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SCIENCE AND TECHNIQUE UNDER CONDITIONS OF A
SOCIALIST RECONSTRUCTION OF
AGRICULTURE

N. I. VAVILOV

LENIN ACADEMY OF AGRICULTURAL SCIENCES, MOSCOW, U.S.S.R.

AGRICULTURE, the basic industry, almost immobile for ages, is now entering upon a new phase. Events of extraordinary significance to agriculture are taking place, events whose meaning is still difficult to comprehend by a contemporary mind amidst present-day conditions. Out of millions of small individual holdings, organized along medieval lines on primitive, egotistical principles, based upon ancestral customs and routine, agriculture in the U.S.S.R. is assuming new forms and is being transformed into a rational, collective, socialist system of farming, composed of large units constructed on a scientific plan.

The general significance of these developing events is determined first of all by geographical data. Of the total area under cultivation in the world as a whole, estimated at 650 million hectares, about 130 million hectares (1930) belong to the Soviet Union, or about one-fifth of the cultivated area of the globe.

By carrying out during the next decade the plan for an extension of the cultivated area in Siberia, Kazakstan, the Far East, and the Northern Region, by the thorough and efficient cultivation of lands now lying idle (about 40 million hectares), and by other measures which are technically quite feasible, the Soviet Union will be able to increase its cultivated area within a few years to 200 million hectares.

To carry out this vast plan the mobilization of science and technique is inevitable. Science is no longer merely an auxiliary aid or a friend; it is one of the chief weapons for constructing life on new principles. The exceptional requirements of a socialist reconstruction of agriculture in a vast country are primarily directed to scientific workers in agronomy and related subjects. From them the country must expect a most active participation in the realization of a new rational type of agriculture on a socialist basis.

In the past, Russian science, as many know, occupied a comparatively high level; the scientists of the Soviet Union are upholding this tradition. Soviet agronomists have made valuable contributions, the importance of which extends beyond the bound-

aries of the Soviet Union. In soil science, agricultural chemistry, agricultural physics, plant and animal physiology, genetics, and plant breeding they have made undoubtedly notable contributions to science.

Not by chance or accident was the Second International Congress of Soil Science held in the Soviet Union (1930), where, notwithstanding the existing difficulties of intercourse, a considerable number of foreign scientists attended the meetings. A number of Soviet textbooks—on agricultural chemistry (Priianishnikov, Hedroiz), on plant physiology (Maximov, Kostychev), on soil (Glinka, Hedroiz)—have recently been translated into German and English.

It is indeed not for us to judge objectively the part played by scientists of the Soviet Union in the world's science. Still we may say that the general level of our scientific institutions and higher agricultural schools is not below those we know abroad. Our district agricultural experiment stations in Poltava, Shatilovo, and Saratov are large institutions. The experiment stations of the Sugar Trust are very nearly equal to those in western Europe. The author has visited many agricultural experiment stations abroad (in 35 countries) and has worked in some of them.

Not long ago opinions were expressed in Soviet Russia to the effect that science had far outgrown life and that we should promote its dissemination rather than further research. But now things are changing. The enormous requirements called for by the large unified socialist system of farming soon revealed the fact that our knowledge, and our scientific training, were inadequate for an efficient solution of urgent problems brought forward by the whirlwind development of socialist reconstruction on a large scale. Moreover, even the general level of agricultural science may be deficient in this respect. The investigator realizes as never before that his work does not keep pace with life.

Until recently our experimental agronomy had to deal with small-scale farming with its limited possibilities and its lack of ability to apply scientific knowledge. Large farming abroad and even in our country certainly made more use of this knowledge. The experience of America, western Europe, colonial agriculture in Java, the Philippines, and Formosa confirms this.

The institution of large-scale farming based on socialist principles—the size of the farms tending to exceed that of even the largest capitalist farms—had the immediate result that our scienti-

fic institutions were called upon for aid on a much larger scale than our scientists had been accustomed to. Practical problems of large, specialized agricultural enterprises; questions of seed production for state-organized large-scale farming; problems of the increase of cultivation of industrial plants and of the introduction of new plants and cultures, arose before the agronomists of the U.S.S.R.

