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AGRICULTURE IN A TURBULENT WORLD ECONOMY

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*Land Resources and Distribution of Agricultural Production
in the USSR*

The Soviet Union has one of the largest areas of agricultural and arable lands in the world. Out of total area of 2,227.5 million hectares in the country, agricultural lands involve 605.9 mill. ha., including 227.5 mill. ha. of arable lands, 40.6 mill. ha. of grasslands and 332.4 mill. ha. of pastures.

The territory of the country stretches for over 9,500 km. from west to east and for 4,500 km. from north to south. This is associated with a great diversity of natural conditions and methods of land utilisation. The characteristics of land resources in the USSR are defined first of all by the temperature regime from the standpoint of agricultural utilisation. Agriculturally the country is subdivided into a number of natural and agricultural belts, which are first of all characterised by accumulated active temperatures (over 10°C). From this the whole country is subdivided into three main belts:

- (1) Cold tundra and taiga natural-and-agricultural belt with accumulated active temperatures below 1600°.
- (2) Moderate natural-and-agricultural belt with accumulated active temperatures of 1600°–4000°.
- (3) Warm subtropical natural-and-agricultural belt with accumulated active temperatures of over 4000°C.

The belts are subdivided into natural-and-agricultural zones, which are characterised by certain balances of heat and moisture, related to main features of soil formation and plant mineral nutrition. These zones are defined by the nature of the soil and surface. In their turn they are subdivided into natural-and-agricultural provinces, which are characterised by specific features of soil surface, related to macroclimate inside the zone, with annual migration of its elements. The provinces are differentiated by the increase of continentality, severity of winter and its snow cover, changes of thermal and moisture supply during the vegetation period, hydrothermal regime of soil biological productivity. The provinces in their turn are subdivided into natural-and-agricultural regions, which are characterised by well expressed geomorphological and hydrological features, composition of soil-forming rocks, dominating type of soil formation, specific features of climate, soil relief and soil

erosion danger. At present 16 zones and 67 types of various contour versions have been identified according to the available taxonomy, which allows the making of very fractional and detailed land taxonomy. The soils are subdivided into seven general categories by their qualitative characteristics. The first involves good arable lands, the second lands primarily suitable for grassland, the third pasture lands, which after reclamation can be suitable for other agricultural purposes, the fourth lands suitable for agricultural purposes after radical reclamation, the fifth lands of low suitability for agricultural purposes, the sixth unsuitable lands for agricultural purposes and the seventh abnormal lands. Most agricultural lands belong in the moderate belt. This includes the majority of arable soils of the USSR, especially in the forest-and-steppe zones and in the steppe zones. The dry-steppe areas are also of great importance.

The main index, characterising the qualitative characteristics of lands in the USSR, is their bioclimatic potential. Bioclimatic potential is the ratio of plant productivity under the given vegetation conditions to productivity under comparative conditions. It is calculated by the

TABLE 1 *Natural-and-agricultural zones of the USSR*

Zone	Total area %	Arable lands %	Ploughed up soils %
Polar-and-tundra	8.9	0.0	—
Forest and tundra-north taiga	10.5	0.0	—
Middle taiga	9.9	0.5	0.5
Total	29.3	0.5	0.2
South taiga-forest	12.6	16.7	12.9
Forest-and-steppe	6.9	30.3	42.8
Steppe	5.6	29.4	50.8
Dry steppe	3.3	12.8	38.3
Semidesert	5.6	2.1	3.7
Desert	2.8	0.1	0.3
Foothills and desert-steppe	0.8	1.3	15.7
Total	37.6	92.7	24.0
Subtropical desert	3.2	0.5	1.7
Subtropical foothills-semi-desert	1.1	2.1	18.3
Shrub-steppe and dry forest	0.1	0.2	22.3
Subtropical moisty forest	0.1	0.1	11.8
Total	4.5	2.9	6.4
The Carpathian and Caucasian	1.0	—	8.6
Middle Asian	1.9	—	5.3
South Siberian	11.3	—	1.7
North Siberian	13.2	—	—
Kamchatka-Kuril	1.2	—	0.1
Total	28.6	3.9	1.3
TOTAL	100.0	100.0	10.1

following formula:

$$\text{BCP} = C_p \frac{\Sigma t > 10^\circ}{1000^\circ\text{C}},$$

where BCP = relative values of bioclimatic potential;

C_p = coefficient of biological production, which depends on moisture availability in plants;

$\Sigma t > 10^\circ$ = accumulated temperatures over 10° , reflecting solar energy and heat availability in plants;

1000°C = accumulated temperatures in the northern border of field crop growing.

