year, and two years. For piglets: at birth, upon reaching the age of two months, four months, six months, etc. In the absence of special scales, the live weight of the animals is calculated by size measurements, the results being converted into units of weight by the use of special tables.

In studying the results of feeding and fattening of livestock, the following indexes are essential: number of head put to feed; beginning of the feeding period; end of the feeding period; duration of the feeding period; live weight at beginning of feeding period; live weight at end of feeding period; live weight gained; and degree of fattening. When the duration of the feeding period and the general gain in weight are known, the average gain in weight per animal per day can be computed. This index will characterize the results of the feeding operation.

Example: On 1 February 1945, a group of 150 piglets with an aggregate live weight of 5,850 kilograms was put to feeding. On 16 July 1945 the group was taken off feeding, their aggregate weight then being 21,442 kilograms. The feeding period lasted $28+31+30+31+30+15=165$ days. The average gain in weight per head per day was $\frac{15,592}{165 \times 150}=630$ grams.

The average weight of one animal at the beginning was $\frac{5,850}{150}=39$ kilograms; at the end, $\frac{21,442}{150}=143$ kilograms.

One of the indexes characterizing the results of feeding and fattening is the slaughter weight of the animal after the hide, head, entrails and lower parts of legs are removed. This term is sometimes referred to as the "carcass weight".

The index for the degree of fattening is the ratio (usually in percent) between the weight of the internal lard and the carcass weight for cattle and sheep, and the thickness of the outer layer of lard ("shpig") for hogs.

A broader but less precise index for the degree of fattening is the ratio of the slaughter weight of the animal to its live weight. For a higher degree of accuracy this index is to be computed by separate breeds and by the smallest possible age group intervals. The more fattened the live stock, the higher the ratio.

Average live weight and average slaughter weight are very important indexes in animal husbandry. It is best to calculate these indexes by separate livestock age and production groups. However, compound indexes of live and slaughter weight by separate types of livestock as a whole (cattle, hogs, sheep) are also computed.

In evaluating these compound indexes, and particularly when comparing them in terms of time intervals, it must be remembered that variations in the average weight per head for a certain type of livestock may be due not only to the difference in the degree of fattening but also to variations in the age composition of the herd and the slaughtered animals.

In order to deduct from these calculations the exact value of the average weight variation, it is necessary to assume that the herd composition remains the same for the period of computation.

For example: The tabulation below presents data for all kolkhozes in N rayon and cattle meat deliveries to the State for 1940 and 1943.

(Table follows.)

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GROUPS OF CATTLE	1940 Head Delivered	1940 Total Weight (kg)	1940 Average Weight per Head (kg)	1943 Head Delivered	1943 Total Weight (kg)	1943 Average Weight per Head (kg)	Total Weight of 1943 Deliveries Weighted in Terms of Average Group Weights for 1940 (kg)
Bulls over 2 years old	4	2080	520	1	530	530	520
Bulls - Breeders	6	3492	582	2	1182	591	1164
Cows	32	12480	390	8	3136	392	3120
Heifers	4	1176	294	--	--	--	--
Bullocks over 1 year old	15	2970	198	29	5887	203	5742
Calves over 1 year old	6	1008	168	5	825	165	840
Calves under 1 year old	7	476	68	6	414	69	408
Total Cattle	74	23682	320	51	11974	234.7	11794

Although the average weight per head for each group (excepting calves over 1 year old) in the compulsory deliveries of 1943 was higher than the same for 1940, the average weight for all groups taken together in 1943 was considerably below (26.6 percent) that for 1940:

$\frac{234.8}{320} \approx 0.734$, or 73.4 percent; 100 - 73.4 = 26.6 percent.

This was due to abrupt variations in age composition. In 1940 the deliveries consisted mainly of adult cattle, while in 1943 mostly young stock was delivered to the State.

If by the use of the index method the effect of age group variations is eliminated, and the total weight of stock delivered in 1943 is weighted in terms of the average group weights for 1940, the average live weight by the total count for 1943 will be above the same for 1940:

A unit of live weight by total head count, assuming the composition of herd to be the same, will be:

$$\frac{530 \times 1 + 591 \times 2 + 392 \times 8 + 203 \times 29 + 165 \times 5 + 69 \times 6}{520 \times 1 + 582 \times 2 + 390 \times 8 + 294 \times 0 + 198 \times 29 + 168 \times 5 + 68 \times 6} \approx \frac{11,974}{11,794} \approx$$

$1.015 \approx 101.5$ percent.

Assuming the same age group composition, the average weight per head of cattle delivered in 1943, irrespective of age, exceeded same for 1940 by 1.5 percent.

The grand total of the offspring yield and accretions in age and live weight is called the overall live weight output, or the overall growth output of livestock. The determination of this type of output is more difficult than the computations of any other type of animal husbandry output.

There are two methods of computing the overall live weight output. One is by the so-called incoming graph, which is the direct summation of output from the offspring yield and the accretions in the weight of the young and adult stock, and the other by the outgoing graph, in which the overall live

weight output is expressed in terms of the outgoing items in the herd turnover sheet.

The second method is the simpler one, and hence is more often used. To apply it, it is necessary to express the herd turnover items in units of live weight. The incoming item "Passed from Younger Groups" and the outgoing item "Passed into Older Groups", are replaced by the arithmetical difference in the two, which will show accretion in live weight due to growth. This accretion is placed on the incoming side of the herd turnover sheet, as well as the gain in weight due to fattening. It then becomes possible to express the offspring yield and the weight accretion in terms of other items on the herd turnover sheet. At this point some conventional designations are employed. Let "B" be the live weight at the beginning of the period; "E", the same at the end of the period; "P", same for cattle procured from the outside; "O", same for offspring yield; "F", the live weight accretion due to fattening and growth; "D", the live weight of stock delivered to State, sold and transferred; "S", the live weight of stock slaughtered on the farm; and "M", the live weight of stock perished.

Then, in terms of herd turnover, the following equation is constructed: $B+O+F+P=D+S+M+E$. From this: $O+F=(E-B)-P+D+S+M$.

Hence, the live weight output, in terms of offspring and growth (their sum), equals the differential between the live weight of the entire herd at the end and at the beginning of the year, less the live weight of cattle procured from the outside plus the live weight under all outgoing items during the year.

The final formula for the overall live weight output will be:

$O+F=(E-B)-P+D+S$.

The count of livestock, in terms of live weight, is called the "meat potential", or meat reserve "on the hoof". At the end and the beginning of each year (E-B) determines its variations for the year. This differential, showing the increase in the meat reserve, less the live weight of the stock procured from the outside, will furnish the proper concept for the overall live weight output (E-B-P).

It follows from the above formula, that the live weight output covers the losses to the herd sustained through compulsory deliveries, sales, transfers and slaughter on the farm, and, in addition, shows up in the live weight accretion of the entire herd (meat potential), if everything runs normally. When the live weight under the outgoing items exceeds the combined live weight of the offspring and growth accretion, the differential (E-B) will have a negative value, i.e., the herd will have sustained a loss in overall live weight during the year (not counting the live weight of stock procured from the outside, which in some cases will overbalance the losses sustained by the herd).

The compound indexes for the overall live weight output of the herd are its average value per reproducing female at the beginning of the year, and the percentage ratio of the same average value to the value of the meat potential at the beginning of the year.

The computation procedure can be illustrated on the above herd turnover sheet by using the live weight values as indicated in the table below.

In this case the overall live weight output equals 364.2 centners, which means, on the average, 214 kilograms per cow at the beginning of the year, and 29.7 percent relative to the value of the meat potential at the beginning of the year.

Based on the above, not only the overall live weight, but also the commodity live weight output may be computed. The latter equals the combined live weight of stock delivered to the State, sold, transferred, etc., i.e., 297.6 centners, which makes on the average 175.2 kilograms per cow at the beginning of the year, 24.3 percent of the meat potential at the beginning of the year, and 81.7 percent of the overall live weight output.

(Table follows.)

COMPUTATION OF LIVE WEIGHT OUTPUT OF CATTLE IN SOVKHOZ N FOR 1939

GROUPS OF CATTLE	Average Live Weight per Head (kg.)*	Number of Head		Meat Potential			Procured from the Outside during 1939		Delivered to State, Breeding Station, Sold, Transferred		Slaughtered on the Farm		Live Weight Output (centners) col 7 - col 9 + col 11+ col 13
		1 Jan 1939	1 Jan 1940	1 Jan 1939 (centners)	1 Jan 1940 (centners)	Variation for 1939 (col 6 - col 5)	Number of Heads	Live Weight (centners)	Number of Head	Live Weight (centners)	Number of Head	Live Weight (centners)	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bulls - reproducers	700	4	5	28	35	7	--	--	--	--	--	--	--
Cows	440	170	180	748	792	44	--	--	17	74.8	1	4.4	--
Heifers	300	25	25	75	75	--	--	--	--	--	1	3.0	--
Bullocks Born 1937	320	8	--	25.6	--	-25.6	--	--	7	22.4	--	--	--
" " 1938	220	53	1	116.6	3.2	-113.4	--	--	49	107.8	2	4.4	--
" " 1939													
" at the End of Year	180	--	57	--	102.6	102.6	--	--	28	28.0	5	5.0	--
" at middle of the Year	100	--	--	--	--	--	--	--	--	--	--	--	--
Calves Born in 1937	280	32	3	89.6	9.0	-80.6	3	8.4	5	14.0	--	--	--
" " in 1938	190	76	50	144.4	140.0	-4.4	2	3.8	20	38.0	--	--	--
" " in 1939													
Calves at the end of Year	160	--	79	--	126.4	126.4	--	--	--	--	2	1.8	--
" at the Middle of Year	90	--	--	--	--	--	--	--	--	--	--	--	--
Adult cattle in fattening	420	--	--	--	--	--	--	--	3	12.6	1	4.2	--
Totals	-	368	400	1227.2	1283.2	56.0	5	12.2	129	297.6	12	22.8	364.2

Footnote to Column 2:
*) The live weight of young livestock of a given group at the end of year is accepted as equal to that of the next older group. The live weight of young stock up to one year of age, for the purposes of delivery, slaughter and sales, is taken as its weight at the middle of the year.

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(f) Manure Yield Determination

To determine the overall yield of manure, the average yield per head (by types and age groups) and the total head count (by types and age groups) must be known.

The standard yield of fresh manure for each individual farm can be determined by the formula $M=(\frac{F}{2} + B) \times 4$, where M is the weight of manure, F is the weight of dry fodder, B is the weight of the dry bedding. Then, $\frac{F}{2}+B$ expresses the weight of dry manure. Wet manure contains 75 percent water and weighs 4 times as much as dry manure, as seen from above formula.

When figuring manure yield for an aggregate of farms of a rayon, oblast, etc, the average yield per head by types and age groups is taken as a basis. The following figures are generally accepted: a horse yields 8 tons of manure per year; a working bull, 10 tons; a bull assigned to fattening, 16 tons; a cow in stall maintenance, 12 tons (when the grazing period is taken into consideration, the yield amounts to 6 tons); young cattle in stall maintenance, 8 tons (when the grazing period is taken into account, the yield is 4 tons); sheep (including grazing period), 0.5 ton; hogs in fattening, 1.5 tons, etc.

When the above figures and the average annual head count of livestock by types and age groups are known, it is possible to compute the overall manure yield by types of farms within a given territorial unit.

(g) Calculating Meat Output

Data on the meat output of sovkhozes and kolkhozes is available in annual reports. Kolkhozes furnish general data only (without breakdown by types). They report the planned meat deliveries to the State in terms of the number of head only, without indicating weights, which makes it impossible to tell at a glance the average slaughter weight per head by type of livestock.

Hence the overall meat output for kolkhozes, by types of meat, has to be calculated. It is necessary to know, on the one hand, the number of head delivered to the State, slaughtered on the farm, unavoidably slaughtered, and sold for slaughter, by types and age groups, and, on the other hand, the average slaughter weight per head by the same types and age groups.

The mathematical product of these two components will express the meat output by types of livestock. The summation of the above mathematical products will express the output by separate types of meat (beef, veal, lamb, pork) and the overall meat output.

The data on the number of head delivered by sovkhozes and kolkhozes can be obtained from their annual reports.

The number of head slaughtered or unavoidably slaughtered on the farm is furnished by sovkhozes in their annual reports. For kolkhozes and other types of farms, the number of head slaughtered is to be calculated by means of mathematical indexes obtained through selective studies. These indexes are ratios of the count of livestock (by separate groups) slaughtered during the year, to the total count of livestock at the beginning of the year, or to the average annual head count, or to the turnover count.

On the basis of these indexes and the data on the total count of livestock by the respective types of farms, the general number of head slaughtered by separate types and age groups can be computed.

By the same method the number of head for meat deliveries to the State can be determined.

The only data that is lacking is the number of head sold for slaughter, since this sub-category is not isolated from the general item, "Number of Head Sold").

The average slaughter weight of livestock by types and groups can be obtained from annual reports in the case of sovkhozes, from selective studies in the case of kolkhozes.

Below there follows the computation of meat output for kolkhozes of a given rayon (in terms of cattle and hogs).

Supposing that on the basis of data obtained by a selective study for the second half of the year for the kolkhozes of a given rayon, the percentage ratios of the combined head count delivered to the State and slaughtered on the farm to the general head count for 1 January of the current year were extablished. In addition data on the general head count for all kolkhozes

of the rayon are given. From this initial data, the general count of head delivered to the State and slaughtered on the farms during the year, for all kolkhozes of the rayon, can be calculated provided that the number of kolkhozes selectively investigated is sufficiently large to make the results representative for all the kolkhozes of the rayon.

See tabulation below:

COMPUTATION OF HEAD COUNT OF CATTLE AND HOGS DELIVERED TO THE STATE AND SLAUGHTERED ON KOLKHOZES OF "N" RAYON OVER ONE YEAR

Types and groups of livestock	Percent Ratio of deliveries to State to the head count for 1 January as per selective study	Percent of animals slaughtered on the farms	General head count for all kolkhozes of rayon on 1 January	Head count in all kolkhozes of rayon	
				Delivered to State	Slaughtered on the farms
CATTLE					
1. Bulls - reproducers	10	5	310	31	16
2. Cows	6	2	3300	198	66
3. Heifers	0.2	-	900	2	--
4. Calves, bullocks and oxen over 1 year old	9	12	1230	110	148
5. Calves up to 1 year	3	2	2900	87	58

HOGS					
1. Hogs over 9 months	25	13	650	163	85
2. Hogs (4-9 months old)	38	20	420	160	84
3. Piglets up to 4 months	--	11	380	---	42

According to the data obtained by the selective study, 10 percent of the total 1 January head count of reproducing bulls was delivered to the State during the year; five percent were slaughtered on the farms. Surmising that the same ratios (if a sufficient number of representative kolkhozes were selected for study) hold true for all the kolkhozes of the rayon, and knowing the head count of reproducing bulls for 1 January of the current year, the number of bulls delivered to the State and slaughtered on the farms for all kolkhozes can be computed. The number of bulls delivered to the State is $\frac{310 \times 10}{100} = 31$; the number of bulls slaughtered is $\frac{310 \times 5}{100} = 16$. The same calculations are made for other groups of livestock.

When the slaughter weight of livestock is known, it is possible to compute the meat output. As per the table below (slaughter weights taken at random):

COMPUTATION OF MEAT OUTPUT FOR ALL KOLKHOZES OF "N" RAYON

TYPES AND GROUPS OF LIVESTOCK	HEAD COUNT OF LIVESTOCK		Average slaughter weight per head (kg)	MEAT OUTPUT (centners)		Totals
	Delivered to State	Slaughtered within		From deliveries to the State	From stock slaughtered on farms	

CATTLE						
1. Bulls - reproducers	31	16	320	99.2	51.2	150.4
2. Cows	198	66	230	455.4	151.8	607.2
3. Heifers	2	--	150	3.0	---	3.0
4. Young stock over 1 year old	110	148	105	115.5	155.4	270.9
5. Calves up to 1 year	87	58	80	69.6	46.4	116.0
Total Beef	--	--	--	673.1	358.4	1031.5
Total Veal	--	--	--	69.6	46.4	116.0
Grand Total	--	--	--	742.7	404.8	1147.5
HOGS						
1. Hogs over 9 months	163	85	90	146.7	76.5	223.2
2. Hogs (4-9 months)	160	84	40	54.0	33.6	87.6
3. Piglets up to 4 months	---	42	7	--	2.9	2.9
Total Pork	---	--	--	200.7	113.0	313.7

If the complete herd turnover sheet is drawn up by separate age groups, with its usual items for livestock delivered to State and livestock slaughtered on the farm (including unavoidable slaughter), the slaughter weights from the above tables will make it possible to compute the meat output.

Continuous data on the storing and procurement of livestock by the State is available from the reports of the People's Commissariat of Procurement and the People's Commissariat of Meat and Dairy Industry.

The offices of these commissariats publish ten-day and annual operative schedules on the storing and procurement of livestock.

The ten-day schedules contain data on compulsory deliveries by kolkhozes, by kolkhoz member households, by private farmers, by workers and employees (combined), and on livestock deliveries by sovkhozes (computed in terms of live weight). The offices of the People's Commissariat of Procurement publish monthly schedules in which additional data on the source distribution (whether from kolkhozes, kolkhoz member households, private farmers, workers and employees) is furnished. The present data is presented in terms of totals for all types of livestock lumped together.

The annual reports contain data on the following: (1) entries on meat delivery accounts in terms of the overall total with segregations for (a) sovkhozes, (b) kolkhozes, (c) kolkhoz member households, private farmers, workers and employees; (2) entries on the State purchase accounts. All data are furnished by individual types of livestock, by head count, and by live weight, with the cost of procurement indicated.

(h) Accounting for Leather Production

Leather production is determined by the number of slaughtered and otherwise dead animals excluding those that died of a contagious disease whose hides cannot be used.

The number of dead animals by age groups may be determined, if the percentage of dead animals is known, based on selective investigations of animal husbandry and numerical head count of overall inventory (census) of livestock. For more general summary calculations, data on livestock mortality, found in monthly kolkhoz reports on animal husbandry may be used (form No 24).

Example: Kolkhozes, which happened to be included in a rayon selective examination of kolkhoz animal husbandry, on 1 January of the accounting period had 350 cows.

In the course of the year 21 cows were turned over to the state against meat deliveries, 7 cows were slaughtered in the enterprise. One cow died. It is not difficult to calculate that the percentage of cows delivered to the government to their number on 1 January is $\frac{21 \times 100}{350} = 6$. The percentage of those slaughtered is 2, and the percentage of dead cows is 0.3.

Assume it is known that the inventory on 1 January of the accounting year for all kolkhozes of a given rayon shows 3,300 cows. It is not difficult to determine the numbers of delivered, slaughtered and dead cows in all the kolkhozes of the rayon. As previously computed (see Russian text page 98) 198 cows were delivered to the State. 66 were slaughtered in the enterprise and 10 cows died ($\frac{3300 \times 0.3}{100} = 10$). The number of cowhides in this example is $198 + 66 + 10 = 274$ (that is, if no cows died from contagious diseases).

If we have established the herd turnover, it should be simple to determine the hides output from animals of different types and groups. To this end it will be necessary to use the same items of turnover: government deliveries, slaughter in the enterprise and

mortality.

We emphasize that one should not consider the production of meat and hides as agricultural. The accounting methods are described here only because the accounting data are found among sources handled by agricultural statistics.

(i) Most Elementary Analysis of Production Data in Animal Husbandry.

Data analysis of animal productivity and products of animal husbandry is usually conducted in following breakdowns:

(1) analysis of the degree of performance of planned output in animal husbandry by types.

Particular importance is attached to checking the plan on animal productivity (milk yield per forrage cow, wool yields etc.) in each separate kolkhoz in connection with determining the additional earnings of kolkhoz members for increasing the yield of agricultural crops and productivity in animal husbandry.

(2) study of movement (by categories) of average indexes of animal productivity (milk yields, wool yields, on-the-hoof and dressed weights, etc.) and overall volume of animal husbandry production by separate branches.

In the compilation "Socialist Agriculture of USSR", the following data are presented on milk and wool production in USSR (page 73, published 1939).

	1932	1938 (Estimated) (thousands of tons)	1938 in percent of 1932
Milk	20,558	28,861	140.4
Wool	69	133	192.8

In the same publication (page 78) we find data on the growth of animal productivity on kolkhoz farms; below are a few of these indexes:

	1932	1937	1938
Average milk yield per forage cow (kilograms)	931	1,027	1,100
Wool yield per sheep at the beginning of the year (kilograms)	1.9	2.4	2.5
Average weight of cattle delivered to the government (kilograms)			
Cattle (excluding oxen)	182	225	225
Hogs	53	84	86

Should we want to study the changes of the total volume of animal husbandry production, we must compute these in monetary terms. To obtain an idea of time changes in the physical volume of production, it is necessary to apply the index method, evaluating production for the various years by constant base-year prices.

In the same compilation we find the following data on animal husbandry production in millions of rubles based on constant prices of 1926/27 (Russian text page 86):

1913 - 4,579.0 million rubles

1932 - 3,292.6 million rubles

1937 - 5,053.5 million rubles

From this we may compute the following indexes of physical volume of animal husbandry production (adjusted for price changed):

1937 relative to 1913 $\frac{5,053 \times 100}{4,579} = 110.4$ percent

1937 - 1932 $\frac{5,053.5 \times 100}{3,292.6} = 153.5$ percent

(3) Study of dynamics of average volume of production in animal husbandry (by separate branches) per capita.

(4) In studying the seasoned inflow receipts of animal husbandry production (for example, milk, wool) the total annual yield should be distributed (in percent) by months or quarters.

(5) Indexes of distribution of animal husbandry production in kolkhozes; are of considerable interest and of practical application. These include the percentage of production delivered to the State, sold, used in the enterprise for production (for example, milk for calves and young pigs), reprocessed, distributed among kolkhoz members by work-days. With these data we are able to compute indexes showing the part produced for sale of individual products of animal husbandry.

(6) Study of geographic location relative to the factors of animal husbandry productivity within rayons, oblast and kray. Apparent differences in productivity indexes of individual sections of the territory under study should be explained, in terms of the unequal distribution of different cattle breeds, feeding conditions, and the overall organization of animal husbandry.

(7) In analyzing productivity indexes (in rayon in oblast), one should widely use the group average method and also single out particularly outstanding enterprises (sovkhozes, kolkhozes) and individual outstanding leaders in animal husbandry (milk-maids, swineherds, etc) with descriptions of their accomplishments. As grouping basis, in computing group averages of the level of animal productivity, various indicators may

be used, selected according to the purpose of the investigation. Examples of indicative factors are: computation of indexes of productivity by groups of cattle by breeds (for example, milk yield, in breeding farms, per purebreed cow of planned breed, per cross-breed cow of planned breed, and per cow of other breeds and non-bred cows. Other indexes show the introduction of piece-work pay on kolkhoz farms; seniority of farm-workers; percentage of (concentrated) and succulent fodder in overall fodder consumption (computed in fodder units); availability of animal yards and the necessity of keeping cattle in the yards of kolkhoz members, etc. Of great interest is the comparison of productivity indexes of animal husbandry in kolkhozes prior to and after the order introducing additional pay for work.

In the compilation "Socialist Agrriculture of USSR, we find published for the first time not only total average productivity indexes of animal husbandry, but some group averages are shown, as well as achievement data on leading oblasts, individual leading establishments, and individual leaders of animal husbandry. For example, you find data on average milk-yield per forrage cow by pure-bred and improved hers in kolkhoz breeding farms, as group averages according to individual breeds of cattle in 1938 (from 2,250 kilograms to 1,684 kilograms). Also shown are group averages of wool yield per sheep in 1938: in sheep-raising sovkhozes of People's Commissariat of sovkhozes (3.2 kilograms), in all kolkhoz sheep-raising farms (2.5 kilograms) and in particular in breeding farms with sheep of a local merino breed (5.2 kilograms) and in breeding farms with Rambouillet sheep (5.1 kilograms).

Such an analysis of data on production indexes makes it possible

to bring out and thoroughly study the experiences of leaders in animal husbandry, and make their achievement the property of and example for other sovkhozes, kolkhozes and rayons. Such an analysis enables us to determine the production potential in animal husbandry. It is also necessary to expose kolkhozes, rayons lagging behind, so that their backwardness may be overcome.

Very effective in studying causes of backwardness is the comparison in the same rayons between kolkhozes, having approximately the same conditions for developing animal husbandry (for example, the same fodder basis) but which have produced different results in safeguarding and developing herds, according to animal productivity indexes.

