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RESULTS OF WORK DONE BY THE ALL-UNION ACADEMY OF AGRICULTURAL SCIENCES IMENI V. I. LENIN AND PROBLEMS OF AGRICULTURAL SCIENCE

Speech made by T. Lysenko,
28 October 1949

The year 1929 marked a change in the agricultural history of the Soviet Union. At that time millions of poor and middle class peasants were organized into kolkhozes and the All-Union Academy of Agricultural Sciences imeni V. I. Lenin, the highest scientific institution for agriculture, was founded.

Many difficulties arose in the development of agronomical science and its biological basis. In overcoming these difficulties, Michurinian teaching grew and developed. The old biological theory of Neo-Darwinism, which separated theory and practice, was not suited to Soviet agriculture.

The unification of the Michurinian theory and kolkhoz-sovkhoz practice is the foundation of biological science in the Soviet Union.

Michurinian biology has verified by scientific investigation and experience the theory of stage development and has thus revealed the laws of the individual development of plants.

The individual development of plants implies not merely growth and change in the composition of plants, but a series of qualitative changes and transmutations from one stage in the development of cells to another. In various stages, the same organism demands different conditions for its environment.

The dialectical approach to biological facts and the evolution of the theory of the individual development of plants and their materialistic explanation made it possible for Michurinian science to understand the interdependence of the ontogenetic and phylogenetic development of plants and animals and thus to interpret correctly the basic laws of plant and animal heredity. As a result, it became possible to find ways of directing the natural changes of organisms in the direction necessary for agricultural practice.

Michurinian teaching has revealed the sources of plant and animal life. The different degree of vitality of organisms in related and unrelated development has long been evident. Dialectical materialism makes it possible to find the means of directing the life of an organism and of increasing the life span of plants and animals by developing related organisms. This idea is important for both theoretical biology and for selection and seed-raising practice, especially with cross-pollinated plants, and also for animal breeding in order to develop new breeds and to improve existing breeds of livestock.

Michurinian teaching has changed the theory of new species formation which has always occupied a prominent position in theoretical biology. Darwinian science attempted to prove that the organic world is steadily changing and developing, that it has its own history, and that it develops on the basis of natural laws.

Darwin's theory of evolution proceeds from the acknowledgement of only quantitative changes and leaves out the laws of transmutations and changes from one qualitative stage to another. Growth thus consists of only an increase or decrease in quantity. Consequently, this theory could only explain the development of the organic world; it could not provide an effective theoretical basis for the practical transformation and change in organic nature. Michurinian teaching, however, is able to provide a theory for materialistic biological science which can be endlessly developed. It begins with the idea that organic forms are in harmony with their life conditions. Life conditions become the first source for changing the hereditary qualities of organisms and also for changing organic forms and transforming one variety into another.

In the paper, The Position of Biological Science, it was reported that 28-chromosome hard wheat (Triticum durum) during fall sowing was changed in two or three generations into a soft, 42-chromosome variety of wheat (Triticum vulgare). For the first time, soft wheat plants were found among the hard wheat plants grown from seeds harvested from the fall sowing. Although special care was taken to prevent hard and soft wheat seeds from being mixed, careful analysis showed that in some cases spikes of hard wheat developed into soft wheat grains. The 42-chromosome soft wheat grows from these grains. This proved that the soft wheat is formed from cells of embryos of hard wheat already transformed into soft wheat. We have here a striking example of how, under the influence of the existing conditions of life, the qualitative condition of individual cells and pieces of tissue of hard wheat are transformed into the qualitative composition of soft wheat.

The possibility that genetically different qualities are present in the bodies of organisms was evident to Michurinian teaching even earlier. But this genetically different quality was evident only as an intra-species quality in which genetically different parts of the organism belonged to the same species. In the wheat example cited above, it is evident that genetically different qualities are contained in the body of an organism and include the qualities of two different species.

Species exist as separate, qualitative forms in the organic world. Agricultural practice takes this into account and bases its activity on this idea. Materialistic biological theory, since it is concerned with species and the formation of species, should also be based upon the idea that species are tangible, qualitatively specific forms of organic nature.

The old biological science, acknowledging only gradual quantitative changes and not recognizing sudden qualitative transformation of one organic form into another, or of one stage into another stage, could not adjust its theoretical base to existing species. For this reason, species were studied only as a means for understanding the system of

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classification.

V. R. Vil'yams' theory on soil fertility and development, in contradistinction to the reactionary theory of the loss of soil fertility due to erosion, has made it possible for agronomical science to find means of restoring and improving fertility conditions. This theory is the theoretical biological base for the grass crop rotation system of soil cultivation.

Vil'yams' theory of soil development explains the use of mineral and organic fertilizers. According to his teaching, plants instead of the soil should be supplied with fertilizer. Since kolkhozes have begun using this method, they have had larger harvests.

The teachings of Michurin and Vil'yams are different aspects of the same theoretical questions of agronomical science and practice. For this reason, the two have blended into one agrobiological science which is now the theoretical basis of the work done by the All-Union Academy of Agricultural Sciences imeni V. I. Lenin.

In recent years, institutes and experimental and selection stations have produced many varieties of agricultural crops, including grains, potatoes, cotton, sugar beets, sunflowers, and fruit and berry plants. New breeds of cattle have been developed and old breeds improved. Progress has been made in all divisions of agriculture. Yet, not all scientific research institutes are skillful in their handling of Michurinian science. For this reason, the academy and its institutes must guide and direct scientific workers in all agricultural and agronomical research institutes with the goal of high sovkhoz and kolkhoz production.

In agrobiological scientific research, it is most important to adhere to the principle of unity of analysis and synthesis. The biological analysis of processes in the development of plants, animals, and soil must always be conducted from the point of view of synthesis so as to guarantee effective agricultural and zootechnical procedure.

