

SOVIET SCIENCE AND AGRICULTURE 1948-1953

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FIVE years have passed since the celebrated session of the All-Union Lenin Academy of Agricultural Sciences at which the Mendelian theory of heredity was rejected as incorrect, and the Michurinist theory, developed by T. D. Lysenko, was adopted by Soviet scientists as the guide for future research in biology. This decision was taken in all seriousness and for severely practical reasons, because it was believed by the majority of the participants at the session that Michurinist theory would help forward most speedily the progress of agriculture in the Soviet Union. A sense of high responsibility was expressed by almost all the speakers, a determination to use their science effectively in raising the productivity of collective farming.

This attitude is stated with clarity in the words of Academician Lobanov : "The question . . . which we are discussing at this session is one of the utmost importance for the further progress both of the biological and agricultural sciences and of socialist agriculture, with which these sciences are inseparably connected. It is incumbent upon our agricultural science . . . to render daily assistance in the struggle for the further progress of our agricultural production, for the accomplishments of the tasks . . . set before socialist agriculture." And in his closing speech Lysenko himself made the same point : "We must effectively place science, theory, at the service of the people, so that crop yields and the productivity of stock-breeding may increase at a still more rapid pace, that labour on state farms and collective farms may be more efficient. I call upon all Academicians, scientific workers, agronomists and animal-breeders to bend all their efforts and work in close unity with the foremost men and women in socialist farming to achieve these great and noble aims."

Many scientists outside the Soviet Union could not comprehend or share this bold and confident outlook. Seeing a familiar theory rejected, and understanding little of the reasons, they believed that the event would be likely to have ill consequences for Soviet agriculture. Genuine misgivings were felt even by many well-wishers of the Soviet Union, while hostile critics were ready with gloomy, almost gloating, predictions of the imminent ruin of collective farming. Professor Dobzhansky denounced Michurinist theory as a monstrous error, and remarked of the Soviet Government : "Having placed a maniac in charge of their agriculture [Academician Lysenko is meant], they are bound to suffer grave losses in harvests, and this for a long time—losses which are assuredly not welcome to them."

One point is at any rate common ground between Soviet scientists and their critics, namely that the progress of agriculture was bound to be enormously influenced either for good or for ill by the new direction in guiding theory. It is therefore not inappropriate at this time to attempt some estimate of the position and prospects of Soviet agriculture five years after the triumph of Michurinism. The materials for a complete appraisal cannot yet be assembled, nor could such a task be accomplished in a short article. Fortunately, however, the indications from the available information are so clear that a reliable judgment is already possible.

The war inflicted tremendous damage on Soviet agriculture and interrupted the rapid growth which characterised the pre-war decades. In the occu-

pied areas the collective farms were wrecked and plundered (98,000 out of 236,000 throughout the USSR), presenting a fearful problem in reconstruction after the invaders were driven out. Throughout the war, however, the Soviet Union was able to feed herself from the produce of the eastern regions, together with accumulated stocks, in spite of the temporary loss of some of the most productive lands in the west. Following the defeat of Nazi Germany, the rebuilding of agriculture was astonishingly rapid, aided by far-reaching and generous government assistance, so that within three years the pre-war output of almost all crops was equalled or exceeded. Thus in 1948 the 1940 level of agriculture had already been regained. These facts are in themselves a remarkable demonstration of the strength and vitality of the collective system of farming.

Less than two months after the session of the Lenin Academy, as if to underline the connection between science and agriculture which had formed the theme of that meeting, the Soviet Government issued a detailed plan for the introduction (starting from 1949) of the *travopolye* system in all collective farms of the steppe and forest-steppe regions of European Russia. It should be pointed out that this system of husbandry, based on the work of Dokuchaev, Kostychev and Williams, was already widely practised; the 1948 plan provided for its systematic introduction over very extensive areas.