In this way, the relative values of BCP represent the product of growth coefficient on moisture availability by growth coefficient on heat availability, i.e. – as the combined coefficient.

The ratio $\Sigma t > 10^\circ : 1000^\circ$ reflects the potential soil productivity in a certain area according to the temperature factor in relative values. In this case the minimum bioclimatic productivity is estimated as a unity, and all others in comparative values to it.

It should be mentioned that the bioclimatic potential of agricultural lands in the USSR is on the average not high. It is considerably lower than the average bioclimatic potential in leading farming countries. Soviet climatologists consider that as a whole an average hectare of arable land in the USSR is 2.5 times lower in its bioclimatic productivity compared with a hectare of land in the USA, or 2 – 2.2 times lower in comparison with the countries of Western Europe. Inside the territory of the USSR the diversity of biological productivity and agroclimatic potential of land is extremely high. Under conditions of sufficient moisture, bioclimatic potential is measured from 1.0 in the northern border of farming up to 5.0 and higher in the southern border. Quite considerable amendments in bioclimatic potential can be introduced by the degree of moistening – from 1.0 under irrigation or sufficient precipitation up to the minimum index under desert conditions. The correlation of bioclimatic potential and moistening permits one to estimate the potential zonal productivity of the agricultural zone and province. Such analysis shows that a very limited part of the territory of the USSR has a high bioclimatic potential with sufficient natural or artificial moisture, and the greater part of the territory has a medium or low level of bioclimatic productivity with insufficient natural moisture, and therefore with relatively unsteady agricultural production. These characteristics of land resources are to a great extent a decisive factor in the distribution of agricultural production in the USSR.

The lack of coincidence between favourable accumulated temperatures and moisture availability is quite a serious factor, limiting the efficient utilisation of land resources for agricultural purposes. There is insufficient precipitation in the warm areas of the country in many cases, and, on the contrary, the moist areas, particularly in the central part and

in the west of the country, are located in the zone of low heat availability. All these factors demand great work on land reclamation, irrigation, mostly in the south of the country, and drainage, in the central and north-west areas. The irrigation programme of Middle Asia, in the south of the European part of the country, now under way, is of great importance. Sometimes the programme on comprehensive improvement of land resources are accepted for large areas. For instance, the specially accepted programme on the development of the non-chernozem zone of the European part of the USSR involves drainage of 9–10 mill. hectares of marshy lands; irrigated grasslands and pastures are being developed in the area of 8–10 mill. ha. Work on their surface improvement is in the area of 23 mill. ha, including liming. Therefore, the bioclimatic potential is, as a whole, not of a static nature but of a dynamic one, which is changing during the process of intensification through a combination of natural and artificial soil fertility factors.

The efficient distribution of agricultural production in the USSR has been formed historically on the basis of traditional zones of farming. This process of formation however, is subject to considerable modification under the influence of scientific and technical progress and the active planning role of the state. The main idea for the distribution of agricultural production in the USSR is the maximum utilisation of agroclimatic potential of the country with consideration of relative restriction of zones, favourable for production of valuable farm crops. Distribution of farm crops depends first of all on the highest adaptability to biological conditions of growing where these produce the highest yield. At the same time agricultural production is planned first of all for those zones, where the lowest cost price of production is achieved; and not only for plant products but also for animal products. Quite important research for the achievement of this task is under way. Some thousand plots for variety testing of agricultural crops are spread through the whole country, which permits obtaining data on yields of all farm crops, by variety, through the whole territory of the country each year. At the same time the registration of cost price of production for all main types of farm products is being carried out at all agricultural enterprises. Such information allows the planning agencies to introduce certain amendments into the plans for the distribution of agricultural production. Long-term perspectives of scientific and technical progress, of forecasting in yielding ability and cost price of agricultural produce is taken into consideration in long-term plans for changes of agricultural production distribution. This topic is one of the most important in the work of research institutes on agricultural economy both in central institutes and those of the republics.