(k) Data Sources on the Number of Cattle and Production in Animal Husbandry

As sources of data on the number of cattle and animal husbandry there are the animal reports and periodic accounts of agricultural enterprises, as well as reports compiled by the central Statistical Administration Gosplan, USSR and its local branches.

From the animal reports of kolkhozes and sovkhozes we gather information regarding the number of cattle as well as primarily on animal husbandry production; the sovkhoz annual reports show detailed fluctuations in the composition of herds, according to individual types of cattle.

Periodic reports supply data on the number of animals and their fluctuations (offsprings, purchase mortality, etc.) as well as certain phases of animal husbandry production. Kolkhozes are obliged to hand in monthly reports on the state of animal-husbandry on form No 24.

The organization and analysis of this accounting is entrusted the Council of People's Commissars to TsSU Gossplan USSR and its local branches.

Kolkhoz reports on the state of animal husbandry contain the following questions: organization of new farms, count the end of the accounting month of horses, cattle, hogs, sheep and goats except for reproducing females, yearlings born during the current year, work horses and work oxen; number of offsprings from the beginning of the year up to the accounting date excluding the number that did not live; livestock mortality of all ages; number of head of cattle contracted for with kolkhoz members, workers and employees) for organizing and rounding out kolkhoz animal husbandry farms; purchase of cattle for the same purposes (including cattle taken off the contracted list); on milk yield (from the beginning of the year up to the accounting month); mating of female reproducers belonging to the kolkhoz; small stock-farming in kolkhozes (count at the accounting date of mature rabbit does and mature birds of all types, number of bee colonies on 1 June and 1 November); availability of fodder for common herd (these data are supplied monthly during the stall-feeding period from 1 October till 1 May). Kolkhozes are obliged to send in their reports on Form No 24 through the village council to the rayon inspector of TsSU Gosplan USSR on the first of every month. Rayon inspectors must collect the reports without fail from all the kolkhozes of the rayon not later than the 3rd day after the accounting month. They must check the correctness and completeness of the submitted reports, and whenever necessary obtain from the kolkhozes additional information and prepare the rayon summary of the accounts. Not later than the 5th of the month following the accounting month summary totals of the number of head of cattle, offsprings, and mortality should be telegraphed to the oblast (kray) representative of Gosplan USSR or to the statistical administration and simultaneously the rayon summary of all indexes in the report should be mailed.

Twice a year (on 1 January and 1 July) additional summaries

are compiled, dealing with kolkhoz groups according to the number of female reproducing head of cattle.

Accounting Form No 24 gives sufficiently detailed material for systematic checking whether we are meeting the government program for animal-husbandry in kolkhozes, also whether Party and State resolutions on animal husbandry are being observed. It is for checking the quality of work performed in the kolkhozes in this most important brand of agriculture. The most reliable material on the head-count of cattle, collected on a wider basis than from other sources of the program, embracing all types of enterprises in a single statistical operation, with the most reliable results, are special cattle censuses, organized and conducted by the Central Statistical Administration and its local branches.

The first special cattle census was conducted as of 1 February 1932, the next on 1 January 1935, and from then on up to the Great Fatherland War, cattle census was conducted yearly, excluding 1939 when it was found impossible to conduct a cattle census due to the fact that a population census was conducted on 17 January.

The basic objective of a cattle census, which serves as a basis for the cattle program and organization, is to obtain data necessary to check on the fulfillment of the government program for development of animal husbandry and at the same time to develop plans for further expansion of this branch of agriculture, as well as current operations in animal husbandry.

One of the basic characteristics of the organizational plan of Soviet cattle census should be considered the established order of conducting the census. In prerevolutionery days, as well as during the first years of Soviet agricultural statistics, the census was conducted by the so-called "Expeditionary" method, i.e. census takers question representatives of separate enterprises as to the number of factors of agricultural production, and in most cases the census taker

did not call at individual homes but the enterprise representatives were summoned to the census taking site (school, reading-hut, questioning at meetings, etc). Soviet livestock census taking developed a procedure of its own, peculiar to individual categories of the economy, and radically different from the procedure formerly employed. Government enterprises, cooperative enterprises and kolkhozes receive census blanks from the rayon or section inspectors of Central Statistical Administration Gosplan USSR and are obliged to fill these blanks by a given date. An enumerator on the spot checks that the blanks are properly filled. In kolkhozes the enumerators are obliged to verify the figures by actual head count. Actual count, up to 1 January 1938, was also compulsory for government and cooperative enterprises.

Inasmuch as, in practice and, as a rule a high degree of accuracy was evident in filling census blanks by government and cooperative enterprises, while an actual count (especially in large animal husbandry sovkhozes) was very difficult for the enumerators, beginning with the cattle census on 1 January 1938, it has been permissable to check the correctness of entries in this type of enterprise, by comparing the entries in the blanks with the cattle inventories on 1 January. Only in cases where such comparisons uncover discrepancies, is the enumerator obliged to take an actual count.

In counting the personal cattle of a kolkhoz member, private peasant, workers and employees and other groups of the population, the enumerators must call on each enterprise, question the owner about the number of cattle he owns, and then actually see the cattle.

Thus for State and cooperative enterprises and for kolkhozes, the accepted basis for Soviet livestock census, is their own accounting of the number of livestock available at a given census date, with subsequent checking by enumerators or inspectors of the Central Statistical Administration.

Basic document for setting up the account, census cards, are livestock inventories (inventory records) which should be taken yearly on 1 January by all socialist agricultural enterprises.

The method established to obtain information on the number of livestock held by individual owners is known in statistics as direct observation. This method assures relatively higher degree of accuracy than the questionnaire method.

One of the basic characteristics of our livestock census, which should reflect maximum accuracy in the number of head of cattle, is the checking of data collected during the census by specially organized selective check-calls on kolkhoz-members, private peasants, workers and employees. Rayon corrective coefficients are based on these control-calls, which enable us to compute the corrected rayon census totals.

Control-calls in predetermined populated areas, picked by mechanical-selection, are made immediately after completion of census taking, which is done by special teams, headed by individuals approved by the rayon managing organizations. It is composed of members active in local organizations.

Thus, the results produced thread through all levels of the economy. In socialistic agricultural enterprises complete control is exercised, and information from every enterprise is included in the census totals. In individual enterprises control is exercised by the selective method, coefficients of undercounting are computed on the basis of control data, which are applied to the rayon census totals to arrive at adjusted totals.

The basic question in the cattle census program is the division of animals counted (by separate types) into sex and age groups.

4. Accounting and Statistical Indexes for Fodder and Livestock Feeding

(a) Fodder groups and their nutritional values.

The goal of a well organized feeding program is to select sack fodder that would enable the animals to produce the maximum quantity and best quality of output per fodder unit.

Fodders vary considerably, but it is accepted practice to consolidate them into the following basic groups (in stall feeding); (1) coarse fodder (hay, straw, chaff); (2) succulent fodder (green fodder, silage, edible root plant fodder, byproducts of certain industrial crops, etc); (3) strong or concentrated fodder (grain fodder, bran oil cake, fodder mixes and others).

Various types of fodder have different nutritive value. As a result, with a variety of fodder, in establishing fodder norms it is necessary to express the nutritive value of fodder in some single units of measure. In comparing nutritive value our accepted unit is the nutritive value of one kilogram of average quality oats.

In addition to the nutritional value of fodder, expressed in fodder units, it is necessary to know the contents of one of the most important elements of food: albumen (digestible, i.e. can be assimilated by the body).

Problems of accounting in animal feeding are divided into three main parts: determining the production and stocks of fodder, establishing fodder consumption, and preparing a fodder balance sheet.

(b) Determining Stocks of Fodder

Conditions of animal feeding during the course of a year change by individual periods. Basic feeding periods are the stable feeding (winter) period and the grazing period.

For a proper organization of summer feeding it is necessary to consider all pastures, which vary considerably, which determines

their productivity.

Pastures are divided into natural (meadows steppe, mountain, woods, swamps etc) and seeded (seeded with fodder grass). Seeded pastures may be permanent, provided they are outside the scope of crop rotation. If, however, the seeded pastures are part of meadow-pasture crop rotation, they are used several years in a row when planted with perennial fodder plants (alternating pastures) or for one year with yearly fodder crops (yearly pastures).

In addition to special pastures, woods, stubble, meadows etc are used as pastures, however, the use of certain parcels and sections (meadows fallows) is contrary to the best usage in agrarian technique.

To determine posture yields, selective area method may be employed, similar to the method used in estimating yields of standing grains. The test area is moved and the average grass weight is determined per area, and later, per hectare. If we know the pasture yield per hectare it is possible to estimate potential yield for all commons and pastures, in natural units, as well as (by computation) in fodder units and in digestible albumen.

To determine the average length of time that animals are in pastures or in stalls in all the kolkhozes of a rayon, we use the weighted arithmetic mean of the data supplied by individual kolkhozes (the number of kolkhozes are the weight).

If individual kolkhoz data regarding assignment to pasture or to stalls covers different months, the number of days of the first month (30 or 31) is added to the days of the second month and the weighted average is computed from these totals. If the average is larger than the number of days in the first month, then to obtain a final figure this number of days ~~are~~ deducted from the average.

Example: Assume that 3 kolkhozes put their cattle to pasture on 25 April, 5 on 28 April, 8 on 30 April, 17 on 2 May, 9 on 4 May 6 on 5 May.

In determining the average time in pasture, take April as a basis and add 30 days to the May dates. To find the average time proceed with the formula for weighted arithmetic averages:-

$$\frac{25.3 + 28.5 + 30.8 + 32.17 + 34.9 + 35.6}{3 + 5 + 8 + 17 + 9 + 6} = \frac{1515}{48} = 31.6$$

The average date when the kolkhozes began to put out their cattle to pasture is 31.6 - 30 = 1.6 or 2 May. If the average would turn out less than 30, for example 29, then the average date would be considered 29 April.

Data on fodder production for stall feeding of animals (other than industrial byproducts) is obtained from statistics of plant cultivation (hay from natural hayfields, production of sown grasses, root plant fodder, silo crops).

The greatest difficulties arise in determining straw yield, which is often very inaccurately accounted for by the kolkhozes.

In individual enterprises (in sovkhozes, kolkhozes) course fodder (hay, straw) after harvesting is stacked in ricks, stacks and hay sheds without being first weighed. To determine fodder reserves, ricks, hay stacks, hay in the sheds, silage in silos and trenches are measured. These measurements are used with the help of specific formulas to determine the volume of hay stacks, ricks, sheds, and trenches and silos, and then by means of tables showing weight per cubic meter for the various products, these are converted into weight units. It should be remembered that with time, hay, straw and other products pack, and their unit weight per volume increases (provisions are usually made for this in tables).

In addition to fodder production, it is necessary to study the indexes of utilization of the feeding supplies. Most important of these are: degree of performance of the planned output in hay harvesting; dead-lines of hay harvesting (extention of these dates has an adverse

influence on yield and quality of hay): utilization of the second harvest of perennial grasses and second growth of natural hay harvests; degree of utilization of hay harvested by combines; degree of performance of planned silage output; detree of performance of plans for the improvement and expansion of meadows and pastures.

(c) Determining Fodder Consumption

Part of the fodder produced in an enterprise is supplied to the Government on compulsory delivery; a part is delivered to MTS as payment-in-kind; part is sold and part is used for seeds. In kolkhozes a certain part of the fodder is distributed among kolkhoz members by work-days.

Part is put into an emergency fund, but the greater part of the fodder is used within the economy for feeding livestock.

Consumption of fodder resources should be studied by the enumerated items (in actual units and in percent). The basic index of cattle feeding is average consumption per animal according to type, age and production groups (for 1 work horse, for 1 cow; for 1 calf, etc.) over a specified period of time, usually a year. Fodder consumption is computed on an average yearly number of head, which is the correct basis. In rough approximations, the number of heads on 1 January may be used, i.e. approximately in the middle of the stable feeding period.

For herds of swine with their fast turnover, fodder consumption is often computed on an average for one abstract or conventional sow, which means that the quantity consumed by the entire herd is divided by the number of mature sows.

In instances of insufficient mass data regarding fodder consumption by separate types and groups of animals, the average fodder consumption per animal converted into conventional quantities consumed by cattle, is used as an index for computation.

For consumption computations the following conversion coefficients are used (in computing the number of livestock into expensive animal units, somewhat different coefficients are used):

Mature horse	1.9	Hogs over 4 months old	0.6
Cow, bull, ox	1.0	Calves up to 1 year	0.25
Norse yearlings	0.9	Young pigs 2-4 months	0.2
Cattle over 1 yr	0.5	Sheep & goats all	0.1

Mature horse, cow, bull, ox	1.0
Horse yearlings and cattle over 1 year old	0.5
Colts up to 1 year	0.25
Calfs up to 1 year	0.125
Sheep and goats mature	0.1
Lambs and kids	0.062
Hogs over 4 months	0.25
Young Pigs up to 4 months	0.05

In evaluating the actual feeding of livestock, the computed average consumption per head should be compared with zootechnical feeding norms. With proper organization of livestock, feeding norms are set up for each group (known as fodder class) in fodder units and digestible albumen.

Fodder norms (yearly, monthly, daily) are composed of two parts: sustaining fodder (i.e. fodder essential for the maintenance of life) and productive fodder (i.e. fodder required for working or producing agricultural products. The amount of sustaining fodder depends on the animal weight-on-the-hoof, while the amount of productive fodder or the type of work (slight, medium, heavy) or on the productivity of the animal (for example milk yield of cows). To express the norms in concrete fodder, fodder rations must be drawn up, the composition of

which depends on the availability in the enterprise of this or that type of fodder.

Knowing the fodder norms, fodder rations and the number of animals by fodder groups, it is possible to compute the necessary quantities of fodder for a day, a month and for the entire stall feeding period. for a group of animals which is part of each class and for the whole herd as a whole.

Knowledge of actual average feeding norms is necessary primarily for the following objectives: (1) feeding norms when compared with weights on-the-hoof and livestock productivity, present one of the most important qualitative indexes of animal husbandry, enabling one to conclude whether the average fodder rations assure normal development of the animals, in serving an increase in their productivity. (2) It is necessary to know the fodder consumption per head for drawing up a feeding balance sheet. The most important index of productivity of fodder utilization is the average consumption of fodder compared with a unit of production.

(d) The Concept of Fodder Balance

To establish the relationship between the availability of fodder and its use, we draw up fodder balance sheets, according to separate types of fodder (in natural units) and according to all fodder (not onlu in natural units, but also in fodder units and digestible albumen).

One should distinguish between fodder balances of separate enterprises (sovkhozes, kolkhozes), necessary to them for a proper organization of livestock feeding, and balances which embrace the sovkhozes, kolkhozes within the rayons, oblasts, krays, republic, for the study of livestock feeding in general, for feed planning,etc.

A difference is made between planning balance sheets and accounting balance sheets.

An accounting fodder balance sheet is made up of the following basic divisions: (1) Fodder on hand at the beginning of the accounting periods. (2) Fodder income during the period of accounting (fodder production and delivered from the outside). (3) Fodder expenditure (deliveries to the Government, payment in kind to MTS, quantity of fodder, fed to livestock, according to types and basic groups of animals, sale, distribution among kolkhoz members according to work-days). (4) Fodder reserves. (5) Free fodder balance at the end of the period of accounting.

(e) Basic Data Sources on Fodder Stocks and Livestock Feeding

Basic sources of statistical data regarding stocks of fodder are the kolkhoz and sovkhoz annual reports. In the sovkhoz annual reports we find data on fodder production and acquisition from the outside, as well as on fodder consumption by groups of livestock. For each such group the average yearly number of feed-days and average yearly and average group number of head of cattle is indicated. The kolkhoz annual reports are more limited in the scope of their data on livestock feeding. Here you find information on fodder production only in the enterprise, but no data on outside acquisitions. Accordingly, from this source, it is impossible to determine the overall size of fodder reserves in the kolkhozes of a rayon, oblast, etc. To a certain degree this void is filled by selective examinations of kolkhoz animal husbandry, during which one determines the quantity of concentrated fodder acquired: oats; barley, other grains and beans, flour and bran.

Selective investigation was formerly also applied to determining the amount of fodder used in animal feeding, but today this question is absent from this source.

Kolkhoz periodic reports supply information on the progress of fodder preparation (Form #22, sent in by the kolkhozes during the

harvesting of fodder crops) and on fodder stocks, according to their groups (monthly report form #24, in which the given items should be filled in during the stall-feeding period - from 1 October to 1 May). Furthermore, the kolkhoz periodic reports provide one with certain indexes regarding utilization of fodder bases: progress in the fulfillment of quotas for hay harvesting, silage harvesting and improvement and development of meadows and pastures.

Sufficiently complete data on the receipt of fodder and its consumption in kolkhozes is contained in the budgets of kolkhoz members.

Example on this subject:

Solve the following example on the above subject:

Sovkhozes A and B have the following information on the number of livestock and production of animal husbandry.

On 1 July 1940, sovkhoz B set out 240 hogs for fattening, with a total weight of 8,880 kilograms. On 1 December 1940, these hogs were called in, and the weight of the entire lot turned out to be 35,320 kilograms.

Based on the above date:

(1) Determine for each sovkhoz the number of fodder-days for cows and the average number of fodder cows and milch cows in January 1940.

(2) Compute indexes showing changes in the number of cows and calves in 1940 for both sovkhozes.

(3) Compute indexes for the degree of plan fulfillment pertaining to outgoing livestock (cattle and hogs for both sovkhozes).

(4) Compute indexes of the degree of retention in 1940 of the entire herd of mature cattle, calves born in 1940, as well as the entire herd of hogs for both sovkhozes.

RESTRICTED

PLAN RELATING TO OUTGOING LIVESTOCK AND CATTLE INVENTORY

ON 1 JANUARY 1941; NUMBER OF CATTLE ON 1 JANUARY 1940

IN SOVKHOZ A AND B

Types and Groups of Livestock	SOVKHOZ A On 1 January 1941			SOVKHOZ B On 1 January 1941		
	Outgoing Livestock Quota	Actual Number of live-stock	Number of head on 1 January 1940	Outgoing Livestock Quota	Actual Number of live-stock	Number of head on 1 January 1940
CATTLE						
1.Bulls - reproducers		4	5		12	10
2.Cows	160	161	158	420	423	405
3.Heifers		15	28		65	55
4.Calves born in previous years		20	18		90	75
5.Bullocks born in previous years		10	12		16	15
6.Yearlings	115	118	79	350	365	248
7.Oxen - work		2			5	2
8.Total head of Cattle	325	330	300	950	976	810
HOGS						
1.Boar		1			5	
2.Sows - basic		10			90	
3.Sows - checked	15	3		120	30	
4.Replenishing stock over 4 months old		32			403	
5.Young pigs from 2 to 4						
6.Suckling pigs up to 2 months		18			491	
7.Hogs being fattened		15			110	
8.Total number of Hogs	80	79	1,000		1,129	

RESTRICTED

NUMBER OF FODDER COWS BY MONTHS IN 1940

IN SOVKHOZES A AND B

DATES	SOVKHOZ A	SOVKHOZ B
On 1 January 1940	138	374
On 1 February 1940	147	386
On 1 March 1940	151	398
On 1 April 1940	162	421
On 1 May 1940	165	428
On 1 June 1940	166	430
On 1 July 1940	166	431
On 1 August 1940	167	431
On 1 September 1940	160	416
On 1 October 1940	156	399
On 1 November 1940	156	398
On 1 December 1940	158	411
On 1 January 1941	161	423

RESTRICTED

NUMBER OF FODDER AND WILD COWS IN SOVKHOZES A AND B

BY DAYS IN JANUARY 1940

DATE	SOVKHOZ A Number of Foraging Cows	SOVKHOZ A Number of Milch Cows	SOVKHOZ B Number of Foraging Cows	SOVKHOZ B Number of Milch Cows	DATE	SOVKHOZ A Number of Foraging Cows	SOVKHOZ A Number of Milch Cows	SOVKHOZ B Number of Foraging Cows	SOVKHOZ B Number of Milch Cows
1	138	51	374	182	17	144	64	382	199
2	138	51	373	183	18	144	64	382	205
3	137	52	375	185	19	145	65	382	210
4	139	54	375	185	20	144	67	383	216
5	140	54	376	186	21	144	69	383	226
6	140	54	378	189	22	145	70	384	234
7	140	55	379	190	23	145	73	384	241
8	141	56	379	191	24	145	76	385	247
9	142	56	379	191	25	146	78	384	253
10	140	56	380	193	26	146	82	384	256
11	139	55	380	195	27	146	82	385	261
12	141	57	379	194	28	146	85	286	265
13	141	57	381	196	29	147	88	386	271
14	143	59	381	196	30	147	90	386	275
15	143	60	381	198	31	147	93	386	282
16	143	62	381	199					

OFFSPRING AND CATTLE ACQUIRED ON THE OUTSIDE

	Sovkhoz A	Sovkhoz B
Live Calves born in 1940	148	400
Live Pigs born in 1940	89	812
Head of Cattle bought in 1940	12	20
AMONG THEM:		
Cows	4	6
Calves born in 1940	6	15
Hogs bought	15	--

RESTRICTED

DELIVERY TO THE STATE, SALES, SLAUGHTERED IN THE ENTERPRISE AND ON-THE-HOOF WEIGHT OF CATTLE IN 1940

CATTLE GROUPS	SOVKHOZ A			SOVKHOZ B		
	Number of Head Delivered and Sold	Number of Head Slaughtered	Average Weight on-the-hoof per head	Number of Heads Delivered and Sold	Number of Heads Butchered	Average Weight on-the-hoof per head
Bulls - reproducers	--	--	500	--	--	540
Oxen - work	--	--	450	--	--	510
Cows	22	5	410	37	4	450
Heifers	--	--	300	--	--	310
Bullocks born in previous years	36	16	230	150	23	235
Calves born in previous years	--	--	210	--	--	220
Yearlings of current year	20	8	--	42	6	--
Weight on-the-hoof in the middle of the year	--	--	90	--	--	95
Weight on-the-hoof at the end of the year	--	--	160	--	--	170

Milk yielded (kilograms)	Sovkhoz A	Sovkhoz B
For the entire year 1940	387,100	1,491,440
In January	32,900	123,840

(5) Determine the index of rejection of cows in 1940 in both sovkhozes.

(6) Compute an index of the addition of newborn calves in 1940.

(7) Compute indexes of the possible reproduction in the herd of cows in accordance with data on 1 January 1941 (for both kovkhozes).

(8) Compute an index of the degree of productive utilization of cows for January, on 1 January and 31 January 1940.

(9) Compute average yearly milk yield for each feeding cow in 1940. for both sovkhozes.

(10) Compute average monthly and average daily milk yield for one feed cow and one milch cow in January 1940, for both sovkhozes.

(11) Compare the average weight per head of cattle, delivered and slaughtered in sovkhoz A and sovkhoz B, applying for yearlings born in 1940, average weight on-the-hoof in the middle of the year.

(12) Determine the production in weight on-the-hoof in sovkhozes A and B.

(13) Determine the weight on-the-hoof produced on an average for one cow at the beginning of the year and the percent ratio to the meat "potential" on 1 January 1940.

(14) Determine commodity production of weight on-the-hoof and coefficient of marketability.

(15) Compare all the above mentioned indexes for sovkhoz A and sovkhoz B and decide, which of the two in 1940 showed better performance.

(16) Compute indexes for sovkhoz B, which show results in fattening hogs.

TEST QUESTIONS

1. Into what types do we divide animals and what sex and age groups are singled out in counting cattle?

2. How do you calculate average yearly and average group head count?

3. How do you compute indexes of fulfillment of planned quotas with reference to livestock offspring?

4. How do you compute indexes for herd preservation?

5. What conditions are required to compute indexes of numberical changes in the cattle count?

6. What is known as the indexes of herd reproduction and how are they computed?

7. What is known as herd turnover, what are its features? How is the accuracy of its structure checked and what basic indexes may be computed on the strength of herd turnover?

8. What should be included in the total production of animal-husbandry as branches of agriculture?

9. What is known as foraging and milch cows and how are their numbers computed?

10. What unit is used in computing the average milk yield (for a foraging or milch cow) and how is the average yearly number of forage cows computed?

11. What indexes are computed in determining the average wool yield?

12. What indexes are used to show the number of offspring, degree of utilization and fertility of female livestock.

13. How do we determine the increase in numbers and in weight of livestock (production of weight on-the-hoof) and what is known as meat potential?

14. What data are required to determine results of fattening operations and which index best characterizes these results?

