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METHODS OF RAISING AGRICULTURAL YIELD
 IN THE NONCHERNOZEM ZONE OF THE USSR

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Successful solution of the principal task set for USSR agriculture by the 19th Party Congress, namely, to attain a further rise in the yield of all agricultural crops, depends to a great extent on the intensive development of land cultivation and animal husbandry in the vast nonchernozem zone of the Soviet Union.

The nonchernozem zone of the European USSR occupies an area exceeding 265 million hectares. Within this area, there are 25 administrative oblasts and autonomous republics of the northern and central RSFSR and five whole republics, the Belorussian, Lithuanian, Latvian, Estonian, and Karelo-Finnish SSRs.

Natural conditions in this zone differ substantially from those in the southern forest steppe and steppe regions.

In periods of heavy precipitation and, especially, in spring after the snow has melted, the soil remains very wet for a long time; this extreme wetness makes it difficult to work the soil and lowers the quality of work performed on it. Consequently, it is necessary to apply special soil improvement and drainage measures.

In general, the climate of the nonchernozem zone is adequately favorable for the growth and development of a large number of cultivated plants, including such grain crops as rye, wheat, oats, and barley and the valuable industrial crop, flax. Soil conditions in the nonchernozem zone are less favorable for the development of agriculture, and need basic improvement.

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Throughout the nonchernozem zone, there is a predominance of podzolic soils, interspersed in various combinations with peaty soils in marshy areas and with meadow soils in river valleys.

Podzolic soils contain little humus and are deficient in mineral elements necessary for plant growth. Where agricultural land utilization practices are backward, these soils are characteristically unfertile. But by applying rational agricultural practices and land improvement measures, it is possible to create on podzolic soils a surface layer which is no less fertile than chernozem.

As shown by the experience of leading kolkhozes and the data of experimental institutions, it is fully possible to obtain in the nonchernozem zone per-hectare yields of 30-40 quintals of grain, more than 30 metric tons of potatoes, and more than 50 quintals (even 100 quintals, in some cases) of perennial hay. And such yields, naturally, are not the highest possible.

Bog soils of the nonchernozem zone, on the other hand, contain much humus and organic matter in the form of peat; in fact, they often contain more humus than is found in chernozem soils. Through drainage and special agrotechnical measures, bogs can be converted into highly productive cultivated land.

The nonchernozem zone of the European USSR is largely characterized by rolling terrain. The rolling hills are almost everywhere covered with great numbers of large and small rocks or boulders.

The variety of natural conditions and the rocky soil necessitate breaking the arable land up into small fields, making it difficult to use large, modern agricultural machinery for working the soil and harvesting the crops. However, even these drawbacks can be overcome in most cases through land improvement measures directed toward combining fields, draining swampy areas, and removing rocks.

One of the basic measures for improving land cultivation conditions in the nonchernozem zone is to deepen the surface layer of soil which is plowed and cultivated. Only deeper working of this soil layer, in conjunction with other agrotechnical and land improvement measures, will make possible a decisive improvement in the water filtration, heat absorption, and plant nutrition qualities of podzolic and bog soils.

In most kolkhozes and sovkhoses of the nonchernozem zone, the surface layer of old arable land is already being worked to a depth of 20-22 centimeters instead of the former 12-15 centimeters; and it is planned to increase the plowing depth to 25-27 centimeters. Plowing to this depth will assure a considerable rise in crop yield, but plowing to a depth of even 25-27 centimeters cannot be considered the final answer in every case to the creation of highly productive soil.

In a considerable portion of the nonchernozem zone, there are podzolic turfy soils; below these, there is a quite thick podzolic horizon, which is deficient in both mineral elements and silty loam particles that play an important role in soil structure formation. But below the podzolic horizon, at a depth of 30-40 centimeters, lies a horizon which, as a rule, contains silty loam particles. In such cases, it is expedient to bring about a basic improvement of the surface plowed layer through partial introduction of the material from the bottommost horizon.

This can be accomplished by a single or occasionally repeated plowing to a depth of up to 40-45 centimeters with a suitable plow, which, however has not yet been developed. In the case of heavy clayey loam soils with a very heavy clayey layer under the plowed layer, it is best not to increase the plowing depth but to loosen up this clayey layer with a subsoil plow without bringing soil from this layer to the surface.