The *travopolye* system is a complete scientifically organised method of agriculture, founded on grass-arable rotations, in which the processes are integrated so as to develop and maintain maximum soil fertility and the highest yields of plants and animals. The principal features of this system as contained in the 1948 plan may be summarised as follows:

1. The planting of forest shelter-belts on all farms along field-rotation boundaries, slopes of ravines, water-partings, rivers and ponds, together with afforestation and fixing of areas of sandy soil.
2. The rational use of the land and the special territorial features of every farm, and the universal introduction of inter-related crop and permanent grass (fodder) rotations.
3. The adoption of correct methods of soil treatment, crop husbandry, and the application of mineral and organic fertilisers.
4. The use of high-grade selected seed of locally adapted high-yielding varieties.
5. The widespread use of irrigation by the efficient management of local water supplies and the construction of ponds and reservoirs.

These measures on individual collective farms were to be combined with the establishment by the State of broad forest shelter-belts extending for hundreds of miles and having a general ameliorating effect on the climate and water regime of large areas.

Parallel with this plan other highly important steps were taken. The movement for voluntary amalgamation of the smaller collective farms was encouraged. This resulted in the creation of larger units which could be more efficiently organised and where science could be more effectively and rapidly applied. At the same time the government took energetic measures for the fullest mechanisation of agriculture. The basis of mechanisation is the network of Machine and Tractor Stations, and the scope of these was developed and their number greatly increased. Many new specialised stations were set up, concerned with the application of machines to particular processes such as shelter-belt planting, technique of livestock farming, land reclamation. The high degree of mechanisation of Soviet agriculture is shown by some figures

for 1952 given by the Ministry. In this year 80% of the spring sowing was mechanised, while combine-harvesters of the Machine and Tractor Stations harvested 72% of the area under grains, 90% of sunflower, 67% of flax, and 90% of sugar beet.

Early in 1949 a comprehensive plan for raising livestock production was issued, proposing a whole series of detailed and concrete measures to this end. The foundation for increased livestock was the production of abundant supplies of fodder, dependent on the development of *travopolye* rotations.

These plans represented the direct application of science to agriculture on a scale which it may be truly said is not known elsewhere in the world. Not only are these plans clearly drawn up with the advice and co-operation of scientists, but they also specifically impose upon Soviet scientists and agronomists, upon the Lenin Academy of Agricultural Sciences, and upon the various research institutes, the responsibility of guiding and improving the work of collective and state farms, and of helping to fulfil the tasks laid down. There is no doubt of the very active part played by the scientists, and in particular by Lysenko himself, in the work of agriculture.

The general results for the development of agriculture since 1948 were summarised by Malenkov at the Nineteenth Congress of the Communist Party in 1952. In 1952 the wheat crop was 48% above that of 1940, while cotton, sugar beet and fodder crops were (in 1951) respectively 46%, 31%, and 25% above 1940. The output of potatoes, oil plants, meat, dairy products, eggs, wool and hides was higher than pre-war. Perhaps the most telling evidence of increased productivity is furnished by the price reductions announced by the Soviet Government on April 1, 1953. Thus, the price of bread and flour (all types) was reduced 10%; legumes, millet, buckwheat, all fodder grains, oilcake, hay 10%; meat (beef, mutton, pork, poultry, cooked meats, sausages) 10%; butter, margarine, edible oils 10%; sugar 10%; potatoes, vegetables, fruits 50%.

These reductions are even more impressive when it is remembered that they are the *sixth* annual price cut since 1947. In fact the prices of such agricultural products as meat, butter, cheese, vegetables and fruit have fallen to less than one-half since 1947. These figures show that the collective farmers are receiving effective scientific guidance, and that the prognostications of Professor Dobzhansky and others have not been fulfilled.

A very important feature of the tremendous increase in agricultural production is that it does not simply reflect an increase in crop area, although this has also taken place. The significant fact is that yields per hectare have increased, a direct indication of the success of scientific methods and planning. Many of the best collective farms are now producing very high yields indeed. Thus the mean yield of winter wheat over very large areas in the Ukraine in 1951 was 24-26 centners per hectare, while some individual farms secured yields of 30-35 centners per hectare from areas of several hundred hectares. In the Nikolaev region the mean yield of grain crops was 27.5 centners per hectare over 38,000 hectares, with one farm harvesting 34 centners per hectare of winter wheat from several thousand hectares. By no means all collective farms have yet attained such levels, but the figures show what has already been accomplished over large areas and what are the possibilities in the near future.*

Many figures are now available which graphically illustrate the progress resulting from the adoption of the *travopolye* system. Typical of many are the indices for collective farms of the Chelyabinsk (Trans-Ural) Region, which introduced *travopolye* rotations in 1945.