15. What is known as on-the-hoof and slaughter weight of livestock?

16. Of what importance is grouping in productivity indexes of livestock?

17. What are the data sources in determing the livestock count and productivity of animal husbandry?

18. How are livestock censuses organized?

19. What is the system of animal-husbandry accounting in kolkhozes?

20. How is the marketability of animal-husbandry production computed?

21. What are the classification groups of fodder?

22. What is known as "fodder unit" and what purpose does the fodder unit serve in the planning and accounting of livestock feeding?

23. In what other unit is it customary to express the nutritive value of fodder and to what end?

24. How is the fodder supply on pastures determined?

25. How is coarse fodder recorded in an enterprise?

26. What is known as sustaining and production fodder?

27. What is a fodder norm and fodder ration?

28. What is known as fodder balance, what are the different types of fodder balance, for what purpose is the fodder balance set up and what are its main items?

29. What are the data source on the fodder stocks?

CHAPTER V

STATISTICS OF AGRICULTURAL OUTPUT

1. The Concept of Agricultural Output and its Statistics

Output is the end product of production, and it is a most important index of the national economic plan. The main objectives of statistics of agricultural output are as follows: (1) Determination of agricultural output in the form of produced consumer goods and industrial raw materials within our national economy;(2) Analysis of existing conditions and elements instrumental to a further development of agricultural output in our country.

For a correct, exact and detailed follow-up and study of output, it has to be kept in mind that there are several types of output.

In the scope of planning and statistics of agricultural output we usually distinguish three types of output - gross output, net output and commodity output. Gross output represents the entire quantity of goods produced by an individual agricultural enterprise or a group of enterprises over a definite period of time.

Commodity output is the entire output of goods realized within a definite period of time through marketing, outside of what is consumed locally by the sovkhoz, kolkhoz, kolkhoz worker's household, private farmer's estates (or outside of all these enterprises together). Commodity output also is considered to include goods earmarked for disposition, though not disposed of within the above period of time.

Net output is derived by subtracting from gross output that production carried over into the current year from expenditures of the past year. This makes it possible for us to judge the extent to which there has been a re-creation of value during this period under consideration.

2. Gross Output

Agricultural gross output comprises output in plant cultivation and in

animal husbandry. In determining agricultural gross output, it is of extreme importance to make a strict distinction between this output and outputs of other branches of national economy. Very often agricultural and industrial output has been intermingled since there are included in the overall volume of agricultural production those products initally processed by industry. These are the raw products of plant cultivation and of animal husbandry, when processed within the agricultural enterprise (vegetable oils, from processing oil-bearing seeds, thread, dairy products, processed meat products, etc.). Such a mixing of things together results in an over valuation of the importance of agricultural output within the entire output of our national economy, underemphasizing the relative importance of industrial output.

For a proper evaluation of agricultural gross output, as a part of the gross yearly output of all plant cultivation, first of all consideration should be given to all raw products gathered in this same year from cropfields, vegetable-gardens, orchards, vineyards and pastures. In addition to this, it is customary to include in the category of plant cultivation products of the cultivation of perennial plants (industrial, fodder, fruitberry, flowers) which is expressed as expenditures made during the fiscal year for preparing the soil, sowing and planting and for care of these plants. Here is included also the output of forestization, i.e., artificial cultivation of forest trees for protection purposes (forest shields in fields, forestization of ravines etc.) as well as for wood production.

Expenditures made for perennial planting which as yet have no yield (For instance: planting fruit trees which do not yield for several years after planting) are to be considered as uncompleted production. Unconsummated production in plant cultivation also include expenditures made in grain and vegetable crops which will yield an output in the next year or even later (early spring plowing of fallows, sowing of winter crops, autumn plowing for summer corn, etc.). Each year starts with a carry-over of unconsummated production from past years. Differences between unconsummated production at

the beginning and at the end of the same year, are included in the gross output of the particular year.

Animal husbandry output, as mentioned above is composed of the following produce: (1) Offspring;(2) Increase in the live-weight resulting from: growth of offspring; feeding and fattening of cattle and poultry reclassified during the year; fattening of animals not slaughtered during the year; (3) Unprocessed goods, the receipt of which is not connected with slaughtering (milk, wool, down, hair, eggs, honey, manure, etc.).

It may happen that certain parts which make up the total gross output of agriculture may appear twice in the sum total production of all branches. As an example of this may be mentioned fodder used during the year it was produced for feeding animals belonging to the household: The cost of fodder is accounted for as a part of the output of plant cultivation. At the same time, the same cost appears in the animal husbandry output.

Seeds received in the particular economy and sown for new crop production, are also a kind of semi-finished product, used for further processing within the same economy, and upon first appearance seem to be included in the output of plant production. Therefore, the concept of gross output in agriculture seems to be closer to the term "gross turn-over" adopted in industrial enterprises (total output of all workshops, where the costs of semi-finished products processed at the same enterprise appear two times). The cost of one's own semi-finished products processed within the enterprise, however, is not entered as part of the enterprise's gross output, and consequently there is no double accounting in computing industrial gross output.

Yet, from the point of view of output's objectives set for a particular year, and having in mind the basic differences between the agricultural and industrial production, the above mentioned double accounting in the computation of agricultural output does not appear as often as it may seem at first glance. As a rule, semi-finished goods in industrial production are

manufactured and given further processing throughout the entire year. With the seasonal nature of agricultural production, however, such semi-fabricated products such as fodder or seeds, are produced only once a year.

Whether we take as a basis for computing gross output the period of an agricultural year (from ~~the~~ 1 July of the current to ~~the~~ 1 July of the next year) or a calendar year (from 1 January to 1 January), in both cases it would appear that to get the products of the soil during this particular year, seeds were used which were received during the preceding year. In this way in computing annual output for this enterprise, as far as seeds are concerned, we do not get a duplication in accounting.

The case is different, however, as far as fodder is concerned. Here is indeed a case of double accounting - more evident during computation of the gross output through an agricultural year than through a calendar year. The fodder produced through an agricultural year will be actually used in the same year and consequently entered as a cost into animal husbandry output during the same year (except fodder used for feeding draft animals used in soil cultivation for the next year's crop, or for feeding offspring to be utilized in the coming year, etc.).

In computing output through the calendar year, double accounting of fodder is only partial, for up to the middle of the year hay produced during the preceding year is used. Straw and grain produced during the preceding year are used through the (three) first quarters of the new year, and the use of straw and grain out of the new crop does not start prior to the end of the third quarter.

3. Commodity Output

Commodity output is one of the most important indexes of activity of socialist agricultural enterprises. Knowing the volume of commodity output we are able to determine such important indexes of agricultural enterprise's activity as the percentage of goods sold and the volume of kolkhoz trade.

Commodity output gives information as to the quantity of goods released by agricultural enterprises to the urban population in the form of foodstuffs and in the form of raw materials for our industry.

At the XVIII Congress of the VKP (b) Comrade Stalin said, "The problem of kolkhoz-sovkhoz grain commodity output is of a great importance" and that "a high sovkhoz-kolkhoz commodity output is its main function, most important for an organized supply to our population." (Source: Problems of Leninism, 11th edition, pages 582-583)

Let us analyze the concept of commodity output for sovkhozes and subsidiary enterprises, kolkhozes and individual kolkhoz member households, taking of these for separate consideration.

Commodity output for sovkhozes represents all produced goods delivered to the State (and for subsidiary enterprises, goods supplied to their own ORS [Workers Supply Departments] or to other organizations in charge of subsidiary enterprises), as well as all other produced goods disposed of outside of the enterprise, and those used to supply sovkhoz workers and employees (or of the subsidiary enterprise).

Commodity output at kolkhozes is comprised of goods delivered to the State as compulsory deliveries, and to the MTS as compensation for services rendered; goods sold to the State and to cooperative enterprises as decentralized procurements; sold at the kolkhoz market; and delivered to the Fatherland Defense Fund. In addition to this, commodity output includes all other goods sold or exchanged for other products; repayment of loans in goods and compensation in goods for various services and work done for the kolkhoz. Not included in commodity output, there are the goods distributed among kolkhoz members in pay according to their work-days worked (not sold out of the stock by kolkhoz members), seeds and fodder used within the enterprise, goods used for up-keep of kolkhoz nurseries, etc.

The commodity output at individual kolkhoz members' households is comprised solely of goods produced at the above mentioned households and sold outside. Goods used as seeds or for personal consumption, as fodder and for other internal purposes, are not a part of commodity output.

It is customary to take as a base for accounting agricultural commodity output the period of one agricultural year (from the harvest time). Both gross and commodity output are calculated with a breakdown for the individual categories of the economy. This is very important in determining the relative significance of particular groupings of socialized enterprises within the entire scope of agricultural production.

For this purpose the breakdown is into groups, as was indicated in their classification (see pages 4-5), i.e., (1) sovkhozes and subsidiary agricultural enterprises; (2) communal kolkhoz enterprises; (3) individual households of kolkhoz members; (4) workers and employees subsidiary enterprises; (5) private farmer's enterprises. Only the first four of the above mentioned groups of socialist enterprises are considered as producers of gross and commodity output.

In order to determine the entire kolkhoz commodity output (communal kolkhoz enterprises and individual households of kolkhoz members), to the commodity output of communal kolkhoz enterprises there should be added goods received by kolkhoz members in compensation for the number of workdays earned, also goods produced by individual households.

Quite often there are some cases of purchase and sale (or exchange) of goods within the economy of one or another socialized grouping (for instance, sales of produce by one group of kolkhozes to another or by some kolkhoz members to other kolkhoz members etc.) or among enterprises belonging to different groups (i.e., between kolkhozes and sovkhozes).

To determine the overall size of the entire mass of commodities of such or internal commodity turnover, there is included in the overall total that quantity of commodity production which is obtained as the sum of all commodities produced by all the economies or socialist groupings of economy (it is desirable, however, to have the internal commodity turnover added up separately).

If there is need to determine the commodity output for a certain group of socialized economies (i.e., of all kolkhozes belonging to a specific rayon or

oblast) then it is necessary to use special accounting to eliminate that internal commodity turnover among the individual economies of this grouping from the overall sum of commodity production. Such elimination of internal good-exchange among individual groups of enterprises (kolkhozes and sovkhozes) is to be done also in cases where the objective is to determine the total index of commodity output to the total output for all agricultural enterprises together.

4. Net Output

The gross output minus all produced goods utilized for agricultural production purposes during a production period will give us the net output. In other words, the net output is the difference between gross output and production expenditures for the same period of time (in agricultural production, usually for 1 year). Net output is an index of value created through work during a fiscal year; it is a part of national income and a source of income of agricultural enterprises and of population employed in these.

Included in material expenditures there is amortization of capital assets made for production purposes, seeds and plantings, insecticides, all types of feed and straw for bedding, eggs used for brooding-hens, incubators and as chicken feed, sugar and honey as bee feed, medical supplies and desinfectors used in ~~the~~ animal husbandry, fuels, lubricants and all other material expenses.

5. Monetary Evaluation of Agricultural Produce

Gross and commddity agricultural outputs are usually expressed in amounts of goods produced. A definite knowledge as to these amounts is a necessary prerequisite for all kinds of agricultural accounting.

However, due to a great variety of agricultural products, information on amounts produced in itself is not sufficient to give us the production totals within various individual groups and branches of agricultural production or in agricultural production as a whole. In such cases, there is a

need of monetary evaluation of the gross and commodity output. The net output, however, is always expressed in monetary values.

The evaluation of output is always given in base-year prices or in prices for the fiscal year (current prices). Evaluation is given in terms of base-year prices when we wish to study changes in the physical volume of agricultural output, i.e., derive indexes of goods produced in kind. In this case, base-year prices must be used in order to eliminate the influence of price fluctuation of the total volume of output. The base-year prices used are those of 1926/27. Evaluation in terms of actual current prices under which the output was actually realized, gives us a concept of the entire monetary value of output for each year and makes it possible to evaluate separately the commodity part and the internally consumed part of output.

Commodity output is evaluated in terms of the actual prices at which it was realized. At present, usually, large part of internally consumed non-commodity output of the kolkhozes, kolkhoz members, private farmers and other groups of population is evaluated in terms of the commodity prices. However, since commodity output is realized at different prices (State procurement prices, State contracting prices, kolkhoz market prices) therefore, the non-commodity part of output is evaluated in terms of average realization prices, or so-called average commodity prices.

Excepted from this rule are goods used mainly for internal consumption in the agricultural enterprises - hay, straw, chaff, etc. It is customary to evaluate the consumed part of such goods in average commodity prices, allowing a discount for realization costs (i.e., costs of delivery to market or to procurement station). And finally, products which have no market price should be evaluated in terms of conditioned prices: i.e., manure is evaluated in terms of the cost of straw used for bedding.

The internally consumed part of agricultural output in sovkhozes is evaluated in terms of actual costs.

In determining net output it is accepted practice to evaluate material expenditures as follows: Expenditures of products and goods of one's own

production are evaluated in terms of the same average commodity prices as were used with the non-commodity part of the gross output. Purchased products and goods are evaluated in terms of actual purchasing prices.

6. Simplified Analysis Methods for Agricultural Output Data

The following basic indexes are worked out in analyzing agricultural output data:

(a) Completion of the agricultural output plan;

(b) Distribution (in percent) of the agricultural gross and commodity outputs to various groups of enterprises. Study of the relative significance of various groups of enterprises in the dynamics of agricultural gross and commodity output gives us an impression of production shifts from one group of economy to another. Most important here is the study of the share of production by socialist agricultural enterprises in the entire output.

In the compilation, Socialized Agriculture in the USSR, (page 87) there is the following table which shows very clearly the redistribution of gross agricultural output among the separate categories of enterprises for the period 1929-1937:

PARTICIPATION OF VARIOUS GROUPS OF ENTERPRISES IN AGRICULTURAL GROSS OUTPUT

	1929	1932	1937
Output of Sovkhozes (and Subsidiary Agricultural enterprises)	1.8	10.6	9.3
Output of Kolkhozes	3.3	51.1	62.9
Output of Kolkhoz Members' Individual Households	1.6	14.4	21.5
Output of Individual Workers and Employees	No information available		1.5
Output of Private Farmers	93.3	23.9	1.5
Total:	100.0	100.0	100.0

After the year of the great turning point, in a short period of time, the individual private farmers who in 1929 had accounted for more than 9/10 of all gross output, now had almost completely disappeared, and the socialist system became the sole dominant group.

(c) Indexes of dynamics (expressed in absolute quantities and in percent) of the gross, net and commodity output for the periods, under consideration, as a whole for agricultural output, as well as for the output of individual branches;

(d) Average total agricultural output for agriculture and for its individual branches, on a per capita basis for rural and for the entire population (urban and rural together);

(e) Indexes which go to make up (in percent) gross and commodity output, on a breakdown for individual agricultural branches and individual product groups.

The above indexes give us an idea of agricultural specialization achieved at individual enterprises, rural soviets, rayons, oblastes, etc.

The elements of USSR gross output broken down into basic agricultural branches and those changes made from the pre-Soviet era up to 1932 and 1937 are presented in the following table published in the above mentioned compilation (page 86).

GROSS AGRICULTURAL OUTPUT (IN MILLION RUBLES AT 1926/27 PRICES)

	1913	1932	1937	1937 In Percent of Output to: 1913	1932
Total output of land cultivation and animal husbandry:	12,607.1	13,071.8	20,123.0	159.6	153.9
Land Cultivation:	8,028.1	9,779.2	15,069.5	187.7	154.1
Including:					

GROSS AGRICULTURAL OUTPUT (IN MILLION RUBLES AT 1926/27 PRICES)

	1913	1932	1937	1937 In Precent of Output Compared to: 1913	1932
Grain Crops	3,840.5	3,460.9	6,351.7	165.4	183.5
Industrial Crops	781.9	1,091.5	1,746.3	223.3	160.0
Animal Husbandry Output	4,579.0	3,292.6	5,053.5	110.4	153.5

(f) Indexes of agricultural commodity production as a whole for all agricultural output, for individual branches and by-product groups. The basic index of the ratio of commodity production is the relationship (in percent) of commodity output the index of the ratio of commodity production for agriculture as a whole and for the various agricultural branches as well, may be computed only from data on gross and commodity output, expressed in monetary terms; commodity output indexes for individual products, however, also may be computed on the basis of absolute quantity data.

Apart from the basic index, showing the ratio of commodity production, the relationship between commodity output and a definite land area unit gives us a pretty good idea of commodity output level (i.e., total land cultivation commodity output per 1 hectare of crop-field and farmland; total animal husbandry commodity output per 1 hectare of agricultural land). Such indexes are very helpful especially in determining kolkhozes' obligations to the State.

There are certain rules to be observed in computing indexes on the ratio of commodity output. These rules apply to determining volume of gross and commodity output. For instance, in building up indexes on commodity yield from land cultivation as a whole, gross output does not include changes in the value of incompleted production. Values of non-market and seldom marketed goods, especially fodder (hay, straw, chaff, green fodder, silage fodder, etc.), are excluded from the categories of gross and commodity output. In the same way, the value of manure is not included in the total of animal husbandry

commodity output.

The computation of land cultivation commodity output is done for the period of an agricultural as well as for a calendar year. As a basis for computation of commodity part of output for the period of an agricultural year, we take the relationship between the actual crop yield of the particular year and the total output for the agricultural year, adjusted for the changes in reserves. When computing the land cultivation commodity output for the period of a calendar year, the volume of commodity output over this same year is compared with the volume of gross output over the same period, also adjusted for changes in reserve stocks comparing the beginning with the end of the year.

Let us designate reserves in agricultural products at a kolkhoz (or at a group of kolkhozes) on 1 January 1944 as 3n and on 1 January 1945 as 3k; the 1944 crop output as P and the output of land cultivation accomplished in 1944 as T. Agricultural goods realized /sold/ could come from reserve held at the beginning of the year and from production received during the year, minus stocks in store at the year's end. In other words, the basis for determining the index showing the ratio of commodity production is a quantity (3n plus P minus 3k) or (P plus 3n minus 3k). Consequently, the ratio of commodity production would be:

$$\frac{T \times 100}{P + (3n - 3k)} .$$

If reserves at the year's end are larger than they were at the beginning, (i.e., $3k > 3n$), or in other words if there is an increase of reserves, the $(3n - 3k)$ is a negative value, and consequently the increase in the reserve is to be extracted from the value of gross output. In the reverse case, i.e., if reserves at the end of the year are smaller than those at the beginning ($3k < 3n$). There is a decrease in reserves, the $(3n-3k)$ is a positive value, and consequently the decrease in reserves is to be added to the value of gross output.

Indexes showing ratio of commodity output should be computed separately by individual categories of the economy.

7. Sources of Data on Agricultural Output

The sources of data on agricultural output are the annual statements of sovkhozes and kolkhozes.

In these yearly reports there is the following data in annual sovkhoz statements; actual expenditures on plant cultivation and animal husbandry production costs (i.e., production volume expressed in cost); non-complete plant cultivation output (i.e., expenditures made for crops for future years); on the realization of output of plant cultivation and of animal husbandry.

It should be emphsized that out of the entire utilization of output as presented in charts of the annual statment entitled: Statement of Output Realization and Utilization and Output Realization Results, there may be included as commodity output amounts delivered to the State and amounts shown under "other realization". In no case should amounts of produced goods consumed as seeds and fodder (shown in the first of the above mentioned charts) be considered as parts of commodity output.

Data contained in annual kolkhoz statements include the worth of the gross harvest and of all products of plant cultivation and animal husbandry gross outputs (for each group by their individual types) at State procurement prices. There also are data on monetary profits realized by kolkhozes through State deliveries, sales on the kolkhoz markets and all other sales of crop and animal husbandry products. In the same statements are entered deliveries and sales of products out of the fiscal year output, reserves from the past year's output, as well as the estimated profit to be gained on goods earmarked for sale during the following year, as evaluated at the general meeting of the kolkhoz members. And finally, there are in the annual kolkhoz statements, detailed data of crop and animal husbandry produce distribution, on the base of which we may determine the annual commodity output with a breakdown of individual products (actually, only in terms of natural production units).

In the process of computing by a unified method the overall totals of gross agricultural output (prior to compilation of annual statements) for sovkhozes, kolkhozes, kolkhoz household economies and for private individual farmers, the gross output is initially computed in units of actual production and eventually evaluated and expressed in monetary terms on the basis of available price data (in 1926/27 base-year prices and in prices of the year under review).

The concept of kolkhoz members' household gross and commodity output may be obtained through a sample analysis of their annual statements.

On the basis of material presented in Chapter VI, the following problem is to be solved: Sovkhozes A and B have achieved grain output indicated in example ~~of paragraph~~ (in section) 2, Chapter IV (Statistics on Yield Capacity). /Should read: Chapter III/

In addition to this, the same sovkhozes had obtained the following output (sovkhoz A in 1943, and sovkhoz B in 1940 and 1943):

CHAPTER VI: TEST PROBLEM

OUTPUT IN CENTNERS

Products	By Sovkhoz, A 1943	By Sovkhoz, B 1940	By Sovkhoz, B 1943	Prices In Rubles Per Centner
Potatoes	1,800	3,500	5,100	250
Vegetables	900	1,600	2,400	620
Fodder Root-Plants	270	560	750	100
Hay From Sown Grasses	7,500	6,800	8,000	150
Hay of Wild Grass	420	500	540	130
Winter-Crop Straw	4,860	3,460	4,156	50
Summer-Crop Straw	3,570	2,656	2,460	75
Milk	3,871	14,914	15,200	600

In addition to milk, the following output of animal husbandry products is received (in monetary terms expressed in base-year units of price):

OUTPUT IN RUBLES IN BASE-YEAR PRICES

Type Of Output	By Sovkhoz, A 1943	By Sovkhoz, B 1940	By Sovkhoz, B 1943
Offspring and Weight Increase of Cattle	453,400	1,390,400	1,695,400
Cattle Manure	208,000	416,000	520,000
Hog Offspring and Weight Increase	159,800	2,203,400	2,755,000
Hog Manure	15,600	195,000	221,000
Horse Offspring	92,000	40,000	45,000
Horse Manure	62,400	31,200	32,500

OUTPUT REALIZED (SOLD) OUTSIDE OF THE SOVKHOZES

Products	Sovkhoz, A 1943	Sovkhoz, B 1940	Sovkhoz, B 1943
In Centners Realized: Grain (See Example Given in Chapter IV(a))			
Potatoes	850	1,800	2,900
Vegetables	50	1,150	1,960
Milk	2,000	10,500	12,100
In Monetary Amounts Realized (In Rubles in Terms of Base-Year Prices):			
Cattle Offspring	120,000	270,000	320,000
Hog Offspring and Fattened Hogs Sold	15,000	960,000	1,250,000

Based on the above data (and grain crop data from the example in Chapter IV) the following are to be solved:

1. Calculate the relative weights (in percent) showing the composition of gross and commodity production of sovkhozes A and B (for individual crops and for separate groupings of cattle).

2. Workout the indexes showing the ratio of commodity output for individual crops, and for overall plant cultivation output; for each group of animal husbandry, for overall animal husbandry output; and for agricultural output as a whole.

3. Based on results from items 1 and 2, determine the difference in agricultural production policy at sovkhozes, A and B.

4. Derive indexes showing changes in output at sovkhoz B, giving separate indexes for each group of products, and group indexes for plant cultivation, for each group of animal husbandry, and for entire animal husbandry as a whole; also the overall index for all branches of agricultural output.

Test Questions

1. What measures of agricultural output are used in agricultural statistics?

2. What is the concept of the gross agricultural output and what should be included in the gorss output of plant cultivation and animal husbandry?

3. What is the concept of commodity putput, its importance in agriculture, and what enters into it?

4. What is the net agricultural output, and how is it calculated?

5. What types of prices are used for the monetary evaluation of agricultural output?

6. What is the way to determine the agricultural commodity output indexes?

7. What are the sources containing information on agricultural output expressed in units of production and in monetary terms?

CHAPTER VI

STATISTICS OF LABOR AND LABOR PRODUCTIVITY IN AGRICULTURE

1. Working Level Accounting of Labor in Sovkhozes and MTS

Statistics and accounting of labor in sovkhozes and MTS deal with the following basic problems: (1) manpower count; (2) manpower composition and turnover; (3) utilization of work-time, reporting to work; (4) wages - general wage fund and wages by professions; (5) shock working, competition, Stakhanov movement in agriculture; (6) indexes of labor productivity. The study of these above problems is based upon data of working level accounting in the enterprise, which accounting is indispensable for a proper administration of agricultural enterprises and the basis of accounting and labor statistics in our national economy.

Let us see how labor accounting is done in sovkhozes.

The basic document in accounting for the number of employees in sovkhozes is the personnel card, which is made out by the personnel section, on each laborer and office employee when they start work. The personnel card gives the employee's full name, marital and family status, party affiliation and other general data, also labor category and profession (for laborers, for instance: tractor operator, chauffeur, combine operator, dairy-maid, etc.) The card contains also information with respect to changed duties and service, use of accrued leave, etc.