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In some regions of the nonchernozem zone, especially in the northwestern regions, deeper plowing is made difficult by the rockiness of the soil. Methods for gathering rocks from the fields with suitable machines have been developed; it is only necessary to assure mass production of such machines and their distribution to MTS in the rocky regions.

Rational solution of the deeper-plowing problem demands a many-sided approach. It is necessary to establish the difference in structure and qualities between podzolic and podzolic turfy soils, both of which are found so widely in the nonchernozem zone. It is necessary for scientific research and experimental institutions to conduct broader and more intensive investigations, with soil scientists, agricultural engineers, and machine designers taking part. Such studies will permit the development and application of more acceptable methods for basic improvement of the plowed layer.

A sure method of obtaining large harvests on podzolic soils, naturally deficient in nutritive elements, is a general application of fertilizers. Many podzolic soils also have an acid reaction; to eliminate this, it is necessary to apply lime. Application of organic and mineral fertilizers in conjunction with lime will assure obtaining large harvests of both grain crops and perennial grasses, while at the same time further improving the soil and raising its fertility.

For speedy, basic improvement of podzolic soils, especially those put to productive use in recent years, it is necessary to use other sources of organic fertilizer as well as manure. These include peat and also certain crops serving as green manure, such as alfalfa, sweet clover, etc.

Bog peat serves as a basic material in the preparation of peat composts; it may be mixed with manure, feces, lupine, vetch, mineral fertilizers, or lime. Peat resources for fertilizer purposes are enormous in the nonchernozem zone and may be found in almost every region.

Besides organic fertilizers, mineral fertilizers of all types must be widely applied to podzolic soils. Experimental and scientific research institutions have already done much work to clarify the effectiveness of mineral fertilizers and lime, to fix amounts to be applied, and to establish times and methods of application. But further and more intensive study is necessary, particularly in regard to testing of new fertilizers; also necessary is the speedy introduction of already developed methods for preparing and applying various organic and mineral fertilizers. Particular attention should be paid to bacterial fertilizers.

In connection with soil improvement measures, it is necessary to carry out intensive work on plant improvement and speedy introduction of already developed new varieties, such as several new wheat varieties developed by Academician N. V. Tsitsin.

Measures for controlling water supply in the soil are of great importance. Agrotechnical measures for raising crop yields cannot be properly applied on excessively wet soils.

Uneven precipitation during the year is the principal reason for temporary excessive wetness of podzolic soils. The total annual precipitation of 500-650 millimeters does not exceed the amount needed by plants to yield a large harvest. Therefore, the struggle against temporary excessive wetness in spring and fall, seldom in summer, should be directed toward storing the excessive moisture in the soil for the use of plants during the succeeding dry periods and not toward its permanent removal.

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This task can be solved most successfully through a combination of land improvement and hydraulic improvement measures. The best type of drainage (hydraulic improvement) system is subsurface drainage of the water into an extensive network of open ditches which serve as collectors of the water drained off.

Of particularly great significance for the development of land cultivation and animal husbandry in the nonchernozem zone is the problem of putting swamps into agricultural production. On properly drained bog soils, it is possible to grow many agricultural crops successfully, including berry bushes and even fruit trees. Attention ought to be paid to the possibilities of growing vegetables and fodder and ensilage crops on these soils; any additional supplies of fodder and ensilage crops so obtained would aid the development of animal husbandry.

More important is the task of improving the quality and increasing the productivity of natural meadows. Meadows, including hay lands and pastures, in the nonchernozem zone occupy several tens of millions of hectares -- an area about 70 percent as great as the total arable area. At present, most natural meadows have a low yield and at the same time produce low-quality grasses. Further development of animal husbandry requires basic improvement of the meadows. Scientific data and experience show that it is possible to create three types of high-yielding meadows in the nonchernozem zone: upland valley, lowland, and river bottom meadows.

Application on a wide scale of agrotechnical and land improvement measures and the assistance of scientific and experimental institutions will permit a decisive rise in soil cultivation and animal husbandry productivity in the non-chernozem zone of the USSR.

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