* In the relatively favourable conditions of Great Britain mean wheat yield is 23-25 centners per hectare, with good farms reaching 38 centners per hectare and over. The record for a small area is 68 centners per hectare.

| Year | Grain Crops | | Cattle | Sheep | Pigs | Poultry |
|------|-------------------|-------------|--------|-------|-------|---------|
| | Yield per hectare | Gross yield | | | | |
| 1940 | 100 | 100 | 100 | 100 | 100 | 100 |
| 1945 | 72.9 | 66.8 | — | — | — | — |
| 1947 | — | — | 105 | 94.1 | 33.6 | 67.4 |
| 1949 | 94.2 | 80.3 | 133.3 | 122.3 | 116.8 | 265.1 |
| 1950 | 158.8 | 140.1 | — | — | — | — |
| 1951 | 152.2 | 140.4 | 152.8 | 178.1 | 228.7 | 1,425.8 |

A collective farm in the Moscow region showed the following increases in yield per hectare after adopting the *travopolye* system: grain crops 94%, hay 77%, potatoes 112%. It should be emphasised that the general rise in productivity, of which these are particular examples, is the result of the application of a whole complex of scientific procedures. Some of the more recent developments of agricultural science in relation to production will therefore be briefly discussed.

Much attention and research work is being devoted to increasing the effectiveness of fertilisers by determining the correct time and method of application for various crops. It has been found that fertiliser is best applied in granular form, not powdered, and close to the crop roots, either at the base of the furrow when ploughing or in drills with seed at sowing. Additional fertiliser may be given to particular crops at suitable times in the vegetative period. This method of application in granular form is more economical of fertiliser; 30-60 kilogrammes per hectare with the seeds are as effective as 200-300 kilogrammes per hectare of powdered fertiliser broadcast. The nutrient is directly available to the plant, while the granular form has a favourable effect on the bacterial population of the soil.

The best type of fertiliser, widely produced and used, consists of a combination of mineral fertiliser (superphosphate) with organic fertiliser (farmyard manure, peat, compost) in granular form. Great efforts are being made to popularise its use among collective farmers. This fertiliser is also used in combination with so-called bacterial manure, that is, with an inoculum of living soil bacteria (*Azotobacter*). The yield of wheat, rye, oats, barley, potatoes may be increased 15-20% by the bacterial inoculum.

These results are of great interest, since bacterial manures have been considered to be useless by many agriculturists outside the Soviet Union. The point is, as the Soviet workers have shown, that to be effective the bacteria used (*Azotobacter*) must be local races isolated from close to the roots of the particular crop. Furthermore, the bacteria must be applied to the seed in combination with phosphate. In these conditions bacterial manuring makes an important contribution to crop production.

Manurial treatment by spraying the vegetative parts has been used very effectively in certain cases. For example, by spraying the leaves of *kok-sagyz* with a solution of superphosphate six weeks prior to the harvest of the roots, the rubber content can be increased by 20%. Similar treatment of sugar beet causes an increase of 2% in sugar content.

Much of the increase in agricultural production can be ascribed to the use by the collective farms of better seed for sowing and of new varieties of plants specifically adapted to local conditions. Several thousand seed farms are engaged in producing high-grade seed of the best local varieties, using Lysenko's methods. Work in plant and animal breeding is being carried out on a wide scale, with special emphasis on the production of varieties adapted to the particular conditions of each natural region. For plants there are now

over 180 selection stations in various regions engaged in this work, and 1,260 varietal-testing plots. Over 1,000 new varieties have been sent for government tests in the last five years, and many of these have been officially adopted as regional varieties. Among new varieties may be mentioned a new winter rye, Volzhanka, produced by Michurinist methods from a local variety, which yields two centners per hectare more than the present standard variety; a winter wheat, Skorospelka, which yields 4-6 centners per hectare more than Novo-Ukrainka; Lgovskaya 873, a winter wheat which in irrigated conditions gives 3-4 centners per hectare more than the standard; a new Siberian winter-hardy wheat, Omskaya 6, created by Lysenko's method of changing spring wheat, Milturum 321, into the winter form. Many varieties of plants have been produced suitable for the adverse conditions of the more northern regions and of Siberia. These rapid advances in plant-breeding are of particular interest since it is in this field of scientific work that the influence of Michurinist theory would be expected to be most immediately reflected.