The personnel card gives all information pertaining to sovkhoz manpower strength (by various groups, professions and other break-downs) for any particular time.

In addition to this personnel cards make it possible to explain fluctuations and turnover of manpower for the desired period of time (day, ten days, month quarter, year) by adding up the number of workers at the beginning of a particular period, those who have started work and

those who have left during this period, also those present at the end of the period.

On the base of above data may be computed the manpower turnover index. When computing this index, usually there are taken into account only those who left and must be replaced, not counting of course, personnel who left on account of natural causes (death, incapacitation, etc.)

In order to determine the number of needed replacements, usually the lower turnover number is taken (either the number of new employees or the number who left, whichever is lower).

Example: There were hired 10 workers during one month. Eight workers left. Replacement was needed for 8. Two additional workers were hired due to production expansion. In case 8 workers were hired during one month and 10 released, it means that the above 8 were hired as replacement and the remaining two were released due to reduction of production.

The manpower turnover index for a certain time period is always expressed in a ratio (percentage) of number of departed workers to be replaced (or, in other words, number of replacements hired to take the place of transferred workers) to the average manpower strength through the same period.

The average listed number of workers for a particular period of time is equal to the total of the number of workers for each day of the period (restdays and holidays including) divided by the number of calendar days over this period.

The above descrived method of calculation of workers replacements, and consequently the manpower turnover index is not quite an exact one. In order to determine a more exact manpower turnover index, rather complicated methods must be applied.

A more precise manpower turnover index would be obtained if there would be determined the percentage ratio of workers left without permission and fired from the sovkhoz for infringements of labor discipline over a particular period of time, to the average manpower strength

through the same period.

Work-time accounting in sovkhozes is done separately for laborers and for sovkhoz employees. A so-called "attendance sheet" is kept for employees, where the daily attendance for those working on the basis of an undetermined work-day is merely indicated when the workers show up on the job, whereas for those with standard work-day (determined number of work hours) every day an entry is made of the number of regular and overtime hours spent on the job.

The basic document for work-time accounting for laborers contains information as to work attendance, number of hours actually worked, time wasted, amount and quantity of performed work or output, and wages earned. Such basic document is called "the account sheet." It varies, however, and varies in form depending upon the type of work. It is obvious that for accounting for the work of a combine operator, different indexes are needed, than for instance, for the work of milkmaids.

A very important item in accounting, is accounting for absenteeism and its reasons (attending to State and social obligations, vacation time, authorized absence, or loafing). Data on absenteeism and its reasons are forwarded daily by sovkhoz's sections to the administrative sovkhoz office where this information is recorded.

Approaching the wage accounting problem, it should be mentioned that in sovkhozes (as well as in any other enterprises and establishments) there are two types of wages: by time and by piece-work. Wages based on time are computed from time actually worked. In addition to the usual time wages, moreover, additional pay is earned for working over and above the usual work day (that is, for laborers whose work performance is computed on the basis of the normal work day).

Piece-work may be either direct or progressive. Direct pay means that each unit of output is paid at the same rate as the proceeding one. Progressive piece-work is contributing to a great increase in the productivity of labor. With this system, for every piece turned out above the

established quota (for the day or for the entire period of work) additional pay is earned. Apart from this, bonuses are granted for high quality of work, for economy in liquid fuel consumption, for salvaging used lubricants when operating tractors, etc. An example of the progressive piece-work pay system is in the payment of work done by tractor drivers and combine operators in sovkhozes and MTS, also machinists and other laborers involved in threshing.

In order to keep track of earned wages of sovkhoz workers and for wage computation purposes there are pay cards for each worker. The data of performed work are daily entered onto these pay cards from accounting sheets.

The data contained in pay cards are used for preparing the workers and employees payroll. Payrolls are prepared and wages paid twice each month.

2. Initial Labor Accounting in Kolkhozes

The organization of labor accounting in kolkhozes is to be done in a way to permit a close supervision of fulfillment of kolkhoze's production plan. The above accounting should provide necessary data for correct organization of piece-rate work, to uncover cases where kolkhoz discipline has been violated and for determining the extent of participation of each kolkhoz member in kolkhoz output. On the basis of data given by accounting, it can be established to what extent the kolkhoz members take part in fulfillment of the kolkhoz production plan, and accordingly show up those who in fact have severed their connections with the kolkhoz. For this purpose the labor accounting is to be done not only in every work brigade, but even in every squad.

In compliance with provisions of the charter of agricultural "artels," work done there is performed on the basis of piece-work. An adequate organization of piece-wage work in a kolkhoz requires a pre-established daily quota of every type of work, and grouping of tasks according to

their importance, complexity and demands upon skilled manpower. For each work group there is to be fixed a daily quota in terms of workdays, as well as an appropriate equivalent in terms of workdays for each basic unit of performed work.

In determining the work quotas there should be taken in consideration existing local conditions and characteristics, previous work experience and achievements of leading kolkhoz members. The quotas are prepared by the "artels" administration subject to approval by kolkhoz general membership meetings.

According to what was said above, it is evident that the workday unit is not to be confused with man-days. The workday is a basic qualitative and quantitative unit of labor, which determines the share of kolkhoz members in the distribution of kolkhoz income. At the same time a workday in a kolkhoz is the basic unit for work-accounting purposes.

For work accounting purposes each kolkhoz has to prescribe the basic work units expressed in terms of workdays, for each type of work.

When various jobs to be done in a kolkhoz are grouped, and the daily work-quotas are determined for each group, and expressed in terms of workdays, then it is not difficult to compute an equivalent in workdays for a unit of each kind of work.

Illustrating example: A particular type of work is classified as paying 1.75 workdays per day of normal work. If, let us assume, the daily quota for one workday is 0.8 of one hectare, the completion of each unit of work (each hectare) will be equal to 1.75 : 0.8 = 2.19 workdays.

Having at hand such calculations, the brigade leader should not have any difficulty in determining the number of workdays to be credited to individual kolkhoz members for the actual number of completed work units.

An adequate work organization in a kolkhoz, and improvement of work discipline depend very much upon the work performed by production brigades and permanent squads. A mass introduction of these working units was indicated as a necessity at the XVIII Party Congress VKP (b).

The organization of production brigades and squads (type of brigade: field cultivating, vegetable planting, hot-house planting, orchard, animal husbandry) may be indicated through the use of the following indexes: number of brigades in a kolkhoz; percentage of kolkhozes with two or more brigades; the average number of kolkhoz members (male and female) over 16 years, and the number of adolescents in a brigade; the percentage of kolkhozes which work with permanent squads; percentage of brigades which use permanent squads; the average number of squads in a brigade; the average number of adult kolkhoz workers in a squad; the average acerage of sowing area assigned to a squad; average harvesting of various crops by squads; percent of brigades and squads with pay bonuses; the average pay bonus for high crop yield in various cultures, per squad. In addition to this the outstanding brigades and squads are to be given individual efficiency ratings (determined upon the average crop yield, upon granted pay bonuses per workday and also upon other bonuses.)

In as far as in the agricultural artel, at the present time the basic form of kolkhoz organization, in the best way correlates the individual interests of kolkhoz members with the social interests of kolkhoz itself, and since the basic objective of the artel is to develop its socialized economy, therefore very great importance is attached to the problems of relationship between the personal subsidiary enterprise of kolkhoz members and the socialized economy of the kolkhoz, the problems of kolkhoz's discipline, and degree of participation of kolkhoz members in work done within the socialized economy of the kolkhoz. The

number of days actually spent by kolkhoz members in work at a kolkhoz and number of earned workdays is a very important index of the participation of kolkhoz members in the communal kolkhoz activity. It is an index of kolkhoz discipline, at the same time. The number of actual days spent in work is to be correctly accounted for in order to be able to determine bonuses earned for overfulfilment of the production plan.

For a proper accounting and study of the above problems group charts must be made. The selection of intervals for grouping kolkhoz members according to the munber of days worked on the kolkhoz, should correspond with that minimum period which, in terms of the order on additional pay for the work of kolkhoz members, establishes rights in the receipt of full-pay and of half-pay for overfulfilling the plan. The grouping is to be done by assigning specific group ranges for various types of kolkhozes: vegetable type (no less than 5 hectars), flax type, animal husbandry brigades, etc. In the Moscow oblast the kolkhoz members of vegetable type kolkhozes (working in the kolkhoz through the period March-Oct. incl.) are to be broken down at least into three groups of the following ranges: (1) up to 110 days of work; (2) from 111 to 139 days; (3) 140 and more days.

According to the present policy of work accounting, there are the following groups to be segregated: kolkhoz members with no workdays; with less than the fixed minimum of days; those exceeding the minimum, to be classified according to a number of intervals. All able-bodied kolkhoz workers over 16 (male and female) living in the kolkhoz are grouped separately; so also disabled, old and sick kolkhoz members, kolkhoz members drafted into the Red Army, those employed elsewhere by State agencies and enterprises, and minors from 12-16 years.

In addition to their actual purpose, the above charts may give sufficient information of participation of kolkhoz members in the kolkhoz communal work, to make it possible to ascertain those kolkhoz members who

have not worked the minimum quota required during the respective year, as well as those who have lost contact with the kolkhoz and are subject to expulsion. The problem of supervision of fulfilment of minimum workday quotas during the Great Fatherland War, when the quotas were increased, was a matter of special importance.

Apart from segregating the kolkhoz members according to amounts of earned workdays, there is to be computed the average workdays amount per kolkhoz member. Such an index analysed for a period of several years (in its dynamics) may give a pretty good idea of kolkhoz work activity fluctuations.

The best index of improving living standards of kolkhoz members, reflecting exactly the development of socialized kolkhoz enterprise, is the increasing amounts of grain, potatos, other goods and money, paid as compensation for earned workdays. In addition to computation of overall kolkhoz average indexes for a certain rayon, for a more through study of these indexes, the kolkhozes must be grouped according to amounts of payments in goods and money received per workday. More desirable even, would be a computation of the average workday compensation within a group of kolkhozes, determined on the basis of gross kolkhoz income, from the yield of basic crops, milk, etc. It is very important also to account for bonuses granted for overfulfillment of the production plan. The increase of kolkhoz members' living standards may be noticed through the indexes of purchase of industrial goods and better nutrition.

Basic initial documentation accounting for labor and the distribution of workdays in kolkhozes is as follows: the record account of workdays and the workbook of the kolkhoz member. The workdays record is filled out daily by the brigadier for the work performed and the equivalent number of workdays to be credited to each kolkhoz member. Each job is entered separately. The column "total" in addition to number of workdays credited to each individual kolkhoz member, contains also the

number of days actually spent at work, which data are important for payment of bonuses.

The workdays record insures a proper accounting of workdays (providing the different jobs are credited separately) and facilitates the success of the job and attendance. The performed work and number of credited workdays are entered into individual kolkhoz members' workbooks. The entries are made personally by brigadier at least once a week. Entered also are all advanced and regular payments received by the kolkhoz member, and amounts in money and in kind credited to the individual. The record of workdays helps the kolkhoz's bookkeeper to maintain the workdays accounting register, containing personal accounts on each individual working kolkhoz member.

In kolkhozes where there is a double-entry bookkeeping, in addition this is maintained for each type of work the brigade's workdays record and an overall record for the kolkhoz (entry is made of the amount of work performed and credited workdays). Such rosters contain data on the annual production plan for the particular work and the fixed production quotas for every five-day period.

The piece-rate wage system is adopted not only in plant cultivating kolkhozes but on animal husbandry kolkhoz farms as well.

3. Sources of Statistical Data on Labor and Wages in Sovkhozes, MTS, and Kolkhozes.

Using working level labor accounting data, the sovkhozes have to compile monthly labor and wage reports (standard form 62, agricultural) forwarding them to their higher organizations and to TsSU agencies which use the above reports for statistical purposes.

Monthly reports contain the basic data on the number of workers and employees (breakdown by categories and skills); on wages; on the average earnings of sovkhoz workers; and on the number of female workers. With this monthly data, the completion of labor and wage plan can be closely supervised, following seasonal fluctuations in the number of workers;

changes in average wages (for various categories and skills); and average number of man-days actually worked per worker. The same report may give even such important indexes as the percentage of utilization of the working days (days worked to the total). The total number of man-days may be obtained by multiplying the average daily number of workers by the number of days of the respective month. For greater accuracy, from this overall quantity there should be subtracted the number of man-days lost on account of rest days and holidays. Further, indexes may be worked out to show absenteeism (the ratio of loafed man-days to overall absentee man-days, as well as to the total number of man-days worked).

Monthly labor and wage reports may provide indexes of fluctuation of permanent workers by determining the percentage ratio of workers who left and those fired for violating the work code, to the daily average listed number of regular laborers throughout the respective month.

When compiling labor and wage reports the sovkhoz personnel is usually broken down into the following basic groups: laborers, apprentices, agronomists, livestock technicians, and engineer-technical personnel, office employees and clerical assistants. With respect to employment period, the laborers are divided into permanent, seasonal and temporary groups. Permanent are those hired for an indefinite time and are on the staff of the sovkhoz. Seasonal labor includes those hired for seasonal work up to 6 months. Laborers hired for 2 months and less and not belonging to the sovkhoz staff, are called temporary. Classification of personnel into the groups: agronomist, livestock technician, engineer-technical, personnel, and clerical assistants, is done according to standard classification charts determining positions and jobs within various groups. Apart of basic production personnel, there are in sovkhozes laborers maintaining and servicing various sovkhoz facilities such as living quarters, dining rooms, snack-bars, etc., also schools, educational institutions and sovkhoz training courses.

The annual sovkhoz statements contain also data on laborers and amount of wages paid through the year according to provisions of the production plan and actual employment of laborers in various groups, the annual statement contains data on the actual number of man-days worked (planned and actual), specifying the number of man-days used in plant cultivation and in animal husbandry branches. These data are essential for computing the productivity of labor indexes (to be discussed later, see page 141 Russian text).

The majority of the indexes presented in sovkhoz labor and wage reports are applicable to MTS, which also compile monthly labor and wage reports (standard form No. 7). In contrast to the above, kolkhozes do not maintain any current labor accounting. The only source of kolkhoz labor statistical data on matters of labor are their annual statements. Out of these annual statements may be obtained data on the number of ablebodied kolkhoz members employed elsewhere, on the number of earned workdays, on bonuses granted for overfulfillment of the production plan, on the number of brigades and squads within a kolkhoz, on the number of kolkhoz members which worked in a brigade and a squad, and on the number of squads and kolkhoz members credited with additional earnings.

The monthly and semi-annual reports on sampling inspections of kolkhoz budgets provide also very good data on utilization of kolkhoz labor and its activity. They contain data on kolkhoz member dependents, specifically male and female adults, children, youngsters and old people; on the number of days and hours worked in the kolkhoz and MTS; on work done by hired laborers; on the number of work-hours spent in work in the individual member's household economy, on days of absence from the kolkhoz (in connection with working for hire and with the MTS, or for any other reasons); and on the number of workdays accounted for over the month reported.

4. Definition of "Labor Productivity"

Direct and Derived "Labor Productivity" Agricultural Indexes.

Labor productivity in agriculture as well as in industry is determined by the output per a fixed time unit. Consequently, the index of labor productivity is represented by a fraction where the numerator is the output and denominator the time unit used to produce it. In the above way may be computed an overall agricultural index, branch indexes (field cultures, vegetable cultivation, animal husbandry, etc.), or even indexes for various products (i.e., grain output, milk output, etc.) in a time unit.

Due to the seasonal character of agricultural work and the fact that the amount of produced goods can be determined only at the year's end, therefore, no direct indexes may be obtained in the course of the year.

There are therefore in agriculture, in addition to direct labor productivity indexes, the derived indexes as follows: (1) labor needed for completion of a certain type of output from 1 hectare of sowed area, from 1 hectare of one or another field cultivation crop. For animal husbandry, the index is for one head of cattle (very often such indexes are referred to as incomplete indexes of labor productivity); (2) period of time spent for completion of a work unit for various types of work, or output achieved in a time unit: for instance, the number of hectars plowed during a 10-hour workday, or the number of hectars harvested by combine in a workday, etc.

Each of the above indexes has its own significance. Thus, the total quantity of output (expressed in monetary terms) in terms of units of time, should be considered the basic labor productivity index. Such a synthetic index is the most important qualitative agricultural index of the level of agricultural production. It is essential in studying the dynamics of labor productivity in agricultural production.

The index of output for individual products (expressed in physical amounts) in a time-unit is of a great importance in planning and operational work in the various branches of agriculture. The indexes of output in a

definite time unit give us the data for determining the technical working quotas in sovkhozes and kolkhozes. We must use the above computed indexes also in order to get an idea of labor productivity for a particular time of the year before the crop is in (for instance, during the sowing campaign, harvest, etc.).

The same incomplete index is also important because an increase in the coefficient of labor productivity, expressed in terms of work done per unit of time, is directly related to a reduction of the period of time used for production. The index of work performed in a time unit, however, cannot replace an absolute labor productivity index. It happens often that even with increasing work-time, as compared with previous years, for the same amount of production, the absolute labor productivity index instead of decreasing shows an increase. This may happen if the additional work time spent on certain agricultural improvement measures (as on thorough cultivation, extermination of field pests, etc.) brings about such a crop increase, and consequently, such an increase in output that this more than covers the additional expenditure of labor and is instrumental in increasing output per unit of time expended (i.e. raises the overall labor productivity index). In this way, relative to changes over former time with complete and incomplete labor productivity indexes, we obtain this result without any change in the scope or quality of agrotechnical undertakings. In this case, with a rise of the incomplete labor productivity index, caused by reduced time for individual operations (sowing, cultivation, harvesting, etc.), there may be a rise in the volume of output, and thus also in the magnitude of the absolute labor productivity index.

5. Relating Various Types of Production and Determining Labor Time in Deriving the Index of Labor Productivity

In section 4 it was shown that in the formula for the complete index of labor productivity, the numerator of the fraction is output, and the denominator the time used to produce it. Let us see in which way the

numerator and denominator of this fraction are determined.

If our objective is to determine the labor productivity index in any basic production branch (as for instance grain output, or milk output in a time unit), then the computing of labor productivity is rather easy, and we have simply to divide the actual physical quantity of output by the amount of time used. Such labor productivity indexes are referred to as "natural."

The computing procedure becomes more complicated if there is a need for an overall labor productivity index for all field cultivation, all plant cultivation, all animal husbandry, or even for the entire field of agriculture as a whole (if there is a need for a so-called summary index of labor productivity).

Due to the great variety and multiplicity of production, expressed in this case through the numerator of labor productivity fraction (grain cultures, industrial crops, potatoes, vegetables, grass, milk, wool, live-weight increase, etc.), we cannot directly add up all these types of production, unless we are able to express them tentatively in unified, comparable units.

There are several possible ways of measuring different kinds of output together. We will describe three of them: (a) the method of recomputing output in abstract (accounting) units, (b) the method of evaluation output in terms of constant prices, and (c) the method of computing the group index of expended labor.

The first method consists of recounting the various output in abstract units, computing with certain coefficients. By this method for instance, the People's Commissariat of Sovkhozes in computing milk output has equated one centner of milk to one calf. For conversion purposes in the field cultivation, one or another product is selected to use as an abstract unit for instance, summer grain, and on the basis of this crop, with the application of adopted coefficients, all other products are converted into it (the above coefficients usually are calculated on

the basis of the amount of labor-time normally required in output, etc.

In the process of calculating the labor productivity index, as a quantity of labor done in a unit of time, use often is made of the method of converting individual operations of labor into abstract units of soft plowing.

The main disadvantage of this method is its abstractness often poorly justified, resulting in the arbitrary character of certain conversion coefficients.

Often in actual practice, the overall gross output and at the same time the labor productivity index are determined by the price method. By this method prices are multiplied by corresponding units of individual products of the gross output. The resulting products are summed up, and the total is divided by the number representing the amount of labor time needed to produce the overall gross output. Since prices are subject to fluctuation over time, therefore, in order to compare labor productivity over different periods, production is evaluated in terms of constant prices (usually those of 1926/27). The gross output for each period, expressed in terms of constant prices, is then computed as an average per unit of labor time, and the resulting indexes may be compared with one another.

As simple as it is, this method has the following disadvantages: (1) 1926/27 prices have changed considerably up to the present time and not in the same way for various products changed, (2) by the application of this method, the nominator of labor productivity index fraction is influenced by prices of individual products. Therefore, with changes in the structure of production, with the substitution of cheaper products by more expensive ones, or vice versa, the labor productivity index, derived by this method, may rise or fall with no relationship to actual changes in the level of labor productivity. In this way it may happen, for instance, that cultivating wheat instead of rye, or more expensive

vegetables instead of cheap ones, etc., the value of gross output would rise (and consequently, the labor productivity index determined by the above method would also rise), at the time when the actual labor productivity may remain unchanged. Application of the above method may even result in such nonsense that (following changes in the structure of production) there may be overfulfillment of the labor productivity plan for each individual branch of production; while the plan for all production taken together is unfulfilled, or vice versa.

In order to eliminate the later disadvantage, the index method should be used in comparing indexes of labor productivity for particular periods or in comparing actual indexes with planned ones. Use of the Index method eliminates the influence of changes in the structure of production. The following example will clarify the above explanation:

	First Period			Second Period			
Type of Output	Amount of Output expressed in constant prices	Consumed Time in Man-Days	Earned in 1 Man-day in rubles	Amount of Output expressed in constant prices	Consumed Time in Man-Days	Earned in one Man-Day in rubles	Change of Labor Productivity Index in the Second Period as compared with the first
A	60,000	12,000	5	97,200	18,000	5.4	108.0
B	70,000	5,000	14	64,000	4,000	16.0	114.3
Total:	130,000	17,000	7.65	161,200	22,000	7.33	95.3

The data presented in the above chart lead to the following quite absurd conclusion: with a rise of labor productivity in each individual branch, labor productivity is decreasing for all production taken as a whole.

This has been caused by modifications made in production structure; namely, increase of the cheap and reduction of the more expensive output.

Applying the index method we will avoid the above absurd results, since then we shall be basing ourselves on the assumption that the production's structure remains unchanged. Applying the data on time consumed during the second period as weights, we get the following labor productivity index:

$$\text{Index} = \frac{5.4 \times 18{,}000 + 16 \times 4{,}000}{5 \times 18{,}000 + 14 \times 4{,}000} = \frac{161{,}200}{146{,}000} = 110.4$$

There is no necessity to apply monetary terms, if when analysing the dynamics of labor productivity indexes, or in making a comparison between actual indexes and those planned, we use for computing the labor productivity index the expended labor method. This method deals only with output expressed in physical terms and with the amount of time spent on its production, i.e., those factors which go into the formula for the index of labor productivity.

Application of the above method may be seen in the following example:

Type of Output	Unit of Measure	Planned for 1944		Actual Results in 1944		
		Amount of Output	Consumed time in terms of Man-Days	Output Received	Consumed time in terms of Man-Days	Time Spent per Unit of Output (as Planned)
A	Centners	15,000	18,000	16,000	17,600	1.2
B	Centners	28,000	22,400	27,000	20,200	0.8
C	Centners	4,000	6,000	4,200	6,400	1.5
					44,200	

The objective is to determine the relationship of the overall actual labor productivity to that planned. We know that a computed labor productivity index is often presented as the amount of labor time expended per unit of output. Applying the above form of relationship and applying the

rule for computing the index of labor productivity, the index would read:

$$\text{Index} = \frac{1.2 \times 16,000 + 0.8 \times 27,000 + 1.5 \times 4,200}{17,600 + 20,200 + 6,400} = 106.1$$

The result shows that the planned labor productivity quota has been overfulfilled for 6 percent.

The same method can also be used for computation of the abstract (incomplete) labor productivity index. In this case, output is replaced by amounts of completed individual work, expressed in physical units.

In order to obtain the unified formulas of complete and incomplete labor productivity indexes, let us indicate expenditures of labor time for a unit of output in the base period as "t_o". Labor time spent per unit of output in the current period is "t_1". The amount of output of the current period is "q_1". Labor time spent for completion of a work unit in the current period is "m_1". Labor time spent for completion of a work unit in the basic period is "m_o". The volume of work completed in the current period is "Q_1". Using the above designations we have as follows:

the individual complete labor productivity index $= \frac{t_o}{t_1}$

the complete average labor productivity index $= \frac{\Sigma t_o q_1}{\Sigma t_1 q_1}$

the individual incomplete labor productivity index $= \frac{m_o}{m_1}$

the average incomplete labor productivity index $= \frac{\Sigma m_o Q_1}{\Sigma m_1 Q_1}$

Applying the above formulas we can obtain formulas for the indexes of economized expenditure of labor.