Not long ago the attention of our mechanics was fixed upon the problem of substituting the steel plow for the primitive light wooden plow ("sokha") in creating a suitable type of light plow for the peasant's horse. Some of our investigators worked for years upon that problem. Now quite different problems—problems of the mechanization of agriculture, and of the standardization of large agricultural machinery—are looming before us. The tractor, which before the revolution 99 per cent of the population had never set eyes upon, is now an essential factor in the reconstruction of agriculture. The Soviet Union not only buys tractors abroad but is already beginning to manufacture them, and in a short period of two or three years the number of tractors in use will attain the unprecedented figure of several hundred thousands. Production of the latest type of machinery is now the question of the day.

In all branches of agriculture—in grain farming, in animal husbandry, in the cultivation of industrial plants such as cotton and various sub-tropical plants, in problems of eradication of pests—the deficiency of our present fund of knowledge and training is quite evident.

It suffices to indicate the scale of changes experienced last year. The total increase in the area under cultivation for 1930 is about 8,000,000 hectares. The acreage under cotton this year amounts to 1,600,000 hectares, as compared with 1,000,000 hectares last year, *i.e.*, an increase of 60 per cent. The area under sugar beets has increased 30 per cent. A considerable increase has been attained for potatoes and maize. Tea plantations, which before the war covered only about a thousand hectares, this year covered 13,000 hectares, and undoubtedly within the next five years will attain an acreage of 100,000 hectares.

Scientists and investigators are faced with immense, concrete problems which require definite, straightforward answers. The problem of the expansion of the acreage under cultivation is con-

fronting us. Only about 5 per cent of the land is under cultivation in the Soviet Union, 95 per cent lying idle. This same percentage is typical of the whole world. In general, only about 5 per cent of the entire land surface of the globe is under cultivation. Even the surface of the earth has as yet been utilized by mankind to only a very small extent. Recently Professor Glinka attempted to compile a world's map of soils. Not until the last International Congress of Soil Science could data be obtained for several regions of Africa and Asia. The history of agriculture shows that only during the last seventy years has agriculture spread over the most fertile regions, the black soils of Eurasia and the New World. Our investigations have shown that ancient agriculturists were confined to the mountainous regions of Southern Asia, the Mediterranean region, Abyssinia, and the southern Andes region in the New World.

The problem of problems in agriculture for the Soviet Union, as well as for the world as a whole, is that of the expansion of agriculture. Lack of organization, the small size farm holdings, their dispersion, the backwardness of many countries, have in the past constituted the reasons for vast tracts of land remaining idle and uncultivated. This big problem has been insufficiently investigated as applied to conditions in the Soviet Union, where production per unit of population has always been very low and where this task of appropriation of new territories for colonization, and for reclamation, is of primary importance.

Even the number of agricultural scientists, which but lately seemed quite adequate, now has proved to be insufficient. We have about 22,000 agronomists of higher qualifications, but today we need five times this number.

The need of specialization in research and concrete knowledge has become evident. "Encyclopedism," a characteristic of the older agronomists, now seems inadequate for an efficient solution of practical problems. If a few years back our agricultural experiment stations could point out their achievements with satisfaction, now one has to reflect rather disconcertedly about the deep chasm between life's practical problems and the comparatively modest fund of knowledge we have at our command in many important lines.

Scientists must acknowledge these facts frankly and draw inevitable conclusions therefrom, *i.e.*, the necessity of organizing re-

search on a broader and deeper basis, and of adapting scientific investigation to the requirements of new large-scale socialist agriculture. No doubt this is possible. The will to achieve, enthusiasm, and above all, comprehension of the extraordinary changes which agriculture is undergoing, are necessary. All thoughts of rest must be forsaken. Sustained efforts are necessary to complete the revolution in agriculture, whereby it will be transformed into a scientifically-organized, large-scale socialist industry.

The reorganization of agriculture in the Soviet Union has necessitated a new development of scientific investigation. New experimental stations have been opened. On June 25, 1929, the Soviet Government issued a decree concerning the foundation and organization of an All-Union Academy of Agricultural Sciences. This academy, known as the Lenin Academy of Agricultural Sciences, represents an association of a number of institutes, including the Institute of Mechanization of Agriculture, the Institute of Economics and Organization of Socialist Agriculture, the Institute of Collective Farming, the Institute of Plant Breeding, the Institute of Animal Husbandry, the Institute of Dry Farming, and the Institute of Reclamation and Irrigation. Since last year special institutes for the study of maize, soy beans, tea, fruits, vegetables, and viticulture have been organized. Many new stations for animal husbandry have been opened in 1930. These institutes are planned on a large scale and represent first-class scientific laboratories. Old experiment stations must also be reorganized on the basis of the regional specialization of agriculture. Last year the Agricultural Academy elaborated a general regional plan for the development of agriculture, comprising important changes due to rationalization of agriculture. This plan must be taken as the basis for the reorganization of experiment stations, which must specialize along definite lines and on definite forms of agriculture. A new network of experiment stations is to be organized, whereby the number of such stations will be doubled. Next year there will be more than 300 experiment stations in the Soviet Union.