The use of additional pollination is now widespread, especially on seed plots, as it causes very considerable increases in yield (winter rye, sunflower, and so on). In spite of repeated statements to the contrary made in this country, vernalisation continues to be used on many collective farms as a means of increasing the yield of spring cereals and certain other crops.

The method of cluster sowing, which came into prominence in connection with the growing of young trees in the forest shelter-belts, is now being extended to many other plants. The yield of potatoes, cereals, sunflowers, sugar beet, has been found to be greater when they are cluster-sown. The best size of cluster, distance apart, and method of sowing are being investigated for each crop. The introduction and mechanisation of this method of sowing is already beginning to have significant results.

The reports of the various agricultural research institutes, of which there are many in the Soviet Union, give a picture of the vast amount of scientific work, continually advancing, which forms the foundation for the rapid growth of agriculture now taking place. Agricultural research is concerned both with immediate practical problems and with long-term questions of fundamental theoretical importance. In addition to investigation concerned with the problems which have already been mentioned, work is being done in connection with methods of irrigation, the mechanisation of agricultural operations, the relation between micro-organisms of the soil and plant nutrition, the study of mineral nutrition of plants with labelled atoms, relation between root-fungi (*mycorrhiza*) and plants, agronomic methods for semi-desert sands without irrigation, classification and development of soils, plant and animal genetics, plant diseases, and many other questions. Many problems almost completely neglected in this country are receiving great attention. The vitality and scale of this research make it impossible to do more than mention a few of the lines of work.

One important aspect of the work of scientists and research institutes that must be mentioned is the educational side. In 1950 the Ministry of Agriculture introduced a new system of mass training of collective farmers in three-year agro-zootechnical courses. In 1952 over 2½ million farmers were enrolled for this course, 160,000 specialists being drawn in to the teaching. A large number of short courses were arranged, attended by over 4½ million farmers last year. Attendance at these courses does not involve cutting off the participants from production. In addition 600,000 lectures on advances in agronomy were attended by about 17 million people in the course of a single year, without reckoning many radio talks. Films and leaflets dealing with agriculture are produced, while numerous visits to scientific institutions are arranged. The government encourages the setting up of "Houses of Agriculture" in the villages.

These are intended to be centres of information and instruction in agricultural questions. In all these mass-educational activities scientists and research institutes naturally take a leading part.

Such an attempt to bring scientific theory directly to practical farmers, to arm them with the most advanced scientific methods, to raise the technical ability and the knowledge of millions of ordinary people to a very high level, is something new in the history of the world. By making science the possession of all agricultural workers, the conditions for even more rapid agricultural progress are being established. At the same time science will be enriched and stimulated by the even closer links with practical experience and problems.

The Fifth Five-Year Plan envisages considerable increases in agricultural production. Over the next five years wheat output is to be increased 55-65%; cotton, flax, sugar beet, potatoes, sunflower by amounts varying from 40% to 70%; while fodder crops are to be increased by 100-200%. The great expansion in output of fodder crops will form the basis for the planned development of livestock which will provide for an increase in meat and fat output of 80-90%, milk 45-50%, wool 100-150%, and eggs 500-600%. The attainment of these targets depends on very considerable increases in crop yields per hectare. The planned increases are remarkable, but in view of the experience of the last five years there is no doubt that they are attainable and will be attained. In the fulfilment of these plans science is clearly going to play an even greater part than in the past.

This brief survey of recent developments in Soviet agriculture is sufficient to demonstrate the extreme vigour of its growth, and the increasing extent to which science is directly involved. Soviet agricultural science is very closely connected with all the manifold problems of practical farming, and is held responsible for their solution by the people and the government. Judged by its contribution to the advance of agriculture, the Michurinist trend in biological science seems, therefore, to have successfully established its value.