According to the formula of the complete labor productivity index, the labor time expended in production of output in the current period based on quotas prescribed for the basic period, would be: $\Sigma t_o q_1$.

Actual labor-time spent in the current period would be: $\Sigma t_1 q_1$. Consequently, saving of labor-time spent during the current period would be: $\Sigma t_0 q_1 - \Sigma t_1 q_1$. Its relationship to work-time consumption based on quotas prescribed for the basic period (the index of labor time saved) would be: $\frac{\Sigma t_0 q_1 - \Sigma t_1 q_1}{\Sigma t_0 q_1}$. Taking the incomplete labor productivity index instead, the above index would read $\frac{\Sigma m_0 q_1 - \Sigma m_1 q_1}{\Sigma m_0 q_1}$.

The index method is very helpful in determining the degree of fulfillment of planned quotas. In spite of its exactness, however, the practical application of this method meets with difficulties due to the lack of available data (it must be known how much time is spent on each type of production or on each job, which data are not given by accounting).

And now, let us turn to the denominator of the formula for the labor productivity index. The most accurate measure of labor-time spent is the number of man-hours expended. However, since no accounting statement contains such detailed information, we have to use instead the data of man-days worked. Here data come in very handy on the over-all number of man-days worked by all laborers (separately for plant cultivation and animal husbandry) contained in the annual statements of the sovkhoz. In time worked there must be included the entire consumed time, including idle time and time spent nonproductively (referred to as gross-hours or gross-days).

In the process of determining the annual labor productivity index, when data on the number of man-days spent is not available, then use is made of the amount of average output per worker (for this purpose the amount of output obtained in a sovkhoz is divided by the annual average number of permanent, seasonal and temporary laborers). The index which

results is considerably less accurate than the previous one.

6. The Use of Labor Productivity Indexes

Labor productivity accounting is important in working out a number of most important practical agricultural problems. We shall describe the use of labor productivity indexes in solving some of these problems.

At the XVII Party Congress VKP (b), comrade Stalin pointed out that: "an abundance of machinery in kolkhozes frees part of rural population from agricultural work," which makes it possible for kolkhozes to release "to expanding industry, annually about one and a half million young kolkhoz members."

In order to determine how much labor-power can be spared from kolkhozes, the amount of labor saved should be determined, as a result of mechanization. This is usually done by comparing data on mechanized labor with labor spent on the same jobs performed with horse traction and manual labor. As an example we are going to present the chart contained in the statistical collection entitled "Socialist Agriculture in USSR," p. 50.

The data used in drawing up the tables was subject to a special study conducted in 1937. As far as the household economy of private farmers is concerned, their budgets were inspected up until 1925.

Labor Economized in Kolkhozes by Using MTS Tractors and Combine-Harvesters in 1937

		Man-days (in millions)	Annual laborers (in millions)
Actual labor expenditure in 1937 for tractor work performed by MTS		220.8	1.9
Labor expenditure for the same work if performed by horse traction and manual labor		1,070.6	9.1
Labor expenditure for the same work if performed within private peasant farms		1,505.8	12.8
Labor economized on work performed by MTS tractors and combine-harvesters	Compared with labor expended on kolkhozes, without use of tractors and combine-harvesters.	849.8	7.2
	Compared with labor expenditure on private peasant farms	1,285.0	10.9

The above chart reveals how there is a saving in the use of labor on one and the same round of work in the socialized kolkhoz economy as compared to private peasant farms; also as a result of the mechanization of agriculture. According to the chart, mechanization frees a considerable amount of manpower from agricultural work. Since the chart contains data on the same round of work under differing conditions, the above data may be used to determine the labor productivity index under mechanization (work performed by MTS tractors), compared with labor productivity for the same work done at kolkhozes with horse traction and by manual labor, and also in contrast to that expenditure of labor which would be needed to do the same job on private peasant farms.

Computed, the first index would read: $\frac{1070.6}{220.8} = 4.85$, and the second one: $\frac{1505.8}{220.8} = 6.82$, which means that after completed mechanization, the labor productivity at kolkhozes subjected to the above study has increased to 485 percent, and compared with labor productivity level at private peasant farms, 682 percent.

Using the data contained in the chart we are able to determine also the indexes of labor saved. The index of labor economized with the mechanization of production, compared with the labor expended in kolkhozes not using tractors and combine-harvesters, would read:

$$\frac{(1070.6 - 220.8)100}{1,070.6} = 79.4 \text{ percent.}$$

The index of labor saved in the mechanized agriculture, compared with the labor expended by private peasant farms, would be:

$$\frac{(1505.8 - 220.8)100}{1505.8} = 85.3 \text{ percent.}$$

A clear concept of the increased labor productivity and lowered expenditure of labor resulting from the mechanization of agriculture, is given by the incomplete labor productivity indexes (per one hectar of field labor) computed for the same jobs, but with production done by a variety of machines. There is in the same periodical (page 49, Russian Text) another chart, which we may use as an example:

Labor Consumption per 1 Hectare of Field Work (in man-days)

	At Kolkhozes in 1937			At private peasant farms through 1922-1925
	Using track-laying tractors (Chelyabinsk Tractor Plant manufacture)	Using Wheeled tractors	Using horse traction and manual labor	
Plowing	0.25	0.41	2.04	2.55
Harrowing and Cultivation	0.05	0.10	0.36	1.15
Sowing	0.10	0.20	0.81	1.81
Harvesting with Combines (at the enterprises using horse-traction power and manual labor--harvesting and threshing together)	0.32	0.48	9.49	14.16
Flax Hackling	—	6.27	13.25	18.98

The data contained in the above chart also are results of the special study conducted in 1937 and budget accounting inspections of private peasant farms.

Example for Chapter VI. The following problem is suggested for chapter VI. In sovkhoz "A" during May 1943, 56 new laborers were taken on while 12 left. During October of the same year 8 laborers were taken on while 49 left. The average listed number of laborers listed in May was 411 persons, and in October 504. In the same sovkhoz, in fulfilling individual jobs in the spring of 1944 and 1943, the following amount of labor-time was expended:

Type of Work	Units of Measurement	1943 Scale of work	1943 Time Spent (man-days)	1944 Scale of work	1944 Time Spent (man-days)
A	hectare	1,020	275	1,130	265
B	hectare	1,020	153	1,130	205
C	hectare	670	74	720	72
D	hectare	250	90	300	96

In the production of output (by individual types) in the sovkhoz there was spent during 1944 and 1943 the following quantity of labor-time:

Types of Production	Units of Measurement	1943 Volume of Output	1943 Time Spent on its production (man-days)	1944 Volume of Output	1944 Time Spent on its production (man-days)
P	centner	15,320	21,448	16,700	18,370
R	centner	26,180	15,708	25,540	17,878
M	centner	2,100	3,570	3,820	4,966

On the basis of the data given above work out the following:

1. Determine the indexes of movement of labor power in sovkhoz "A" in May and October 1943.

2. Determine the individual and average indexes of labor expenditure per hectare during spring operations in 1944.

3. Determine the individual (for the various types of production) and average complete indexes of labor productivity in 1944.

4. Determine the indexes of economy in labor expended in 1944 compared with 1943.

TEST QUESTIONS

1. In sovkhozes how is the number, composition and movement of the work force calculated, also the labor time, regularity of attendance and wages? What serve as the basic documents for such accounting?

2. How is the average listed number of laborers calculated?

3. How are the indexes of the movement of the labor force calculated?

4. What kind of periodical accounting is there in sovkhozes and MTS for labor and wages? What is the content of such accounting, the periods covered, and to whom submitted?

5. How is labor accounting done at the kolkhozes and what is meant by a labor-day?

6. What is meant by the index of labor productivity?

7. What is the complete and incomplete index of labor productivity?

8. How do you compute the index of complete and incomplete labor productivity?

9. How are indexes of economizing labor calculated?

Chapter VII

Agricultural Output Cost Statistics

1. Cost in Agriculture

The overall sum of costs embodied in a unit of produced output is called cost.

A lowering of cost of output in industry and agriculture is of the greatest importance to the national economy, since it is one of the basic sources of socialist accumulation.

As a result of those characteristics of the process of agricultural production compared to industrial production, which was indicated in the chapter on labor statistics, it is an accepted practice (as in the case of labor productivity) to use, together with indexes of unit costs of agricultural production, what is termed the "incomplete" indexes of cost: i.e. cost indexes of units of differing labor (for instance, one hectare of plowing, one hectare of sowing, etc), the expense for maintaining one animal (of one or another group of livestock) over a particular length of time.

From incomplete indexes of cost it is not difficult to construct complete indexes, once the volume of production of the particular year is known. If, for instance, we calculated all costs on one hectare of sown land under one or another crop, and then established the productivity of one or another crop per hectare, then evidently, the unit cost (of for instance, a centner) of output will be equal to the sum of costs incurred on one hectare, divided by the extent of productivity (in centners per hectare).

For individual categories of agricultural enterprises, the question of cost determination is not worked out in the same way: for State farms, for the subsidiary economy (gardens, etc.) of enterprises, offices and organizations, units of particular work as well as unit costs of production may be defined as cost. For MTS, in view of the special nature of the activity of these enterprises, only indexes of the cost of work may be calculated

since the MTS themselves do not produce any material output. The overall index on the cost of operating tractors, combines and prime movers is calculated on the basis of one hectare of the usual soft plowing. In calculating the unit costs of the work of the MTS, only those expenditures are taken into consideration which are incurred by the MTS itself (not including those expenditures of the kolkhozes for work done by the MTS).

Differences in cost depend upon the stage of production from which we calculate them. In this connection, the practice is to differentiate cost in an agricultural enterprise, or productive cost, (including all the costs of the enterprise incurred in turning out the product and internal transportation costs from the place of production to the place of storage), from commercial cost, or the cost of the product when it leaves the producing enterprise.

Production cost is calculated for the entire output of the enterprise (for commodity output and also for output not to be marketed) and the wholesale cost applies only to the commodity output. This wholesale cost includes in addition to production cost the make-up of the administrative-managerial expenditures of the trust (of which the enterprise is a part) or the respective Administration of the People's Commissariat. It includes also expenses incurred in trade selling, transportation expenditures beyond the confines of the enterprise, percentages paid on loans, insurance, etc.

When the sovkhoz has a cost accounting department (when operating with an independent bank balance) then a calculation also can be made of departmental cost, which is ~~minus~~ less than sovkhoz cost on the sum of expenditures borne by the sovkhoz as a whole.

2. Cost Components

There are three basic parts which compose the overall sum of production costs: (a) that part of the cost of the means of labor (the product of the labor of previous years), applied to the output of the current year as amortization; (b) the cost of products of labor which is embodied in the basic materials (seeds, plants, fodder, etc.) and in auxiliary materials (fuels, lubricating materials, fertilizers, chemicals, medicines, spare parts,

repair materials, etc.) and which, in contrast to the means of labor, are completely used up in the process of production; and accordingly their cost is completely taken up in the sum of production costs; and (c) the wages of the workers in the agricultural enterprise (together with bonuses). In addition to this, in cases where it is necessary, the cost of services performed by other enterprises, organizations and persons is included is the composition of cost.

A breakdown of costs into their constituent parts discloses the economic content of the category of cost which is essential for economic analysis. It is accepted practice to term each one of those groups of cost, the cost components. In calculating cost, the actual practice often is to classify expenditures not according to cost factors, but by the so-called complex types of expenditures. As an example, mention may be made of expenses incurred on motive power (live and mechanical) on automobile transportation, on current repairs, etc. Here also must be included the overall productive and the overall non-producing expenditures of the enterprise.

Each of these complex expenditures is made up of expense factors: such as, for instance, live motive power which has a breakdown into the cost of fodder, wages to grooms (including bonuses), amortization of working livestock, etc. Expenditures for mechanizing motive power can be subdivided into tractor amortization, wages to tractor operators (including bonuses), the cost of current tractor repairs, expenditures on operating fuel, lubricants, etc. The cost of current repairs can be subdivided into wages (with bonus), the cost of materials, heating fuels, etc.

In case expenditures are calculated on the basis of a complex of expenses, it is essential to draw up the books so that each type of complex expenditure can be distributed according to the cost components while at the same time insuring a complete economic analysis of the structure of cost.

A different breakdown for classifying expenditures is a division into direct and indirect expenditures. Direct expenditures are those which can be borne directly by the particular product or by the particular work done

(for instance, on grain, fodder for a particular group of livestock; on wages, pay to the workers who took direct part in carrying out the particular job; etc.). Indirect expenditures are considered to be those which relate to several types of output, and to several types of work, where it is not possible to determine directly the expenditure on each product or each job (for instance, amortization of buildings used in animal husbandry which are used for various types of livestock, expenditures for repairing farm machinery and equipment, etc.). Included in indirect or overhead expenses there are the joint overall production expenses (i.e. in common for several brands) and the overall economic expenses (i.e. those incurred by the entire enterprise). Indirect expenditures are broken down by particular products or jobs done under varying conditions and methods (for instance, in proportion to direct wages, in proportion to the sum of primary expenditures without costs for raw materials, for the particular year).

Finally, expenditures are divided into fixed and proportionate.

Fixed expenses do not vary with changes in the volume of production (expenditures on keeping up offices, amortization of buildings, etc.). Proportionate costs vary relative to increases or decreases in volume of production.

In analyzing the structure of cost factors it is essential to study the relative weight of each component (in percent) and then compare the cost structure between individual enterprises or between groups of enterprises (for instance, among sovkhozes of different types), by individual branches of the economy (for imstance, for field cultivation and for animal husbandry). It is essential to study the structure of costs in terms of changes in the individual cost factors or components.

In calculating the cost of one or another product of of one or another job, the technique of applying this expenditure to the unit of output (or of work done) is commonly called calculation.

One of the most difficult problems of calculation is dividing up the direct and indirect expenditures among the particular kinds of what are termed joint products: i.e. the basic product resulting from one or another

object (for instance, the linen trust board relative to flax seed; hay and clover seed; calves and cows milk; or the offspring, the increase in live weight, the wool and the milk in sheep raising).

Working out all the calculation problems is the subject of accounting.

The task of statistics, however, should be considered to be an analysis of the structure of the total sum of costs by their components, an analysis of cost dynamics, an analysis of cost plan fulfillment, an analysis of economics resulting from lowered costs, an analysis of the factors underlying lowered costs - based upon a mass of data.

3. Plan Fulfillment and the Dynamics of Cost

Just as in analyzing other indexes of agricultural production, one of the most important sources of analysis for costs of production is the calculation and study of indexes on the degree of achievement of planned costs. Since usually no difficulty arises from an analysis of plan fulfillment in terms of the individual agricultural products; in this case we are concerned with deriving and studying individual indexes.

The task becomes somewhat complicated when it is necessary to deal with cost plan filfillment by individual branches, by a group of branches or by the entire agricultural output as a whole, i.e.: with heterogeneous products. Here aggregate indexes have to be worked out. In order to become familiar with the nature of their uses as applied in working out the particular problem, let us take the following example.

Fulfillment of Cost Plan of an Agricultural Enterprise

(or group of enterprises) by Heterogenous Production

Types of Production	Extent of Output		Cost of a unit of output		Cost of Planned Products		Cost of Actual Production	
	Plan	Actual	Plan	Actual	In Cost as Planned	In Actual Cost	In Cost as Planned	In Actual Cost
A	1200	1900	10	9	12000	10800	19000	17100
B	700	600	12	14	8400	9800	7200	8400
C	300	290	15	16	4500	4800	4350	4640
Total	2200	2790	--	--	24900	25400	30550	30140

The index of cost plan fulfillment with the actual structure of production $= \frac{30,140}{30,550} \times 100 = 98.7$ percent, i.e.; the plan was overfulfilled by 1.3 percent. If, however, the same index were derived from its planned structure of production, then it would appear that the cost plan was underfulfilled: $\frac{25,400}{24,900} \times 100 = 02.0$ percent, i.e.: the actual cost of output as a whole was above planned cost by 2 percent.

It would appear, in other words, that overfulfilling the cost plan (with the actual structure of output) depended not only upon lowering the cost of product "A", but also upon the failure to maintain the planned structure of output (without which the plan would not be fulfilled). Such an infringement of the plan to a significant extent facilitates an overfulfillment of the cost plan (in calculating it in terms of the actual structure).

In analysing the dynamics of cost of particular types of homogenous production or of particular jobs, the usual approaches of analyzing dynamic series may be used, but in studying changes in time, the costs of heterogenous production or a complex of various work, depending not only upon the level of cost of each product (or each job), but also upon the composition of the products (or the changes in relative weight of the various types of work), then it becomes necessary to use the index method. We shall illustrate its use under such conditions (see next page 100).

The cost index, as it usually is calculated (using the weight of the period under review), is equal to $\frac{\Sigma c_1 q_1}{\Sigma c_0 q_1} = \frac{113,850}{125,000} \times 100 = 91.1$ percent. Thus, the cost of heterogenous production was lowered by 8.9 percent. Unquestionally, cost has been lowered though not as low as had been envisaged in the plan.

The extent of planned lowering of cost we can express by the formula $\frac{\Sigma c_{n_1} \times q_{n_1}}{\Sigma c_0 \times q_{n_1}}$. In our example this index is worked out as follows:

$\frac{120,800}{134,000} \times 100 = 90.1$ percent, i.e.

COST DYNAMICS AND ECONOMIES IN PRODUCTION COSTS

Types of Production (or work)	Volume of Production (or of work)			Unit Costs			Cost of Actual Production (Work) 1943			Cost of Planned Production (Work) 1943		
	1942	1943 Plan	1943 Actual	1942	1943 Plan	1943 Actual	In Unit Costs of 1942	In Unit Costs of 1943 Plan	In Unit Costs of 1943 Actual	Cost 1942	Planned Costs of 1943	Actual Costs 1943
A	2,500	1,000	4,000	12	11.5	11.3	48,000	46,000	45,200	12,000	11,500	11,300
B	4,200	6,000	4,000	18	16	16	72,000	64,000	64,000	108,000	96,000	96,000
C	1,300	1,400	500	10	9.5	9.3	5,000	4,750	4,650	14,000	13,300	13,020
TOTAL	8,000	8,400	8,500	--	--	--	125,000	114,750	113,850	134,000	120,800	120,320

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the plan envisaged a lowering of cost by 9.9 percent, while the actual decrease attained, as indicated above, was 8.9 percent.

On particular types of production, the plan for lowering cost is met and even overfulfilled, and if on all varying types of production the plan has turned out to be not fulfilled, then this is explained exclusively because the actual composition of production turned out to be different from what was indicated in the plan. On the basis of the example given, a calculation can be made also for the planned and actual absolute extent to which costs of production were cut down.

The planned task in economizing was equal, evidently, to the difference between the cost of planned production at planned levels of cost in 1942 and the cost of the same production in terms of planned cost in 1943:

134,000-120,800 = 13,200.

Under the conditions of fulfilling in 1943 the planned structure of economies, the record would show something above the economy envisaged by the plan: 134,000-120,320 = 13,680.

In view of this, however, that the actual structure of production differed from that planned, the actual degree of economy turned out to be less than was envisaged according to plan; 125,000-113,850 = 11,150.

4. Factors Underlying Cost Reduction

Lowering unit costs of production depends upon either an increase in the factors indicating productivity (crop yield, milk yield, wool shearings, egg laying ability, etc.), or else a decrease in costs of production, or a combination of the two factors working simultaneously. The influence of the degree of crop yield on cost is illustrated as follows:

Name of the Particular Economy	Overall Sum Of Costs Of Production Of the Particular Crop	Area Sown Under the Particular Crop(hectars)	Overall Yield of the Particular Crop (Centners)	Overall Sum of Costs as an Average per 1 Hectare Sown	Overall Sum of Costs as an Average per 1 Centner of output
A	81,000	600	9,000	135	9
B	50,400	400	4,200	126	12

With a higher level of expenditure on one hectare of sown area, in sovkhoz "A" the cost of a unit of production is lower than in sovkhoz "B". The reason for this is the higher average yield on sovkhoz "A" (15 centners per hectare), than on sovkhoz "B" (10.5 centners per hectare). Accordingly, the greater amount of expenditure per hectare in kolkhoz "A" resulted in such an increased yield, that its unit costs turned out to be noticeably lower than those of sovkhoz "B". This same approach to analysis can be applied in studying changes in cost overtime. In this case, to establish the influence of increased yield toward lowering cost, it is not essential that the expenditures on one hectare of sown area in a comparable type of economy (or in a comparable year) be greater than in the economy (or year) taken as a base. With an increased yield resulting in lowered cost, expenditures per hectare of sown area may be lowered, but to a lesser degree than expenditures per unit of output. This becomes clear from the following analysis of the table given.

Let "S" represent the total sum of costs, "Q" the overall size of the crop, the sown area "P", and the yield per hectare "U". Then the cost calculated for 1 hectare of sown area becomes $\frac{S}{P}$ rubles; for one centner of output (cost) $\frac{S}{Q}$, and the yield from one hectare is expressed as $\frac{Q}{P}$ centners. Evidently, in dividing the sum of costs on one hectare of sown area by one centner of output, we get the amount of yield per unit of area:

$$\frac{S}{P} : \frac{S}{Q} = \frac{S \times Q}{P \times S} = \frac{Q}{P} = U$$

From this it is not difficult to understand that in increasing yield, $\frac{S}{P}$ either increases to a greater degree than $\frac{S}{Q}$, it diminishes to a lesser degree than $\frac{S}{Q}$, or else it grows as $\frac{S}{Q}$ diminishes.

Exactly the same method of analysis may be used in studying indexes of cost of production in animal husbandry. In this case in studying the influence of changes of productivity, the sum of costs must be calculated per head of that livestock group under consideration (for instance, per 1 cow) and per unit of the respective output (in the particular instance, per 1 kilogram of milk), comparing the changes shown with changes in the index of productivity (average milk yield per one milking cow).

A rather elementary method of studying the influence of growth or decrease of the particular cost factors upon a change (or on plan fulfillment) of cost is through working out the overexpenditures or economies achieved by each of these factors and by determining the impact of each factor in the overall quantity of increase or decrease in cost.

The use of this approach to studying cost plan fulfillment of one or another product through the individual cost factors concerned, we illustrate in the following example:

COST FACTORS	Costs of Actual Production 1943		Over Expenditures (-) or Economy ( )	Percent over-Expenditure or Economy	Percent lowering or raising the overall amount of cost due to particular factors
	At Planned Rate of Expenditure per unit	Actual Expenditures			
1.Amortization	10,000	11,200	-1,200	-12,0	-1,1
2.Basic and Supplimentary Materials	50,000	48,000	2,000	4,0	1,7
3.Wages	40,000	39,000	1,000	2,5	0,9
4.Common Expenditures of Production and Enterprise	15,000	20,000	-5,000	-33,3	-4,3
TOTAL	115,000	118,200	-3,200	- 2,8	-2,8

The final column is derived as follows: the overall sum of overexpenditure amounts to 3,200 rubles, or 2.8 percent, each percent of overexpenditure is the relationship 3,200: 2,8 = 1,143 rubles. The impact of overexpenditure on amortization in the overall percentage of overexpenditure amount to 1,200: 1,143 = 1.1 percent.

The economies achieved on basic and supplimentary materials amounting to 2,000 rubles corresponds to a lowering of cost by 1.7 percent, etc.

From the table given it follows that the basic reason why the cost plan was not fulfilled was because of exceeding the common costs of production and enterprise. Moreover, also the sum calculated for amortization turned out to be somewhat larger than planned. Economies were noted, on the other

hand, on basic and supplementary materials and also on wages. While lowering the overall expenditure on wages, pay per unit of output can be increased as a result of increased labor productivity.

In an analysis of the factors of change in cost, a more detailed breakdown of components may be given (for instance, by subdividing basic and auxiliary materials, bringing out expenditures for heat fuel, by subdividing the common expenditures for production and enterprise, complex expenditures may be brought out, for instance, the expenses of motive power).

Making use of this same approach, factors underlying changed time cost may be brought out in rough estimate.

5. Basic Sources of Data on Cost of Output and Labor in Agriculture.

The annual reports of the sovkhozes and MTS are the basic sources for cost data in agricultural production.

In the annual sovkhoz reports we find the overall sum of expenditures and the unit costs of basic production (plan and actual) - in plant cultivation with a breakdown showing particular types of crop (for grains separating winter and summer crops); calculating expenditures on grain crops (winter and summer); expenditures (by components) in livestock production and the cost (plan and actual) of a unit of output of milk and wool; the overall sum of expenditures on auto and cart transportation and the cost of one ton-kilometer; expenses on the upkeep of work livestock and the cost of live traction power per work day.