Intensification of agricultural production, and scientific and technical progress in this field involves, as one of the main elements, a considerable increase in the level of interregional division of labour in agriculture with the formation of specialised zones of agricultural production. These zones are being formed or have already been formed with consideration

of specific bioclimatic potential, the level of production cost price, availability of labour resources and centres of consumption and the production infrastructure. These specialised zones involve the Central Asian one, which mainly specialises in cotton production, Transcaucasian republics, specialising primarily in horticultural and vegetable production and production of subtropical crops, sugar beet production zones in the Ukraine and in the south of the RSFSR, zones of market wheat production in Kazakhstan, Western Siberia and the Ukraine and in the south of RSFSR, dairy zones in the Baltic Sea republics and in the centre of RSFSR.

Proceeding from the Food Programme, it is planned to expand in future interregional specialisation with the formation of zones for potato production, greater specialisation in milk production and zones for production of corn, flax and sunflowers. Thus the formation of specialised zones in agricultural production is the main trend in the development of agricultural production distribution. The rates of this zonal specialisation to a great extent define not only the level of intensification in each specialised zone (and possibilities of removal of secondary and non-typical production from it) but also the further development of transport, production and commercial infrastructure. In this case considerable possibilities of changes in interregional divisions of labour are envisaged. For instance, with consideration of a high heat supply and availability of high labour resources, Central Asia can become an important zone for fruit and vegetable production as well as its development of cotton production. A special project, called 'Green Bridge', has been developed for production of vegetables and fruits in Central Asia and their transportation to the Urals and Siberia to supply large industrial centres. The improvement of supplies for Moscow, Leningrad and other central industrial districts with vegetables and fruits from the southern areas of the country is also projected. In view of the construction of the Baikal–Amur Road and the development of areas in Eastern Siberia and in the Far East, it is planned to develop there a large zone of agricultural production, primarily aimed at food supply for the new developed regions.

The development of such an extended interregional system of agricultural production with the large territorial dispersion of different zones leads to increased requirements in transportation. In many cases transport facilities represent the limiting factor in further extension of interregional division of labour. However, it would be wrong to explain all tendencies in specialisation of agricultural production only by the formation of specific zones which produce different types of agricultural products. First, in the majority of cases, agricultural crops are produced within the framework of a crop rotation, which itself provides a number of farm crops. Second, plant production is, as a rule, combined with animal husbandry in all zones. Third, the very important objective of each region is the achievement of a definite degree in self-supply for a number of farm crops, specifically for those which are difficult to

transport – such as milk, some types of vegetables and, very important, feeds for the production of some animal products in the areas of their consumption. This leads also to the formation of large suburb zones of intensive agricultural production farming, which is first of all aimed at dairy farming, poultry, swine breeding (to some extent) and the production of potatoes and vegetables. The formation of such suburb zones is particularly specific in central and north-west areas, where large industrial and administrative centres have an historical background. By this means, distribution of agricultural production must not be limited only by increasing the interregional division of labour.

The planning process for distribution of agricultural production, which, as already mentioned, proceeds on the basis of estimation of agroclimatic potential and cost price of agricultural production, is implemented by the planning agencies by means of and due to the establishment of plans for deliveries and sale into the all-union funds of the main specialised types of agricultural production for the particular republic and region. The planning agencies in this case seek to distribute production in zones, which are unique in character, specifically by accumulated temperatures for production of southern agricultural produce, such as cotton, southern types of vegetables and fruits, corn, rice, etc. Distribution of grain production and purchases of grain are also practised first of all in areas of its lowest cost price and highest yielding capacity. However, the requirements of the country for grain and some other agricultural products cannot be satisfied only by low cost price. Therefore some part of production is distributed in areas with the worst climatic conditions and higher cost price. As a result of this, the zonal system of prices has been developed in the country, which stimulates production not only under the best agricultural conditions, but also under the worst.