This reconstruction of agriculture has just begun; it is only in its early stages. The organization of large-scale and collective farming is in its first phase. The primary task of the Agricultural Academy and the experiment stations is, so far as we can judge, to carry on thorough and original investigations for the purpose of solving practical problems. Agriculture and agricultural industries

are, notwithstanding their antiquity, most backward. New methods must be worked out, creative efforts must be encouraged, and knotty problems solved. Agricultural problems are very concrete and local, but at the same time we need a synthetic knowledge of the country and its conditions. The fundamental tasks of the Agricultural Academy are to synthesize the investigations of district and provincial experiment stations, to coordinate the work of these investigations, and to promote similar methods of research.

Science is international. True scientists are internationalists. In seeking out our own path, in investigating our own conditions, we must keep up to the scientific level of international science—we must know its achievements. Investigators in the U.S.S.R. are confronted with an immense field of work. Science and the socialist reconstruction of agriculture are indivisible, and their relations must grow closer as the years go by. Science is a necessary part of a socialist state. We are organizing agriculture according to a plan, but this plan on its large scale can be worked out only with the aid of scientific data and as the result of definite scientific knowledge.

Unable to solve its manifold problems by the efforts of its own scientists alone, the Soviet Union is willing to invite foreign specialists. The problem involved in a socialist reconstruction of agriculture will be solved by sustained, collective effort. Important practical problems, impossible of solution by solitary scientists, must be solved by large scientific societies, or institutes—by scientific collectives. Due to the imperative needs of agricultural production the organization of scientific institutes for research must be closely allied to industry. Laboratories must be transformed so as to enlarge their capacity. Investigations must be industrialized, in order to accelerate the obtaining of results.

Among the most difficult tasks of agricultural science in the Soviet Union are those of perfecting the art of dry farming, of overcoming drought and winter killing of wheat. Our yield depends upon weather conditions. The continental climate, with its extremes of heat or cold, brings good or bad harvests. The drought conditions in the United States in 1930 are an ordinary phenomenon in Russia, where practically every four or five years we have drought in a large area in the southern and eastern part of the Soviet Union. The agricultural experience of the world can aid us very little in this respect. All the best American drought-

resistant varieties of wheat are our common Russian varieties, which do not satisfy our needs. German and Swedish wheat under our conditions perish immediately the first year. Thus the Soviet plant-breeder is confronted with tasks hard to solve but which must be solved.

It would be erroneous to suppose that the immense practical problems created by large-scale socialist agriculture can be solved by every-day methods, by mere good luck, or by foresight or intuition. Our investigators must broaden their knowledge by a study of the achievements of science throughout the world. In solving practical problems our scientific institutes must be versed in theory. In organizing institutes for research, called upon to solve practical problems, we must likewise guarantee the development of theoretical science, without which the very level of scientific investigations will be lowered. Only the harmonious development of scientific thought along both theoretical and practical lines can give the best and quickest solutions to practical problems. The most important achievements of the nineteenth and twentieth centuries were linked up with discoveries in theoretical science. A scientist nowadays has no right to avoid practical problems, but he is needed primarily as a theorist. Immortal fame was achieved by Pasteur not because he occupied himself with the practical problems of the wine and brewery industry, sericulture, and the cure of contagious diseases, but because, in approaching practical problems from the heights of science, he could solve these problems in a new and general way, which had been sought in vain by practical men.

Our tasks are indeed of a general nature. The transformation of agriculture in the Soviet Union, affecting science and technical problems, is certainly introducing quite new principles. Large-scale socialist agriculture and the organization of agricultural industry on a new basis must stimulate scientific thought. The problems now affecting science and engineering in the Soviet Union must attract, we believe, the attention of the International Conference of Agricultural Economists. The problems of today in the U.S.S.R. are the problems of tomorrow in other countries.