In this annual reports, the MTS have data on the expenses for operating tractors, combines and prime movers and on the unit costs of such work (plan and actual). The expenses are subdivided by items, among which we find elemental (fuel, wages), and complex (repairs) expenditures.

EXAMPLES ON CHAPTER VII.

To chapter VII, the following test questions are to be worked out.

1. In the annual reports of one of the sovkhozes of the People's Commissariat of Sovkhozes for 1942 and 1943 we have given the following data on expenditures for the production of field crops.

NAME OF CROP	Sown Area (hectares)			Actual Yield of Basic Output (centners)		Planned Yield per Hectare 1943 (centners)	Cost of Basic Output per centner (in rubles)		
	1942	1943 Plan	1943 Actual	1942	1943		1942	1943 Plan	1943 Actual
Winter grains	100	128	128	1,817	2,665	19	36.54	36.00	34.31
Summer grains	412	337	374	4,993	4,984	13.0	31.39	31.00	27.73
Potatoes	33	50	51	2,281	5,095	110	14.82	13.00	12.52
Vegetables	12	19	19	1,631	2,774	150	20.73	25.00	22.92
Fodder roots	16	20	21	2,355	3,170	225	6.08	6.50	6.20
Silage crops	23	25	18	3,030	2,740	150	4.20	4.00	4.00
Annual sown Grasses for hay	8	35	104	95	2,538	15	16.74	16.00	14.87
Perennial sown Grasses for hay	191	167	239	4,619	7,170	25	9.68	10.00	7.51

Required on the basis of this data:

(a) Derive the index of cost plan fulfillment for all crops for 1943, in terms of the actual and of the planned structure of output.

(b) Calculate the percent of planned lowering of cost and the actual index for lowering cost in 1943 compared with 1942.

(c) Calculate the planned and actual amounts of economizing in production costs in 1943 compared with 1942.

(d) Work out the effect of increased crop yield on lowering the cost of potato production and summer grain crops in 1943 compared to 1942.

2. Over these same years reported there is the following data on expenditures for adult dairy herds (by components) and on the cost of milk (this sovkhoz does not stress milk):

Calculation Components	Sum of Expenditures (in rubles) 1942	1943
Wages	54,271	59,519
Feed	87,642	68,473
Other Direct Expenditures	10,047	15,156
Common Expenditures of Production and Enterprise	50,212	53,014
TOTAL	205,172	196,162

Calculation Components (continued)	Sum of Expenditures (in rubes)	
	1942	1943
Of which, for milk production:		
Plan	250,941	182,642
Actual	198,899	187,241

MILK PRODUCTION

MILK OUTPUT (in centners)	1942	1943
Plan	2,730	2,280
Actual	2,422	2,402
Number of Milking cows	78	81
Average milk yield per milking cow (kilogram)		
Plan	3.500	3,000
Actual	3,105	2,966

EXPENDITURES FOR FEEDING THE MILKING HEAD

TYPE OF FEED	Quantity (in centners)		Cost (in rubles)	
	1942	1943	1942	1943
1. Concentrated	402	348	21,522	20,570
2. Bulk	2,682	1,948	17,702	12,073
3. Succulent	3,873	3,680	29,266	25,760
4. Green feed	1,800	1,967	18,766	9,920
5. Other feed	--	--	386	150

On the basis of the data given it is required that the following questions be answered.

(a) To what was the change due in the structure of costs for the milking herd in 1943 over 1942?

(b) In what way has the cost of a kilogram of milk changed in 1943 and as a result of what has this change taken place (show the part played by the individual factors)?

(c) What is the index of plan fulfillment on the cost of milk?

3. In the annual reports of one of the MTS in 1942 and 1943 we have the following data on the cost of tractor work.

ITEMS OF EXPENDITURE	Total Expense 1942	Total Expense 1943	Average Expenses per 1 hectare plowed as Planned 1943
1. Fuels (for motors)	200,220	200,300	14.07
2. Repairs	113,600	75,640	6.45
3. Wages to Producing Laborers	72,420	87,865	5.66
4. Wages to Other Personnel	99,420	84,222	6.86
5. Miscellaneous	29,820	20,176	1.87
TOTAL	515,480	468,203	34.91

The total work done is expressed in terms of average hectares of soft plowing: in 1942 as 14,200 hectares, and in 1943 as 15,370 hectares.

(a) Are the cost factors or are common expenditures brought out in the enumerated items of expense?

(b) How has the breakdown of cost expenditures changed in 1943 over 1942?

(c) Derive the index for planned cost fulfillment in 1943.

(d) Calculate the percentage of planned lowering of cost and the actual index of lowered cost in 1943 relative to 1942.

(e) Calculate the planned and actual amount of economizing in cost of production in 1943 as compared to 1942.

(f) Indicate the relative importance of the various factors in lowering the costs of tractor work at MTS, calculating on a basis of 1 hectare of soft plowing.

TEST QUESTIONS

1. What is termed cost and of what significance is the study of the factors which indicate cost?

2. What are the characteristics of the factors which indicate cost of production in agriculture?

3. Of what basic components are costs of production made up, and what are factors of expenditure and of common expenditure called?

4. What are termed the direct and indirect, the constant and proportionate expenditures?

5. How is the index of cost plan fulfillment and of decreased costs computed?

6. How do you calculate the planned and the actual amount of economizing in cost of production?

Chapter VIII

STATISTICS OF CAPITAL ASSETS IN AGRICULTURE

1. Classification of Capital Assets

Capital assets or basic means of production are products of the past, of already expended labor. Means of labor are the implements of labor (machines, implements, inventory, working and producing livestock, etc.), and also structures, buildings, etc.

The extent and structure of capital assets is one of the most important factors determining the degree of power, the size and nature of the activity of agricultural enterprises.

It is the task of statistics to indicate the extent of capital assets, to study their structure and change, etc. Since there are various categories of agricultural enterprises and since there is variety among the assets themselves, therefore in studying the basic means of production it is necessary to classify them. Assets in agriculture may be variously classified. The basic division is into assets according to property form and according to intended use.

There are the following property form groups of assets in keeping with the Stalin-Constitution:

1. Assets which are State property, the wealth of all the people (sovkhoz assets, MTS, and the subsidiary economies of State enterprises and offices).

2. Assets held as cooperative-kolkhoz property (assets of the kolkhozes, and also the assets of agricultural enterprises of cooperative organization).

3. Assets making up the personal property of the kolkhoz members, the maximum extent of which is taken into consideration in the charter of the agricultural artel (kolkhoz).

4. Assets which make up the personal property of the laborers and employees.

5. Assets belonging to the private non-collectivized peasants and to the non-cooperated artisans.

According to intended use, assets are divided first of all into two basic groups:

1. Capital assets used in production

2. Capital assets for uses other than production

Production capital assets in turn are subdivided into active and non-active capital assets. A detailed classification of active production assets is given in the annual reports of the sovkhozes and MTS. (For a classification of capital assets which is given in the annual reports of sovkhozes, see the example below, which is given for solution in connection with the subject under discussion).

Non-active capital assets of productive uses are: (a) capital assets to be saved or kept in reserve, which are kept out of use, over one or several production periods, (b) basic assets for transfer, being taken over by one sovkhoz from another at the time that the final balance is being drawn up, and (c) young plants for setting out.

Capital assets for uses other than production are composed of (1) living quarters; (2) buildings of public utility and their equipment (restaurants, baths, laundries, etc.); (3) buildings with equipment for cultural and educational uses and for health (clubs, libraries, schools, hospitals, nurseries, etc.).

2. Monetary Evaluation of Capital Assets

To determine the overall extent of capital assets these funds must be expressed in terms of money.

A monetary evaluation of capital assets may be accomplished in one of three ways: (1) in terms of complete initial cost; (2) in replacement cost, or; (3) in terms of initial cost less depreciation.

Initial cost is derived from an evaluation of assets at those prices which were current at the time that these assets were obtained.

The overall cost of capital assets used in production in socialist agricultural enterprises in the USSR in terms of the balance evaluation without subtracting for the cost of depreciation at the beginning of 1938 amounted to 30,568.2 million rubles. Of this sum, 28,551.3 million rubles

went for assets used in agriculture. 2,016.9 million rubles of the total assets were for subsidiary and auxiliary production. The assets of agricultural use are made up of the following basic parts: buildings and structures (8,334.3 million rubles), tractors (2,499.4 million rubles), combines (985.4 million rubbs), agricultural machinery and instruments (3,303.2 million rubles), productive livestock, birds and bees (3,491.4 million rubles), working livestock (3,076.1 million rubles), reclamation installations (2,091.5 million rubles) and others. (source: Socialist Agriculture, statistical collection, Gosplan Press, 1939, page 22).

Replacement cost is arrived at in evaluating assets in terms of those prices at which new capital assets of the particular type and quality can be purchased at the present time. In order to evaluate capital funds at cost minus deterioration, original cost must be taken less amortization covering the period that the capital assets have been in use and adding the cost of capital repairs.

We call attention to a simple example of how to work out all the three ways of evaluating capital assets in production. Let us assume that at the beginning of 1934 a sovkhoz acquired some sort of agricultural machinery for 10,000 rubles. The amount of work which the machine must accomplish over the entire period of its usefulness (in hours, hectares, etc.) is given as 12,000. The total cost of necessary capital repairs during the life of the machine, let us assume, is 4,500 rubles. The worth of the machine as scrap at the end of its period of usefulness is given as 500 rubles.

In 1939, the cost of this same machine new, was lowered to 9,000 rubles. In this example the initial cost of the machine was 10,000 rubles and the replacement cost in 1939 was 9,000.

In order to go about calculating the cost, taking depreciation into consideration, it is essential first of all to calculate the amount of amortization. The requirement that amortization be excluded from initial cost in order to arrive at cost with depreciation all stems from the fact that capital assets in production participate not only in one but in sev-

eral production processes, and their cost is carried over into the cost of the product not in entirety but only in part. The cost of that part of the means of production which goes into the output product is what is termed amortization. The amount of amortization to be subtracted depends upon the initial cost, capital repairs during the entire period that the assets exist, on cost when assets are liquidated (scrap value) and on the volume of work which the machine must accomplish during its entire period of service.

If we designate initial cost as "IC", with "CR" representing the cost of capital repairs over the life of the assets, "SV" final scrap value and "W" the number of work units which the machine must turn out over its entire period of service, then the amount of amortization removed on the average from one unit of work must equal:

$$\frac{IC + CR - SV}{W}$$

The rate of discount for amortization as a percentage of initial cost is established by the respective People's Commissariats (People's Commissariat of Agriculture, People's Commissariat of Sovkhozes) for the particular types of assets. Funds for the reproduction of capital assets are built up from deduductions for amortization. In accordance with the orders of People's Commissars USSR of 8 March and 15 April 1938, 55.5 percent (for sovkhozes under the People's Commissariat of sovkhozes) and 57.1 percent (for sovkhozes under the People's Commissariats of Agriculture and of Food Industry) of all amortization deductions on all types of capital assets (except for working and producing livestock) are left at the disposal of the sovkhozes and are used by them for capital repairs. The remainder of amortization deductions is taken over by the agricultural bank.

Using this procedure explained, let us calculate in our example the average amount of amortization deduction per unit of work: The amortization deductions for a year $= \frac{10,000 + 4,500 - 500}{12,000} = \frac{14,000}{12,000} =$

1.17 rubles.

Let us suppose that up to the end of 1939 a machine accomplished 7000 units of work. Then the sum of amortization deductions equals 1.17 rubles X 7,000 = 8, 190 rubles. If it is given that 2,750 rubles were spent on capital repairs over a six-year period, then the cost of the machine taking depreciation into consideration, at the end of 1939 is expressed as follows: 10,000-8,190+2,750= 4,560 rubles.

Cost, taking depreciation into account, gives us the degree to which capital assets have been depleted, which is necessary to know in planning assets. In determining amortization discounts, it should be borne in mind that with perennial plants (trees and shrubs) only those old enough to bear fruit are subject to amortization calculations. Of livestock, only those are taken into consideration which are part of the capital assets of production, i.e.; full-grown working livestock and producing cattle (except animals being fattened up). Yearlings and livestock being fattened are considered as operating funds and are not subject to amortization.

If we wish to study changes in the overall natural size of capital assets (summed up for all types and groups) over time, then it is essential to express the cost of assets in constant prices. For constant prices, in actual practice 1926-1927 prices are taken or those of 1923. The capital assets of the sovkhozes of the People's Commissariats of Agriculture and of Sovkhozes were recomputed in terms of 1934 prices.

3. Initial Analysis of Data on Capital Assets

For an initial analysis of data on capital assets, the folllowing minimum number of statistical indicators are calculated.

(a) indexes of plan fulfillment of capital investment for the fiscal year;

(b) indexes of the change of capital funds, by their individual types, by groups and in sum total; (in studying changes in the individual kinds of funds, we can use data expressed in physical units.

In calculating indexes of change of the capital funds by their respective groupings, and particularly for the sum total it is necessary to evaluate the funds for each year in constant prices);

(c) indexes of the distribution of capital assets (in percent) for productive and non-producing capital, and for productive assets by the particular types and groups;

(d) a distribution of assets (in percent) by basic types of property, that which indicates the degree of socialization of particular types of property in the kolkhozes is of special interest and

significance since the kolkhoz members can have (within established limits) personal property - dwellings and useful structures, livestock, fowl, bees and small-size farming equipment.

Indexes of the degree of socialization of property can be expressed as a relationship (in percent) of particular types of socialized kolkhoz property to the total of socialized property together with that property which is for the personal use of the kolkhoz members. Example: If in the kolkhozes of any particular region there are 10,120 head of socialized kolkhoz cattle and 6,500 head for the personal use of the kolkhoz members, then the index of socialization of cattle is the equivalent of

$$\frac{10{,}120 \times 100}{10{,}120 + 6{,}500} = 60.9 \text{ percent.}$$

4. Sources of Data on Capital Assets

Speaking of data sources for capital assets, first of all, attention should be called to the annual reports of the sovhozes, MTS and kolkhozes.

The cost of capital assets is given in the annual reports in terms of initial valuations. In the annual reports of the sovkhozes and MTS we find data on the cost of assets at the beginning and at the end of the year, on the shifting around of capital assets during the year among enterprises, on the depletion of assets becoming dilapidated and worn out, on existing capital assets by various types at the end of the fiscal year, on capital repairs (plan and actual), on new construction, and on calculated amortization.

In the annual reports of the kolkhozes we have information on shifts in capital assets throughout the year. In addition to data on capital assets within the economy, the annual reports also contain detailed information on the capital investments made during the year under review. We can get certain data on the capital assets in the economy of the kolkhoz members (expressed in kind) from their budgets.

Finally, it is necessary to point out that data on livestock assets (working and producing livestock) for all categories of the economy can be obtained (expressed in units of kind) from livestock census and livestock count information.

Classification of Assets	On Hand as of 1 January 1943, (expressed in initial cost)	Classification of Assets	On Hand as of 1 January 1943, (expressed in initial cost)
A. Capital assets of production use, in use		B. Capital assets of production use, in reserve	--
1. Buildings and structures (except for reclamation)	1,745,608	Including young plants (trees and shrubs) set out	--
2. Reclamation structures and planting set out	--	C. Capital assets for residence culture and welfare public services	
3. Land reclamation and reservoirs (without equipment)	4,862		
4. Plantings which yield	--	14 Residence buildings	918,740
5. Tractors	38,204	15 Public welfare (restaurants, baths, laundries, etc.)	79,940
6. Combines	18,203	16 Cultural, educational and health (clubs, libraries, schools, hospitals, nurseries, etc.)	180,774
7. Other agricultural machines and instruments	30,893		
8. Miscellaneous agricultural inventory and implements	19,425		
9. General inventory	26,581		
10. Transportation:			
(a) mechanized	45,990		
(b) horsedrawn et al	8,942		
11. Working livestock (adult)	143,363		
12. Producing livestock (adult), except that being fattened or on the range exclusively for meat (for slaughter)	374,406		
13. Buildings, equipment and inventory of technical and auxiliary enterprises:			
(a) repair shops	51,827		
(b) electric stations	187,032		
(c) miscellaneous industrial enterprises	59,225		
TOTAL for Section "A"	2,754,561	TOTAL for Section "C"	1,179,454
		SUM TOTAL	3,934,015

On the basis of the data given, it is required that the composition (structure) of capital assets of sovkhoz "A" be worked out in terms of relative size.

TEST QUESTIONS

1. Into what groupings are agricultural capital assets divided?
2. What methods of evaluating capital assets are used?
3. What is meant by amortization and how is amortization calculated per unit of work?
4. What in agriculture is useful as sources of data on capital assets?
5. What principal indexes are worked out in studying (analyzing) data on capital assets?

CHAPTER IX

STATISTICS OF AGRICULTURAL MECHANIZATION

1. Statistical Objectives Pertaining to Agricultural Mechanization

Basic objectives of accounting and statistics of agricultural mechanization are: collection and processing of data for the analysis of the degree of plan performance covering the overall scope of tractor operations; to analyse the degree of plan performance of output by tractors, combines, and other agricultural machinery; to analyse the increasing complexity of agricultural mechanization; to bring out and study the achievements of agricultural leaders in using machinery; to expose lagging sovkhozes, MTS, and kolkhozes; to analyze the degree of plan fulfillment for fuel consumption; and to analyze cost indexes of tractor operations.

2. Classification of Prime-Movers Used in Agriculture

All machinery, used in agriculture should be divided into two basic groups: prime-movers and operating machinery.

Prime-movers, the source of power used in agriculture, in turn are divided into two basic groups - primary and secondary movers. Under secondary movers we include electric generators and electric motors. They are called secondary, because in order to obtain the type of power they generate, another source of energy is required. Thus, an electric generator, which converts mechanical power into electric power is motivated by mechanical power. In contrast, an electric motor is driven by electric current and converts electric energy into mechanical energy. Primary sources of energy should be divided into sources of live energy and sources of mechanical energy.

Primary mechanical movers are subdivided into (1) heat engines, liquid fuel operated (fuel oil and other petroleum products): (2) gas generators, converting solid fuels, lumber mill scrap, agricultural refuse, etc into gas generating fuel; (3) steam engines (4) hydrolic water and (5) wind movers.

Thus the classification of prime movers in agriculture may be summarized in the following breakdown:

A. Prime Movers

I. Live motive power (draft animals):

(1) work horses (2) oxen (3) camels (4) other draft animals.

II. Mechanical Movers

(1) Liquid fuel operated engines with low compression: (a) tractors (b) automobiles (passenger and trucks), (c) combine movers (d) stationary movers - petroleum, gasoline.

(2) Liquid fuel operated engines with high compression - diesels.

(3) Gas generators: (a) gas generating tractors (b) gas generating automobiles (c) stationary gas generating movers.

(4) Steam movers: (a) stationary steam engines, steam turbines (b) locomobiles

(5) Hydraulic movers: (a) wheel (b) turbine

(6) Wind movers

B. Secondary Movers

I. Electric generators

(1) Direct current dynamos

(2) Alternating current generators

II. Electric motors

(1) Direct current electric motors

(2) Alternating current electric motors

In measuring the power of the mover we must know the unit of measure employed. The power of all the above-mentioned mechanical movers (excluding electric movers) used in agricultural production, is usually measured in horse power. This technical power unit expresses the capacity of a machine to produce work, equal to the effort of lifting 75 Kilograms to a height of one meter (75 Kilogram-meters) in one second. This unit is customarily expressed in Russian by the letters "l.s." or by letters of the Roman alphabet "HP". The power of a tractor is customarily indicated by a fraction, whose numerator is the draw-bar capacity (i.e. the power available when the tractor is used as a tractive medium) while the denominater is the pulley capacity

(i.e. the force of the tractor when used as a stationary mover, as during threshing).

Draw-bar capacity is lower than pulley capacity, because in using the tractor for traction, part of its power is utilized for its own locomotion, for towing, friction of parts, etc.

The power of electric movers is usually expressed in Kilowatts (101.9 Kilogram-meters per second), then 1 Kilowatt is equal to

$$\frac{101.9}{75} = 1.36 \text{ HP}$$

The power of a horse in mass calculations has been accepted conventionally as 3/4 (0.75) HP. This correlation, however, may change depending on the type and quality of the horses. For each individual enterprise the conversion coefficient may be calculated more precisely, if it is known that power is equal to the product of tractive force multiplied by speed of movement per second. Tractive force (which is expressed in kilograms) in turn depends on the live weight of the horse, representing 13-15 percent (average 14 percent). The average speed of a horse at a walk may be considered 4 kilometers per hour or 1.1 meters per second. Thus, if for example, the live weight of a horse is 400 kilograms, tractive force represents $\frac{400 \times 14}{100} =$ 56 kilograms, while its power is equal to 56 x 1.1 = 62 kilogram-meters per second, i.e. $\frac{62}{75} = 0.83$ l.s.

For converting into mechanical units the power of an ox is considered equal to 2/3 of that of an average horse, i.e. in round numbers 0.5 HP.

Subsequently we shall dwell in more detail on those things that indicate the presence and use of tractors-prime-movers, which have played an important role in the technical reconstruction of our socialistic agriculture.

3. Tractor Inventories

The following basic types and makes of tractors are used in agriculture:

Tractor Types and Makes	Nominal tractor power in HP draw-bar Pulley
I. Wheel-tractors	
1. SKhTZ	15 / 30
Plowing:	
2. "Universal" - Y-1	10/20
3. "Universal" - Y-2	10/20
II. Track-laying	
1. Stalinetz ChTZ - ligroin	48/60
2. Stalinetz ChTZ - diesel	50/65
3. Stalinetz ChTZ - gas generating	35/50
4. SKhTZ-NATI - Kerosene (carburator)	32/46
5. SKhTZ-NATI - gas generating	27/40

These types and makes serve as a basis for accounting in a tractor park.

In studying the application of mechanical tractive power in agriculture we are interested in two basic groups of indexes: indexes showing reserves, that is, tractors on hand, and indexes of their utilization.

Tractors on hand may be expressed by various indexes:

(a) A register (counted in the balance of the establishment) or a count of physically present tractors at a given time (at the beginning and end of a year, at the beginning of a quarter, month, start and end of an agricultural period, etc) is considered the simplest form of index.

(b) The preceding index is inadequate, in as much as the tractor park contains tractors of various makes and consequently of varying power capacity. Therefore to determine the total power of a tractor park, it is expressed in draw-bar capacity in horse power (HP).

To express the power of an entire park in HP one should group all tractors by makes, multiply the power of each make by the number of tractors of this make and add the results.

To facilitate computation it is now accepted practice to express tractor power in conventional units of 15-power tractors. To determine the size of a park in terms of conventional 15-power tractors, the total power of the entire tractor park should be divided by 15.

Example: On 1 January 1944, MTS had 15 ligroin ChTZ "Stalinetz" tractors, 10 diesel "Stalinetz" tractors, 12 STZ-NATI tractors, 20 KhTZ and STZ wheel tractors and 8 "Universal" tractors. Knowing the draw-bar power of the tractors, we can carry out the following calculation:

Tractor Make	Number of Tractors	Draw-bar Power in HP	Total Power of all tractors of every make in HP
1. Tractors ChTZ "Stalinetz" ligroin	15	48	720
2. Tractors ChTZ "Stalinetz" diesel	10	50	500
3. Tractors StZ NATI	12	32	384
4. Tractors KhTZ and STZ - wheel	20	15	300
5. Tractors plowing - Universal	8	10	80
TOTAL	65	--	1,984

On January 1, 1944 the MTS park had 65 tractors with a total of 1,984 horse power. The number of tractors converted into conventional 15-power tractors is equal to $\frac{1,984}{15} = 132$.

Note: There is another method to convert the count of the tractor park into conventional 15-power tractors, i.e. by multiplying the number of tractors of each make by calculated, conversion coefficients, and adding the results. As conversion coefficients one may use the ratio of the power of each make of tractor to 15 (draw bar capacity). For example, the conversion coefficient for the ligroin "Stalinetz" tractor is equal to $\frac{48}{15} = 3.2$, for a "Stalinetz" diesel tractor 3.33, for STZ and KhTZ wheel tractors 1, for "Universal" tractors 0.67, etc).

(c) The preceding two indicators do not reflect tractor movement during the year, although their number may fluctuate considerably (new tractors come in, some tractors are disabled, some are transferred to other establishments, etc). For various computations one should know the number of tractors for this or that period (month, quarter, season, year) and their movements. As a result it is necessary to calculate one more index - average registered number of tractors for this or that period. Using this

index it is possible to calculate the average output of one tractor per season.