The adequate process of planning and distribution is practised at the level of a separate republic and district with distribution of the planned tasks for deliveries and sale of the main type of agricultural products to the state. Taking into consideration the cost price of production and zonal agroclimatic conditions, the zones for some types of agricultural production are being developed inside the regional specialisation. But in this case the additional and subsidiary branches as a rule are always developed; their objective is usually to meet local consumption and not to provide the deliveries for centralised funds. In this case the process of planning envisages only the indices of market produce which is sold to the state, but not the sowing areas or livestock population; that creates a certain flexibility in the process of production planning by the farms themselves as well as their high manoeuvrability in the solution of the specialisation process directly at the production level. Planning of market deliveries both at the interregional (all-union level) and at the level inside the regions goes ahead simultaneously with planning means of production of the future produce. These means of production are allotted not only for the procurement volume, but also for the total gross production of a particular region.

The development of agribusiness (agro-industrial complex), in particular the production infrastructure, the system of procurement and trade, the food industry and especially the transformation of agricultural raw material into ready food, introduces certain correctives into traditional schemes of agricultural production distribution. The question is not about the formation of pure agricultural zones of a specialised nature but about the development of agribusiness zones, which would supply the country market with ready types of food and not with agricultural raw material. The accepted measures on the accelerated development of the third sphere of agribusiness (i.e. food industry and supply infrastructure) will permit the formation of such kind of agribusiness zones efficiently. The main part of agricultural produce should be processed on the spot in this case, and should not be transported to large centres of consumption for its subsequent processing. Economic calculations prove that such a type of industrial processing in the zones of raw material production is efficient in practice for all branches of the food industry, except bakery and some others. For instance, as the production of 1 ton of meat requires on average 1.8 tons of raw material and considering, that transportation of livestock is much more expensive than transportation of the finished product, the meat industry is located primarily in the zones of livestock and poultry production. During the 1960s and 1970s 75–80 per cent of new facilities in the meat industries were developed within the zones of raw material production. Annual saving caused by the introduction of meat from raw material areas is 300–400 million roubles, as compared with its production in areas of consumption.

Adequate processing takes place in other branches of the food industry with the objective of comprehensive processing in the areas of agricultural raw materials and of waste utilisation, using them also for feeding purposes. The development of facilities for the food industry in specialised zones has a further effect on the growth of specialisation of agricultural production itself, in particular on the development of the sugar, meat, dairy, butter and fat industry. Specialised agribusiness has been formed in zones of cotton production with ginning and processing of cotton raw material and cotton seeds. It is planned to develop specialised agribusiness zones for potato, fruit and vegetable production with output of final produce ready to use. The development of the refrigerating industry with production of deep frozen products is of particular importance in this case.

From the scientific point of view, the problem of interregional and intraregional division of labour, the combination of branches, striving for utilisation of advantages in bioclimatic potential of different zones, efficient use of differences in cost price of agricultural produce is, as has been already mentioned, one of the main trends in economists' activity regarding USSR agriculture. At present, with the development of systemic studies, modelling and the wide application of electronic computers, these tasks are generally solved by using economic and mathematical methods. The objectives for transportation of agricultural

produce (raw materials and finished produce) are solved traditionally, as well as the efficiency of the use of capital investments in zones, considering land reclamation and comparative cost price of agricultural production, the tasks on comparison of production efficiency in different zones, taking into account transportation costs. Such objectives are solved at the level of the whole country (distribution of market produce volumes among republics and regions) as well as at the level inside the region (distribution of production within the region). The further development of these researches, as our experience proves, requires considerable improvement of the information basis, the development of a great number of normative indices, coefficients of flexibility in production functions and corresponding mathematical application. A special programme has been developed at the Academy of Agricultural Sciences. This programme deals with the development of research on the application of economic and mathematical methods, in particular, those for the solution of the problems of agricultural production distribution with the development of imitation models with the possibility of solving multiversion tasks on optimisation of distribution of agricultural production, aimed first of all at the fulfilment of two main objectives: maximisation of production and possible general reduction of the whole complex of expenses in agriculture, the food industry, transport and trade.