To arrive at the average registered number of tractors, it is necessary first to determine the number of tractor-days, i.e. total number of days all the tractors were at the disposal of the enterprise, during a specified period of time. This figure will be obtained by adding the number of tractors at the enterprise every day of the period. The quotient of dividing the number of tractor-days by the number of days in a given period will be the average registered number of tractors for that period. Example: Let us assume that on April 1 a given sovhoz had 10 KhTZ tractors, on April 5 two tractors of the same make were added, on April 16 one was withdrawn and on April 25 three more tractors came in. We want to determine the average number of tractors for the month of April. Let us perform the following calculation.

	number of days	Number of tractors present during that period	Number of tractor-days (col.3 x col.2)	
1	2	3	4	
1-4 April	4	10	40	Average number of KhTZ tractors during April in a given enterprise equal to $\frac{355}{30} = 12$
5-15 April	11	12	132	
16-24 April	9	11	99	
25-30 April	6	14	84	
TOTAL	30	--	355	

If a sovhoz or MTS park has tractors of various makes and if we wanted to have an idea of the park's power for a year, it would be necessary, first, by the above mentioned method, to determine the average seasonal number of tractors by make, considering as a season the working period, i.e. that period of time (in days) from the start of spring field operations to the end of fall field operations; the entire number of tractors listed in the inventory books of the enterprise should be considered (include the inactive tractors). Knowing the seasonal average number of tractors of each make it is possible by one of the two methods mentioned to calculate the power of the tractor park

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converted into 15-power tractors. As a result we obtain the average registered seasonal number of tractors converted into conventional 15-power tractors.

An example is given below of the calculation of registered seasonal average number of tractors converted into 15-power units. In a given sovhoz tractor spring field work started on April 15, autumn field tractor work ended on November 2. At the start of the field work the enterprise had 2 "Stalinetz" ChTZ ligroin tractors and 11 STZ and KhTZ wheel tractors. The following changes took place during the work period.

"Stalinetz" tractors: One tractor was added on 2 May and one on 5 July. One tractor was withdrawn on 15 September.

STZ and KhTZ tractors: 3 tractors were added on 25 April and one tractor was withdrawn on 3 June. 2 tractors were added on 12 July and one tractor was withdrawn on 1 October. In addition, on 1 July 2 STZ-NATI tractors were added.

Let us first determine the average seasonal registered numbers of tractors by make.

"STALINETZ" TRACTORS

Date	Number of days in the period	Number of tractors present during each period	Number of Tractor-days
15/4-1/5	17	2	34
2/5-4/7	64	3	192
5/7-14/9	72	4	288
15/9-2/11	49	3	147
TOTAL	202	-	661

Seasonal average registered number of "Stalinetz" ligroin tractors $\frac{661}{202} = 3.3$

STZ and KhTZ - WHEEL TRACTORS

Date	Number of days in the period	Number of tractors present during each period	Number of Tractor-days	
15/4-24/4	10	11	110	Seasonal average registered number of STZ and KhTZ wheel tractors $\frac{2840}{202} = 14.1$
25/4-2/6	39	14	546	
3/6-11/7	39	13	507	
12/7-30/9	81	15	1215	
1/10-2/11	33	14	462	
TOTAL	202	--	2,840	

STZ-NATI Tractors: Two tractors of this make were received on 1 July (up to 2 November) 125 days each. Inasmuch as the entire work period was 202 days, the seasonal average registered number of STZ-NATI tractors is equal to

$$\frac{2 \times 125}{202} = 1.2$$

We now are able to express the seasonal average registered number of tractors converted to 15-powered units.

Tractor Make	Draw bar power in HP	Seasonal average registered number of tractors	Total Power	Number of tractors converted into 15-powered units
ChTZ-Stalinetz ligroin	48	3.3	158.4	10.6
STZ-NATI	32	1.2	38.4	2.6
STZ-KhTZ wheel	15	14.1	211.5	14.1
TOTAL	--	18.6	408.3	27.3

Seasonal average number of all tractors, converted into 15-power units, based on the data in the above tables may be calculated in two ways: (a) by converting into 15-power tractors, separately according to make and adding up the results (last column in the table); the total is 27.3; (b) by dividing the sum total power of all tractors of all makes (total of column 4) by 15: $\frac{408.3}{15} = 27.2$. The difference is 0.1. The second method is more accurate;

besides it is not necessary to do the calculations shown in column 5.

To characterize a tractor park from the standpoint of quality it is very important to show the mechanical condition of the tractor park. To this end, tractors should be divided into serviceable and those requiring current repairs, capital or replacement repairs (i.e. necessitating replacement of basic parts).

4. Indexes of Tractor Utilization

Tractor utilization in an enterprise is characterized by two basic indexes: index of utilization of the tractor park and average production of one tractor.

The index of utilization of the tractor park is equal to the average number of tractors, operated during a given period of time (arrived at in the same manner as the average registered number of tractors, but only with machines that performed work), expressed as a relative to the average registered number of tractors for the same given period of time.

In determining tractor output during the tractor operating period of a given year, one should bear in mind that had the tractor during the entire period performed only one type of work, we could express its output in numbers of physical units of work performed (for example, numbers of hectares plowed).

However, during the course of a year a tractor performs various types of work, therefore to arrive at a summary index of its yearly output, it is necessary to express the different types of work in homogenious units and sum up the work performed during the years in these units.

The unit used in expressing each type of agricultural work, for their comparison and summing up of all work, is the plowing of 1 hectare of soft land (or in other words, 1 hectare of conventional soft plowing). Definite coefficients have been established to convert all agricultural operations into units of conventional soft plowing. These coefficients may change depending on a number of conditions. As a rule, tractor parks in MTS and sovhozes, and particularly those in all MTS or sovhozes of a rayon or oblast

taken as a whole have tractors of various makes and the number of tractors varies with the work period. Therefore, in order to characterize the average output of a tractor, in any one enterprise or group of enterprises, one should divide the total quantity of work performed by the tractor park, converted into hectare soft plowing units, by the average registered number of tractors, converted into conventional 15-power tractors.

In determining the average output, one must base oneself, specifically, on the tractors registered and not only on those that actually performed the work. Otherwise the degree of utilization of all the park tractors would be in correctly reflected and there would be no incentive to increase such utilization.

Let us illustrate this situation. Suppose in a given MTS, average yearly registered number of tractors converted into 15-power units was 116 units and that during the year this MTS performed the following work (work performed by MTS during the year expressed in physical units and converted into conventional units of soft plowing):

Type of work	Unit of Measure	Actual work performed in physical units	Coefficient of conversion into units of soft plowing	Work performed in conventional units of soft plowing
1. Plowing fallows	hectare	6,000	1	6,000
2. Cultivating fallows	hectare	4,800	0.6	2,880
3. Winter fallows	hectare	14,000	1	14,000
4. Plowing cloves, etc.	hectare	6,000	1.4	8,400
TOTAL WORK PERFORMED		--	--	74,143

Average output of one conventional 15-power tractor is $\frac{74,143}{116} = 639.1$ hectares in conventional units of soft plowing for the work period of the year.

As final indicator of a tractor's output one should consider the extent to which the planned output has been met. We obtain this index, by

determing the percentile relation of the average factual yearly output to the planned output.

A very important index, characterizing the degree of effective use of tractors and necessary for the correct organization of tractor work, is an index of the utilization of the tractor's tractive force.

Tractive force (or power) is the quotient of dividing power by speed, while power in turn is determined by the amount of work per second (equal to the quotient of dividing work by time). The work of the machine (in this case the tractor) is equal to the product of multiplying tractive force by distance travelled.

Let us establish the following conventional designations:

N - power

P - tractive force in kilograms

S - distance in meters

T - time in seconds

R - work

V - speed per hour in kilometers

Using these designations, we may express:

$N = \frac{R}{T}$; $R = P \times S$, therefore $N = \frac{P \times S}{T}$ (1) i.e. $P \times S$ kilogrammeters per second.

Since, as a unit of power we accept a horse-power equal to 75 kilogram-meters per second, therefore power, expressed in horsepower is equal to:

$$N = \frac{P \times S}{T \times 75} \qquad (2)$$

Using tractor speed equal to V Kilometers per hour, we have:

$$N = \frac{P \times V \times 1,000}{75 \times 60 \times 60} = \frac{P \times V}{270} \qquad (3)$$

This deduction is a result of the following considerations:

$\frac{S}{T}$ in formulas (1) and (2) = speed in meters per second. V = speed in Kilometers per hour. To express V and $\frac{S}{T}$ in the same units, we should: (1) multiply V by 1,000 in order to express the result in meters, and not in Kilometers; (2) divide V by 60 X 60 to convert to seconds and not per hour.

From formula (3) we obtain the following equation of tractive force:

$$P = \frac{N \times 270}{V} \qquad (4)$$

This formula enables us to determine the tractive force of a tractor, if we know the draw-bar capacity (N) and speed (V), 270 = a constant multiplier.

When trailor attachments are used, the tractive force of the tractor must overcome the tractive resistance of the attachment. In operation the attachments encounter soil resistance and the resistance of plants (in clearing work), etc. Resistance per 1 Centimeter of operating width of the attachment is called specific resistance, while the resistance of the entire attachment is called tractive resistance and is measured in Kilograms. In figuring out the tractive resistance of a plow one must consider the depth of plowing.

If we designate the attachment operating width by A Centimeters, specific resistance by K Kilograms, then the tractive resistance will be K x A Kilograms. If we talk about a plow, the K will be k x B, where k is resistance per 1 square centimeters and B depth of furrow.

Special tables are available for calculating tractive force and tractive resistance of various attachments. The higher the tractive force of the tractor and tractive resistance of the attachment, the higher the utilization of tractor efficiency. The ratio (in percent) of tractive resistance of the attachment to the tractive force of the tractor is called the coefficient of utilization of tractive force of a tractor.

For the maximum utilization of tractive force of the tractor a suitable choice of attachments is imperative. The tractor will be efficiently used only with a correct selection of attachments. On the one hand it should not be overtaxed, while on the other the load should not be much below its capacity.

5. Calculating the Effective Use Made of Liquid Fuels

The amount of fuel (kerosene, ligroin, diesel oils) and lubricants used in operating a tractor is of significant importance. The actual

consumption of fuel per hectare of conventional soft plowing (by each make of tractor) is calculated and compared with established quotas.

6. Automobile Utilization Indexes

The extent to which agriculture is supplied with truck transportation may be expressed either by the number of cars on a certain date (for example on 1 January), grouped by makes and their total tonnage, or by the number of machine-days the trucks were in the enterprise, or by the average registered number of automobiles during a given period (by makes, with total tonnage indicated). These indexes are calculated in the same way as comparable indexes showing adequacy of tractor supply.

The number of machine-days worked and the percentage ratio of this number to the total number of days the automobiles were available at the enterprise all serves to indicate the effective use of automobile parks.

The work of an autopark may be characterized by a number of indexes, basic among which are the total tonnage transported and the distances covered. A composite index of tonnage and distances is the number of ton-kilometers, i.e. work-units required to transport one ton over a distance of one kilometer.

To determine correctly the total number of ton-kilometers covered by all the automobiles, it is necessary to determine this number for each individual trip and then add those together for all the trips over a given period. The number of ton-kilometers for each individual trip is equal to the product of tonnage moved multiplied by the number of kilometers covered with this tonnage.

Example: An automobile for sovkhoz A carried 2 tons to a point B (30 kilometers) and returned empty. Then from the same sovkhoz, this car delivered to a point C (18 kilometers away) a load of 1.8 tons. From point C to point D (8 kilometers away) 1.5 tons are delivered and from point D to sovkhoz A (22 kilometers away), a 1.2 ton load is carried.)

It is required to determine the total number of ton-kilometers for these trips. Our calculations are as follows;

Trips	Distance (Kilometers)	Tonnage carried	Number of Ton-Kilometers Worked
From A to B	30	2.0	60
From B to A	30	--	--
From A to C	18	1.8	32.4
From C to D	8	1.5	12.0
From D to A	22	1.2	26.4
TOTAL	108	6.5	130.8

It would be incorrect to compute the ton-kilometers by the totals of distance covered and quantity of goods moved. Thus, if in the above example, to arrive at the total number of ton-kilometers we would multiply 6.5 by 108, the product (702 ton-kilometers) would be far removed from the truth (130.8 ton-kilometers).

Let us name a few other indexes, characterizing automobile utilization:

(a) Index of utilization of automobile park, is determined by calculating for a given period, the percentage ratio of the number of machine-days of work performed by the automobile to the total number of machine-days the automobiles remained in the farm enterprise.

(b) Index of pay-load runs, i.e. the part of the distance covered with a load.

(Example: Two automobiles each covered 120 kilometers, 90 kilometers of which with a load; 3 automobiles each covered 180 kilometers, carrying a load of 140 kilometers; one automobile covered 160 kilometers, of which 80 kilometers was with a load.

Coefficient of pay-run $= \frac{(90 \times 2 + 140 \times 3 + 80) \times 100}{120 \times 2 + 180 \times 3 + 160} = \frac{680 \times 100}{940} =$

72.3 percent.)

(c) The index of effective load is equivalent to the ratio (in percent) of the total tonnage carried to full load capacity of the automobiles. In other words, it is the ratio of the actual ton-kilometers to the load-capacity ton-kilometers.

(Example: The following table shows the load-capacity, actual work performed and calculation of effective load capacity).

Automobile Make	Tonnage	Distance covered in kilometers	Tonnage moved	Number of ton-kilometers	Production Capacity with a full load
ZIS-5	3	50	2.8	140	150
ZIS-5	3	50	2.6	130	150
GAS-AA	1.5	20	1.3	26	30
GAS-AA	1.5	5	0.8	4	7.5
GAS-AA	1.5	23	1.4	32.2	34.5
TOTAL	--	148	8.9	332.2	372

Based on the above we are in a position to compute the index of effective load by make of car and for the park as a whole.

Index of effective load for ZIS-5 automobiles

$$= \frac{(140 + 130) \times 100}{150+150} = \frac{27,000}{300} = 90 \text{ percent}$$

Index of effective load for automobile GAS-AA

$$= \frac{(26 + 4 + 32.2) \times 100}{30 + 7.5 + 34.5} = \frac{6,220}{72} = 86.4 \text{ percent}$$

Index of load capacity for the whole automobile park

$$= \frac{332.2 \times 100}{372} = \frac{33,220}{372} = 89.3 \text{ percent}$$

(d) Average technical speed of the automobile is equal to total distance covered (kilometers) divided by the actual hours of running time (including stops for whatever reason). This index shows the degree to which the operating time of the automobile was effectively used.

(e) Average commercial speed is distance covered (in kilometers) divided by the total number of hours the car had been in use (including all stops for all and every reason). This index gives the degree of effective time-use of the automobile.

(f) Average performance of one average registered automobile and of one average registered automobile ton is given in ton-kilometers for a given period of time.

To obtain these indexes, we first divide the total number of kilometers covered in a given period by the average registered number of automobiles. Then this is divided by the average registered number of automobile-tons (i.e. total tonnage of the average registered number of automobiles).

Example: At the beginning of May a sovkhoz had 3 GAZ-AA automobiles (1.5 ton capacity) and 2 ZIS automobiles (3 ton capacity). On 18 May one AMO automobile (2.5 ton capacity) was added. During May a total of 3,614 ton kilometers were produced.

The average registered number of automobiles for the month under the given conditions is equal to:

$$\frac{(3 + 2) \times 31 + (1 \times 14)}{31} = \frac{169}{31} = 5.45$$

Average registered number of machine-tons for the month in the given example is:

$$\frac{[(1.5 \times 3) + (3 \times 2)] \times 31 + (2.5 \times 14)}{31} = \frac{360.5}{31} = 11.6$$

Average performance for one car is: $\frac{3614}{5.45} = 663.1$ ton-kilometers

Average performance per machine-ton is: $\frac{3614}{11.6} = 311.6$ ton-kilometers

Each enterprise with automobiles, keeps a record of work performed with trip-sheets. Information in these trip-sheets enables one to calculate all the enumerated indexes as well as fuel consumption.

7. Miscellaneous Types of Movers in Agriculture;
Indexes of Mechanical Traction Power Potential;
Mechanical Tractive Force Indexes.

As mentioned above, besides tractors and automobiles, other types of mechanical movers are used in agriculture: kerosene, gasolene, petroleum, steam, wind, water, electrogenerators and electro-motors. Finally, live native-power is extensively used in agriculture. The total power of all movers gives us an indication of the overall power potential.

To ascertain the overall power potential, with a variation of prime-

movers, however, it is necessary to express this in homogeneous units. In agriculture, as mentioned before, such a unit is mechanical horse power (HP). Tractor power, as we know, is expressed in these same units-HP. Power of motor-combines and automobiles, is also measured in HP. Power of other mechanical movers is also measured in these units. Power of electrical installations is expressed in kilowatts. Power of wind-driven motor is determined in HP. In this case the capacity depends on the diameter of the wind-wheel and wind velocity. Capacity of wind-driven prime-movers should be based on the average yearly wind velocity in the given area. The power of water-driven prime-movers may also be computed in horse-power. Conversion of live and electrical motive-power into HP was discussed earlier.

By expressing the power of all energy sources employed in agriculture, in HP it is possible to compute total power potential One should keep in mind, that adding up all available energy sources, belonging to a given enterprise or a group of enterprises, may in some cases result in duplication, while in other cases, on the contrary, may fall short in the estimate of energy consumed by the enterprise. A double count may occur in enterprises with secondary movers through the inclusion of their capacity into the total power potential. To avoid duplication, one should deduct from the total power of the prime-movers the power of movers serving electro-generators and exclude from the total the energy of electrogenerators (in as much as their power will appear in the form of motor power, run by electrical generators). On the other hand, we should add to this total the power of electric motors and electric apparatus run by outside power, i.e. those working on current received from outside.

In the final analysis, the total power potential of agricultural enterprises is equal to the sum of the power of prime movers (mechanical and live motive power), less those serving electrical generators, plus the output of electrical motors and apparatus run by outside current, as well as lighting equipment used for technical purposes and the lighting of working space.

The same conditions apply if we want to determine the total power produced by agricultural enterprises (total power produced is equal to the

product of the power of prime-movers multiplied by the hours of work. In the case of mechanical movers it is measured in horse-power hours; and for electrical movers, in kilowatt hours. To convert kilowatt hours into horse power hours, we use the same coefficient as when converting kilowatts into horse-power: 1.36).

In spite of the rapid growth of agricultural mechanization, live motive power, and in the first place, the horse retains its importance.

Accounting and statistics of horse work power should show the availability of such force and indexes of its employment.

In each separate enterprise the reserve of live tractor power may be determined by the average number of days that all work animals are actually with the enterprise during given period of time (i.e. by the number of feed-days of the work-animals, which is determined in the same manner as cow feed-days).

If we know the number of work horses (or other work animals) for each day, we are in a position, for a given period of time (for example, month, quarter, year), to determine the average registered number of horses by dividing the number of horse feed-days by the length of the period in days.

For determining the live traction power potential in a given rayon, oblast, etc. registration and livestock accounting data are used. Besides, at sovkhozes and kolkhozes, sources of information on work animals are the periodic reports (monthly and quarterly) on the strength of which we may compute the average yearly number of work horses and work oxen.

In consideration of the role of live motive power in agriculture, considerable importance is assumed by the index of the degree of mechanization of power potential, which is equivalent to the ratio of the power of mechanical and electrical prime-movers to the total power of all motive forces.

Example: On 1 January 1945 the following prime movers were at sovkhoz "A".

5 Tractors - total power	158 HP
2 Combines - with prime-movers	60 HP
2 Automobiles - motor capacity	92 HP
3 Stationary prime-movers	38 HP
1 Electrogenerator	6 Kilowatt or 8.16 HP
2 Motor-generator sets	5 Kilowatt or 6.8 HP
1 Electric motor	3 Kilowatt or 4.08 HP

The electric generator is served by a prime-mover of 10 HP. On the same date, the sovkhoz had 40 work-horses with an average live weight of 390 kilograms. Tractive force of each horse $= \frac{390 \times 14}{100} =$ 54.6 kilograms, power $=$ 54.6 $\times$ 1.1 $=$ 60.06 kilograms-meters per second, or $\frac{60.06}{75} =$ 0.8 HP. The power of all 20 horses $=$ 0.8 $\times$ 40 $=$ 32 HP.

The total power potential in the given sovkhoz on 1 January 1945 was:

(158 + 60 + 92 + 38 + 10 + 6.8 + 4.08 + 32) $=$ 380.88 HP

Index of mechanization of power potential $= \frac{(380.88 - 32) \times 100}{380.88} =$ 91.6 percent.

Index of electrification of power potential $= \frac{(6.8 + 4.08) \times 100}{380.88} =$ 2.8 percent.

Of great interest in agricultural production is the coefficient of mechanization of tractive power. To illustrate the computation of this coefficient, let us convert into HP the entire tractive power potential on a given date in MTS and Kolkhozes of a rayon. Assume that on that date we had 250 tractors with a total draw-bar capacity of 5,860 HP, and 6,080 head of work horses. Using 0.75 HP as the power of each horse, we determine the total power of all horses as 0.75 $\times$ 6,080 $=$ 4,560 HP.

Total mechanical and live tractive power is equal to 5,860 HP + 4,560 HP $=$ 10,420 HP, while the index of mechanical tractive power in the rayon is $= \frac{5,860 \times 100}{10,420} =$ 56.2 percent.

Indexes of mechanization of power potentials and tractive power may be computed not only in accordance with the power structure of the prime-movers, but also in terms of the composition of the power produced.

8. Determining the Quantity and Effective Use of Operative Agricultural Machinery. Indexes on the Effective Use of Combines.

In determining the quantity and effective use of agricultural machinery and implements they are as a rule grouped according to use. Agricultural machinery and implements may be divided into the following main groups:-

1. Soil cultivating machines and implements (plows of various types, surface plows, harrows).

2. Sowing and planting machinery (seeders of various types, potato planters, planting-setting machines and others).

3. Machines and implements for plant care (various cultivators, hoes, hillers).

4. Machines for harvesting and processing grass crops (hay mowers, horse and tractor rakes, clover-hullers, hay presses).

5. Machines for harvesting grains (combines windrowers, reapers, reaper-stockers, binders and others).

6. Grain threshers, semi-complex and complex.

7. Sorters and winnowers.

8. Machinery for harvesting and processing other crops (potato diggers, beet pullers, flax drawing, flax scutching, cotton pickers, etc.).

9. Special equipment for vegetable raising and gardening.

10. Machines and equipment for roadbuilding and reclamation (rollers, swamp plows, bush rooters, brush cutters, grubbing machines).

11. Machines and implements for animal husbandry (hay cutters, root cutters, silo cutters and other machines for preparing fodder, separators, milking apparatus).

12. Special implements for poultry raising, bee keeping, silk-worm breeding.

13. Apparatus for combatting agricultural pests.

Individual types of agricultural machinery and implements are grouped according to the types of tractive power, for which a given machine or implement is designed (tractor, horse). Larger machines are grouped by make.

Inasmuch as combines of different make have varying operating widths (15 foot combines have an operating width of 4.6 meters, 20 foot combines - an operating width of 6.2 meters, northern - an operating width of 2.5 meters), to arrive at an overall index of sufficiency in combines, the entire combine park is expressed in terms of conventional 15-foot combines.

(Note: By multiplying the number of combines of each make by the corresponding conversion coefficient /15 foot - by 1; 20 foot - by 1.3; northern - by 0.54/).

An index of the prevalence of combine harvesting is the degree to which combines are used in harvesting spike grains, sunflower and other crops which may be harvested with combines. This coefficient is equal to the ratio (in percent) of the acreage harvested by combines to the total acreage under the above mentioned crops.

The coefficient of utilization of agricultural machines and in particular combines, is determined by the ratio of the average number of machines which were in operation to the total number of machines at the start of the harvest.

Basic indexes for determining output of a combine, when used as a harvesting machine (and not for stationary threshing) are:

(a) Average acreage harvested (in hectares) during the season, based on the conventional 15-foot combine and on each make of combine separately. This index is arrived at by dividing the total combine harvested acreage by the average seasonal registered number of combines, converted into conventional 15-foot combines, or by the number of combines of corresponding makes.

Of primary importance is the average acreage harvested per day. With an increase in average daily acreage harvested, the period of harvesting decreases. This is of great importance in overcoming loses of grain.

(b) Average quantity of threshed grain during the season, based on one conventional 15-foot combine and on each make of combine separately.

9. Determining the Degree of Mechanization in Agriculture.

By mechanization of Agriculture in the broad sense of this word we mean the reorganization of agriculture in terms of embracing new advanced techniques - tractors and other mechanical movers, combines and other up-to-date agricultural machines. The mechanization of agricultural production is achieved through machine-tractor stations.

Basic index of the mechanization of separate agricultural operations is the percentile ratio of a given operation, performed by mechanical tractive force, to the total volume of the same operation. (Example: If the total acreage plowed for summer planting (winter planting, spring planting and fallows and summer crops) was 6,000 hectares, including 4,800 hectares tractor-plowed, then we may say that plowing for summer planting is mechanized to the extent of $\frac{4,800 \times 100}{6,000} = 80$ percent.

Indexes of mechanization of other operations may be computed in the same manner. In addition to these indexes, to evaluate the qualitative level of agricultural labor it is very important to establish what share of the work has been performed using complex horse-drawn agricultural machines.

10. Primary Analysis of Agricultural Mechanization Data

In analysing data on the mechanization of agriculture, one first analyzes data pertaining to the degree of mechanization of individual agricultural operations. On the strength of such an analysis we are in a position to judge the extent to which there is a properly coordinated mechanization of the various operations.

The second phase of the analysis is a study of the quantitative dynamics of tractors, their total power, number of automobiles and their total tonnage, combines, other agricultural machines and implements. The dynamics of all qualitative indexes is also very important (output per tractor, combine, automobile, degree of mechanization of individual operations, degree of mechanization of tractive power etc).

It is of interest to study changes in the composition of the tractor park (dividing the total number of tractors and their total power into caterpillar tread and wheel tractors, and the different makes within their basic divisions).

Another phase of the analysis should be examination of energy resources in agriculture (in percent), also the mechanization and electrification of these resources. For this purpose, the energy potential of all these power

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resources is expressed in units (in HP). These are summed up and then the relative wieght of the power of each unit is determined as related to the total; so also the relative importance of the power of mechanical and electrical prime-movers to the total.

An index of the amount of power available to labor is very important. It may be calculated either as the relationship of the overall power of all movers, serving the operating machines (in HP), to the average yearly number of operating workers (potential index of degree of power equipment) or as the amount of energy produced during a year (in horse-power hours) per one man-hour.

Groups of MTS should be analyzed according to tractor park capacity, average output per tractor and per combine, groupings of tractor and combine operators by seasonal output. All these classifications enable us to express various aspects of the problem in relative values (in percent). In analysing the tabulations for each separate year and overtime, a number of important deductions can be made. Specifically, both outstanding and backward MTS should be singled out for further study. In particular the greatest accomplishments of individual tractor and combine operators should be brought out. It should be possible to gain an idea of the additional results which could be obtained from more effective use of tractors and combines. It is possible to determine how the productivity of labor changes overtime, as applied to the MTS as a whole and to individual tractor drivers and combine operators as their output increases and they are promoted from one group to another, etc.

In group analysis we calculate certain group averages: for example - average seasonal output of a tractor or a combine, grouped according to ordinary and leading tractor and combine operators, and also according to the basic types of tractors and combines. Based on such analysis of the material in the statistical collection "Socialistic Agriculture of the USSR", yields interesting data, not only on the overall average output of the tractors and the combine, but also on the output per tractor or combine according to groups of leading MTS. Analysis of this data also gives the picture for

outstanding MTS and tractor and combine operators. For example, in 1938 with an average output for all MTS in hectares of conventional plowing for one wheel tractor as 476 hectares, and 1,229 hectares for one caterpillar-tractor, in Aktanysh MTS, Tartar ASSR, 1,417 hectares were worked over. In the Mozharsk MTS, Ryazansk Oblast, 3,784 hectares were worked per caterpillar tractor, etc. These results represent material for determing potential increases of machine utilization.

11. Sources of Data on the Number and Performance of Tractors, Automobiles, Combines, and Other Machines

Basic sources of statistical data on the number and performance of tractors, automobiles, combines and other agricultural machines are the yearly reports of sovkhozes, MTS, and kolkhozes, as well as special accounting data on tractors and combines which is collected by the TsSU (Central Statistical Administration), Gosplan USSR. Annual reports contain information on the shifts during the year on the number of tractors and combines; while in the sovkhozes, in addition to this, automoiles are accounted for. Here we also find figures on the average yearly number of tractors converted into 15-power units, and (in MTS accounts) on the average yearly number of combines converted into 15-foot units, average yearly registered number of automobiles and their total tonnage. These same reports show average tractor output (in units of soft plowing) and data on fuel consumption.

Kolkhoz annual reports give the number of automobiles, agricultural machines and implements on a certain date -- the end of the accounting year. Aside from the annual reports there is an additional source of information on the number of tractors, combines, automobiles and their performance. This is the account of current operations on the sovkhoz and MTS.

Branches of TsSU Gosplan USSR annually count the distribution of tractors on January 1 and July 1. This is of particular importance, in

the first place because the count covers all kinds of establishments having tractors and in the second place, because it gives a picture of the overall mechanical condition of all the tractors. Accounting for combines by year of make and mechanical condition was first initiated on 1 November 1945.

In agricultural enterprises tractor output and that of the tractor operators in MTS is accounted for by the report sheets of the tractor-operator. On these sheets entries are per shift and by separate operation. Each operation is described by type of soil, nomenclature and number of attachments, depth of cultivation, quality of work, volume of work performed per specifications and actually (in natural physical units and converted into conventional units of soft plowing). In addition we find here fuel consumption (measured at the start of each shift and at the end of each operation performed during the shift) and lubricant consumption. The report sheets of the tractor operator provide for cumulative recording of work-days, and also give the reasons why tasks were not accomplished together with the remarks of the sectional agronomist.

Performance of combines and combine-operators is accounted for on the record sheets of the combine operator. Records on these sheets are kept by work-dates, by individual fields of crop rotation, and separate crops and operations. On these sheets we enter assignments and their execution, fuel consumption (which is measured daily and the start and end of the operation) lubrication consumption, and a computation of the combine operator's earnings.

The principal accounting document for automobile operation is the trip sheet of the automobile, which includes the name of the driver, time of departure from and return to the garage, assignment, gasoline consumption, place of pick-up and load destination, number of kilometers covered and ton-kilometers, time on the road and delays.

Example for Chapter IX.

Solve the following example based on chapter IX.

In sovkhoz A during the year 1940, field operations started on 18 April and ended on 28 October. At the start of field operations the sovkhoz had the following tractors (by make):

Tractors STZ and KhTZ, wheel (15/30 HP)	6
Tractors plowing (10/20 HP)	2
Tractors ChTZ-S 60 ligroin (48/60 HP)	2

Inventory of trucks on 1 January 1940 was:

GAS-AA - load capacity 1.50 tons	1
ZIS-5 - load capacity 3 tons	1
ZIS-21 - load capacity 3 (gas generating)	1

At harvest time, the number of combines was:

15-foot (Kommunar)	2
Northern	1

During 1940 the following changes took place in the tractor and automobile parks (number of combines remained constant throughout the year).

Tractors STZ and KhTZ

2 May received	2 tractors
14 July received	1 tractor
3 October checked out	2 tractors
10 November checked out	1 tractor

Plowing Tractors:

10 June received	2 tractors
5 August checked out	1 tractor

ChTZ-S-60 Tractors:

12 September checked out	1 tractor

Besides, on 29 July 2 tractors SKhTZ-NATI checked in (32/48 h.p.).

Automobile Park: One 3-ton (gas generating) automobile ZIS-21 was received on 15 July.

In addition, the following yearly average number of prime movers were in the sovkhoz:

Petroleum prime movers	5,	total capacity	70 HP
Hydraulic prime movers	3,	total capacity	75 HP
Electric motors	1,	total capacity	3 Kilowatts
Electric generator	1,	total capacity	6 Kilowatts

Yearly average number of horses in the sovkhoz during 1940 was 58, whereby average weight on the hoof per horse was 410 kilograms. Yearly average registered number of production workers in the sovkhoz during 1940 was 450.

The following information is available regarding the performance of tractors, automobiles and combines during 1940.

Tractors: Average seasonal number of tractors actually employed 16.2

Fallows plowed by tractor	300 hectares
Clover plowed by tractor	580 hectares
Double harrow plowed by tractor	1,820 hectares

Other work performed in conventional units of soft plowing 4,552 hectares

Output quota per season per conventional 15-power tractor 350 hectares

Automobiles: machine-days actually employed 920

total distance covered	165,600 Kilometers
of which with load	136,500 Kilometers

Carried from sovkhoz A to point B (40 Kilometers) 2.2 tons of load

From point B to point C (10 Kilometers) 1.9 tons of load

From C to sovkhoz A (35 Kilometers) the automobile was empty

From sovkhoz A to point S (28 Kilometers) 5 tons were moved

From point S to sovkhoz A (28 Kilometers) 3.5 tons were moved

All other trips made during the year amounted to 286,305 ton-kilometers

Combines: 3 combines worked on harvesting;

spike grains harvested by combines	640 hectares
threshed during harvesting	10,310 centners

Total acreage under spike grain crops in the sovkhoz during 1940, - 720 hectares. Output quota for 1 conventional 15-foot combine, - 240 hectares.

It is required: 1. Determine index of the degree of utilization of the tractor park.

2. Determine average yearly output of one average seasonal 15-power tractor in hectares of soft plowing.

3. Compute the percentage of fulfillment of the tractor output plan.

4. Determine the degree of effective use of the automobile park.

5. Compute the coefficient of pay-load trips for automobiles.

6. Determine the total number of ton-kilometers performed by the automobiles.

7. Determine the performance per one average year automobile and per one average year machine-ton in ton-kilometers.

8. Compute the coefficient of the extent to which combines have been used in harvesting spike grain crops.

9. Determine the coefficient of the effective use of combines.

10. Determine average output per combine and quota execution.

11. Determine the components of power potential in horse-power and in percent to total power potential (average for 1940).

Show graphically the composition of energy potential (using bar charts or pie diagrams).

12. Determine the degree (in percent) of mechanization of all energy potentials and the degree (in percent) of mechanization of tractive force.

13. Compute the coefficient of the amount of energy available for one yearly production worker in the sovkhoz.

Given:

(1) Coefficients for converting work into hectares of soft plowing.

fallow plowing	1
clover-field plowing	1.4
single harrowing	0.11

(2) Motor power of automobile GAS-AA 1.5 tons, 32 HP

Motor power of automobile ZIS-5 3 tons, 60 HP

Motor power of automobile ZTS-21 3 tons, 38 HP

Motor power of combine Kommunar 30 HP

CONTROL QUESTIONS

(1) Into which two groups do we divide all machines used in agriculture?

(2) Into which groups do we divide prime-movers used in agriculture?

(3) What indexes are used in expressing the availability of tractors?

(4) How do we determine the index tractor park utilization and the index of tractor output: what conventional units are used to express tractor output?

(5) What basic indexes are used in determining the availability and utilization of automobiles?

(6) Into which basic groups do we divide agricultural working machinery by application?

(7) What is known as the coefficient of use of combines?

(8) What conventional units are used to express the number of available combines of different makes?

(9) How do we compute an index of utilization and indexes of the output of combines?

(10) How do we determine the indexes of mechanization and the extent of tractor use for particular agricultural operations?

(11) How do we compute the size and composition of power potential?

(12) How do we determine the index of mechanization of all energy potentials and tractive power?

(13) How does one compute the index of power at the disposal of labor?

(14) How do we determine the degree of planned performance for liquid fuels and lubricants?

(15) Of what significance is the grouping of farms by indexes of utilization of agricultural machines?

(16) What are the sources of data pertaining to availability and utilization of agricultural machines?

CHAPTER X

THE ACCOUNTING SYSTEM IN AGRICULTURAL ENTERPRISES

1. Standard Forms for Agricultural Accounting and Statistics

Branch offices of the TsSU (Central Statistical Administration) Josplan USSR provide methodological management over the work of agricultural accounting departments. Actually they supervise and check their work; through statistics they arrange agricultural accounting. At the same time these branch offices of TsSU, themselves carry out various phazes of agricultural statistics: They conduct census (for example, live stock inventory, current tractor inventories, and the count of combines). They make special selective investigation (for example, studies of productivity in kolkhozes, studies of kolkhoz livestock husbandry, studies of fodder supplies in the kolkhoz, current studies on the budgets of kolkhoz members, etc). Branches of TsSU analyze the annual reports of sovkhozes, MTS, and auxiliary enterprises. As of 1935, TsSU branches have been responsible for establishing the size of sown area for the particular year.

It is the duty of TsSU branches also to estimate yields for all types of crops. To this end they analyse sovknoz and kolknoz accounting data on the prospects for agricultural crops and check these reports through selective evaluation made by inspectors of the various land sections and rayons. This is done also by taking sample measurements of the crops before harvest time.

The People's Commissariat of Agriculture, the People's Commissariat of Grain and live stock, Sovkhozes and other administrations engaged in agricultural production, keep primarily operational records, required for daily operational guidance of their subordinate enterprises.

The People's Commissariat of Agriculture and its local branches, organize, receive and summarize reports on the operations of Kolkhozes and MTS.

A close liaison exists between the work of TsSU (Central Statistical Administration) and the work of the above mentioned organizations. TsSU branches make extensive use of the operational accounting for statistical analaysis, and TsSU branches produce final summation figures on basic elements of agricultural production (areas under cultivation, crop yield, number of cattle). The quality of these summaries often depends upon the soundness of the reports and accounts on which TSSU branches base their figures (for example, statements on approval of work done, five-day reports preceding the final accounting of areas seeded, inventory of cattle preceding live stock census, etc). On the other hand, agrarian organizations are interested in timely and exact determination, by three TsSU branches of the final figures of agricultural production or of the particular relevant factors; knowledge of which is essential both in planning and in operational work.

2. Kolkhoz Accounting

The accounting system of agricultural enterprises consists of agricultural enterprises consists of an annual accounting and periodic reports during the year. Annual reports are a basic source for a thorough knowledge of the organizational-economic well-being and work kolkhozes, sovkhozes and MTS.

The Kolkhoz annual reports supply information on the number of households in a kolkhoz, actual and registered; on the population--adults, able-bodied and youth 14-16 years old; on the number of able bodied kolkhoz members, engaged in industry, transport, etc. but residing at the kolkhoz; on the number of work days performed by all kolkhoz members; on their grouping by work-day performance, on shares received per work-day both in kind and in money; on the number of production brigades and sections including those who received additional pay; on the number of kolkhoz members who received additional pay; on the fulfillment of crop plans; on gross harvesting broken down by individual

crops and their distribution; on livestock inventory and fulfillment of the State plan for developing animal husbandry; on production in animal husbandry; on kolkhoz fulfillment of its obligations to the State for deliveries and payment in kind to MTS; on the number of individual agricultural machines and implements; on the monetary income of kolkhoz members and its distribution among them; on capital investment; on expenditures of funds for cultural and welfare needs; and on the financial balances of the kolkhozes.

Annual kolkhoz reports are prepared under the guidance of agrarian organizations. Primary objectives of annual reports are to summarize the annual operations of the kolkhozes, control of their managements, and proper income distribution among the kolkhoz members. Annual reports are subject to statistical analysis by agrarian organizations. The analysis is rather detailed. In addition to adding up direct totals of all data in the report, in working over the material, kolkhozes are grouped by various characteristics.

Grouping characteristics may be summarized into the following main classifications:

(1) Characteristics describing kolkhozes by power, by size: grouping kolkhozes by the number of households per kolkhoz, and by monetary income per kolkhoz.

(2) Characteristics, describing individual elements and achievements of agricultural production in kolkhozes: grouping kolkhozes by average yearly milk yield per forage cow; the number of kolkhozes paying additionally for achievements in individual branches of agriculture, etc.

(3) Characteristics showing the distribution of kolkhoz income: grouping of kolkhoz by percentage of monetary income allocated to the indivisible fund, by the percentage of monetary income allocated by workdays.

(4) Characteristics showing kolkhoz members' participation in the communal economy of the kolkhoz and level of work discipline: grouping by number of workdays performed by the kolkhoz members, by seeds, potatoes and

money distributed as earnings per work-day.

The existing system of periodic kolkhoz accounting was approved by order of the Council of People's Commissars of 28 April 1938. Eleven accounting forms were confirmed for all kolkhozes and three additional forms only for cotton and flax producing rayons.

Subsequently several additional accounting forms were introduced: Form #15 - "Progress report on soil preparation, planting of sub-tropical crops and nurseries." Form #16 - "Kolkhoz report on the organization of animal husbandry farms and properly supplying them with livestock." Form #17 - "Report on planting gardens, vineyards, berry fields, and availability of plants in nurseries." Form #18 - "Progress report on the preparation, use and building of nurseries and hot houses." Form #19 - "Progress report on pest and disease control of agricultural platns." Form #20 - "Report on insecticides for combating pests in agricultural plants." Form #21 - "Report on sowing care and harvesting of seeds and harvesting of rubber bearing plants." Form #22 - "Progress report on fodder preparation." Form #23 - "Report on sewing, planting and agricultural-technical measures in the care of mulberry trees." Form #25 - "Report on sowing, care and harvesting of coriander." On the other hand Form #9 was revoked - "Progress report on the threshing of grain and vegetable oil crops. (already discussed in Chapter III).

As of May 1942, animal husbandry reports form #11 (quarterly accounts) and Form #16 (monthly accounts) have been replaced by a single monthly form #24 - "Kolkhoz reports on the state of animal husbandry."

Time limits have been set up for sending in each accounting form. Kolkhozes must channel their reports through rural Soviets to the rayon zoological authorities, with the exception of form #4 (final accounting of total planting) No 5 (kinds of sewing for current year crop) and No 24, which are presented to the TsSU inspectors.

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Organization and development of kolkhoz accounting on the state of animal husbandry (form #24) is entrusted to TsSU Gosplan USSR and its local branches. The primary objective of periodic kolkhoz accounting is to procure data required by the agrarian organizations in their operational guidance of kolkhoz production. At the same time these reports may be used for statistical analysis, for index computation showing the work of the kolkhoz.

All kolkhoz reports should be thoroughly checked at the rayon zoological headquarters (forms #4.5 and 24 - by TsSU inspectors) which, in addition to operational use by individual kolkhozes, summarize the reports by rayon and present totals for the oblast (krai) agrarian organizations.

Control may be exercised by inter-connecting data of each report, by comparing reports of different kolkhozes, through personal acquaintance with the agricultural specialists in each individual kolkhoz and with those conditions which show up through the reports.

3. Sovkhoz and MTS Accounting

Sovkhoz annual reports as compared with kolkhoz reports present a fuller picture of the organizational-economic condition and work.

Sovkhoz accounts contain information on the basic means of production and capital investment; annual variation in the number of tractors, combines, automobiles, end of the year inventory of all agricultural machinery, indexes of utilization of tractors, combines, truck transportation; information on the state of the agrarian fund, acreage under crops, gross harvest of plant cultivation, on herd turnover, fulfillment of specifications for the development of animal husbandry; yields of products of animal husbandry; fertility and milk yield of cows, number of kolkhoz workers at the end of the year and average registered number for the accounting year; number of work-days performed separately for plant cultivation and for husbandry; plant cultivation

and animal husbandry costs; index of utilization and costs of live tractive power; production sales, and deliveries to the Government; profit or loss of the enterprise and a number of other data.

TsSU branch offices analyze statistically the sovkhoz annual reports, prepare summary tables and compute a number of indexes. This analysis is not devoid of a grouping plan, since the figures are added by individual People's Commissariats, and by production grouping of sovkhozes.

However, this is far from adequate use of the wealth of material contained in the annual reports. It is advisable within the classification plan of the sovkhozes, to group the information both along lines of organization and production,(by size of land area, by the number of workers, by cost of basic means of production, by power of tractor park, by labor efficiency indexes, by production costs, by proportion of goods for marketing, by yield level, by milk yield etc). It is essential that group averages be computed from these groupings.

During the course of a year, sovkhozes supply their associations with periodic production-statistic accounting covering separate phases of their operations. Branch offices of TsSU Gosplan USSR receive and analyze monthly reports on labor and wages (form #62 agriculture) and a number of other reports.

MTS annual reports give us an indication as to the number of kolkhozes served; the variation in the number of tractors, combines and automobiles during a year; number of workers, and wage funds; availability of basic facilities, prime-movers, buildings, storage capacity for petroleum products, number of agricultural machines; the extent of opeations done by tractors, combines and prime-movers; degree of performance of planned output, by operations and in totals computed in hectares of soft plowing; performance per average yearly tractor in hectare of conventional plowing, per average seasonal combine, average performance (in hectares) of tractor and combine operators who during the entire season drove tractors of the same power, or a combine of

one type, and the number of tractor drivers, and combine operators who have done over the seasonal quota of work; liquid fuel consumption; delivery of payment-in-kind to the kolkhozes; cost of tractor, combine and prime-mover operations; maintenance of tractors, combines and other agricultural machines, capital investment, etc.

Branch offices of the TsSU analyze MTS annual reports for each separate MTS and summarizing by oblast (kray). This gives the basic indexes of their work and service to the kolkhozes. This includes the number of households in each kolkhoz, sowing area, work horses and oxen; number of tractors by type and make; number of combines by type and other agricultural machines and automobiles (indicating total tonnage) at the end of the accounting year. These annual reports also indicate the number of tractors (converted into 15-power units) and average seasonal number of combines (converted into 15-foot units). They show tractor performance in hectares of conventional soft plowing, and the performance per one average yearly conventional 15-power tractor (in hectares of soft plowing); also grain area harvested by combines, and the quantity of grain harvested by combines and the average production for one conventional 15-foot average season combine. The number of workers is given (average registered for the year and at the end of the year); also the cost per hectare of conventional soft plowing. These indexes give an idea of the degree to which tractors and combines have been put to use by individual MTS and by all of them together. They show fuel consumption and the cost of work undertaken.

In addition, MTS are grouped on an oblast (kray) level, by power of tractor park, by the number of kolkhozes served, by the land area under crops, by the production per tractor and per combine, by the cost of operations in units of plowing, and by fuel consumption per hectare of soft plowing. These indicative considerations are not combined with other indexes of MTS performance in preparing group tables; nevertheless

they are important in bringing out the larger and smaller MTS, in determining the number of leading and lagging MTS in the use of available tractors and combines, and in pointing to the achievements of those who have taken the lead.

Periodically, MTS present reports on the state of repair of available tractors and combines on tractor performance (converted into soft plowing and in natural units for the basic work), on the performance of combines and on the number of workers and wage funds, etc.

4. Budgeting for the Individual Kolkhoz Member

An analysis of the budgets of the individual kolkhoz member is the only material for a detailed study of the economy of the individual kolkhoz member, his connection with the cooperative kolkhoz economy, which can show how the living standards of the kolkhoz members are rising. From the budgets one may obtain, monthly, the following information: number of members per family, utilization of the kolkhoz member's labor (number of days the kolkhoz member was absent from the kolkhoz, number of days worked at the kolkhoz, number of hours worked at the kolkhoz and on his personal subsidiary enterprise), number of accumulated work-days, monthly turnover of cattle, milk yields, quantities of wool shorn, eggs collected, honey yield, fodder consumption; monthly turn-over (income and expenditure) of agricultural products (with indications as to income from kolkhoz from one's own subsidiary enterprise, acquisitions, expenditure for personal use; for animal fodder, etc.); acquisition of industrial products; nutrition; monetary income from diverse sources and disbursements for different needs.

TsSU branches examine the budgets of the kolkhoz members only in some rayons, and in each selected payon - in "nests" usually of three kolkhozes. In each kolkhoz the budgets of 12 kolkhoz members are examined. The kolkhoz members keep books which record the amount of produce used for food and all monetary expenditures, showing exactly for what the money was spent.

A special instructor works in each budget "nest". He helps the kolkhoz members keep their records and he himself keeps monthly records by enterprise, on special blanks, information on the number of members in families, work at MTS, outside the kolkhoz and outside their own agricultural enterprise, work of the kolkhoz members during an accounting month in his kolkhoz, accumulation of work-days, products delivered to the kolkhoz members from the kolkhoz, changes in the livestock count over the month, turnover of farm products, etc.

The forms drawn up by the instructor are sent to the oblast (kray) representative of Gosplan USSR or to the Statistical Administration, where they are analyzed.

CONTROL QUESTIONS

1. How is agricultural statistics organized in USSR?
2. What are the basic questions in the annual kolkhoz reports?
3. How and according to what program are the annual kolkhoz reports analyzed?
4. How is the periodic kolkhoz accounting system built?
5. What basic questions enter into the program of sovkhoz annual reports?
6. How are the sovkhoz annual reports analyzed?
7. What basic information is contained in the annual MTS reports?
8. How and according to what pattern are the annual MTS report analyzed?
9. What is the method of examining the budgets of individual kolkhoz members?