As examples, the following important questions must be worked out by research institutions to show the practical application of agro-biological science in kolkhozes and sovkhozes in fulfilling the planned tasks:

1. Utilization of the Grass Crop Rotation System

The grass crop rotation system is one in which the same or a similar crop, upon being replanted in a field where it formerly grew, grows in soil which has become more fertile and contains fewer weeds than formerly.

It is known that the most important condition for soil fertility is that the soil be fine. Only firm, fine soil can assure adequate food and water for plants. The structure of the soil is influenced by the roots of perennial grasses (mixtures of grasses and legumes). For this reason, grass crop rotation is necessary.

Grass crop rotation must be handled skillfully. It is important agriculturally as a means of improving the harvest and increasing the gross yield. A grass crop rotation system which does not ~~raise~~ improve the harvest is, of course, of no value.

The following question is asked by some scientific workers: Is it possible to increase agricultural production in a grass crop rotation system before the soil has been built up by grasses and while the grasses are still growing in part of the area?

Some scientific workers think this is impossible. They think that uncultivated areas should be utilized for the introduction of grass crop rotation since this will not lower the gross yield of agricultural production.

The introduction of grass crop rotation, however, is most necessary in those areas of the Soviet Union which are already under cultivation. Grass crop rotation should be so introduced that during the growing period of the grass the gross yield of agricultural products will be steadily increased. This is the only correct method of introducing grass crop rotation.

Small hay harvests of perennial grasses are a primary factor in delay in the introduction of field crop rotation in sovkhozes and kolkhozes. It is obvious that if the harvest is small, the number of roots in the soil will be small and cannot form the soil texture, needed after the fall plowing.

For this reason, perennial grasses yielding 10-15 centners of hay per hectare are of practically no value in soil building. Furthermore, the small harvest of hay per hectare and the slight improvement in soil fertility induced by perennial grasses cannot replace the harvest of grain, perennial oats, barley, and other grain feed crops which can be obtained from each hectare in kolkhozes and sovkhozes. It must also be remembered that fields sown with grass which grows poorly are easily accessible to weeds, especially couch grass.

The main problem in field grass sowing is that of working out and mastering ways of growing perennial grasses which will produce higher harvests, so that even in dry regions the hay yield will be 30-50 or more centners per hectare. Thus, the main tasks of scientific workers, agronomists, and kolkhozes and sovkhozes are to find means of accomplishing this.

Mixed grass harvests of clover and alfalfa yielding 30-50 centners of hay per hectare increase the fertility of the soil in one year more than harvests yielding 10-15 centners of hay per hectare do in two years. The same is true for green grass harvests. In the case of high harvests of green grass, the use of perennial grasses for two years has been found to be economically and agriculturally profitable in a number of cases.

In the case of good hay harvests, it would be economically unprofitable to plow fields planted with perennial grasses during the summer. To obtain good harvests of perennial grasses, the fields must be plowed in the fall. This is necessary for the grass crop rotation system. In the case of low harvests, averaging 10-15 centners of hay per hectare, it is economically expedient to plow the fields in the summer for winter sowing. Fall plowing would result in a loss since the necessary soil layer will not be formed and the small harvest will not compensate for other feed grain crops which might have been sown in fields occupied by grass.

In hay harvests of perennial grasses where the yield is at least 30-40 centners per hectare per yield, it is necessary to plow the fields in the fall for spring crops, but not in the summer for winter sowing. Fields sown with mixtures of legumes and grasses and producing not less than 30 centners of hay per hectare should not be plowed. It is better to harvest these fields a second time and to plow them in the fall for spring planting.

A good hay harvest of perennial grass completely compensates in value the harvest of grain feed crops (barley or oats) which might have been obtained from the same field. Besides yielding a good harvest, good conditions for soil fertility are formed for subsequent crops.

Furthermore, it is possible to obtain big hay yields, about 30-40 centners per hectare, every year in dry regions, depending upon the means used for cultivating the perennial grasses.

The method to be used for plowing perennial grass so as to insure high harvests must be suited to each region. A big grass yield is one of the deciding factors in guaranteeing big yields of all crops in field crop rotation and high livestock productivity. The plant nourishment available in the soil plays an important role in the formation of big yields of all crops. Organic fertilizers -- manure, humus, and compost -- have long been utilized in agricultural practice. However, more attention should be paid to mineral fertilizers produced for agricultural utilization. Research to find more efficient means for applying and using mineral fertilizers — nitrogen, phosphorus, and potassium — is one of the most important jobs of the Academy of Agricultural Science and other agricultural scientific research institutions. Unfortunately, this work is lagging at the academy. Neither science nor practice should tolerate the current extremely low coefficient of utilization of mineral fertilizers, especially of phosphorus in the soil as superphosphates. A good coefficient of utilization would show an increase in yield of 25-30 kilograms for each 100 kilograms of phosphorus used. Our usual coefficient of utilization of phosphorus is 15-20 percent.

The basic difficulty with many scientific workers, and especially with academic institutions, is the continuing inability to grasp Vil'yams' teaching on soil development and fertility. These scientists pay little heed to, or completely disregard, the fact that the basic nourishment of plants is the result of the activity of soil microorganisms. Concentrating on only one physico-chemical soil process, they as yet do not understand that it is possible to supply plants with the needed forms of food at the right time, simply by directing their life and developing the corresponding soil microflora. The proper soil formation, according to Vil'yams, is necessary to permit water and air occurring in the soil simultaneously to form plant food.

The species formation of soil microorganisms is extremely varied. Intraspecies and inter-species relations of microorganisms are similar to the intra-species and inter-species relations of microorganisms. These biological rules have long since shown the possibility of depositing fertilizer in the soil in small or granular pieces.

Agricultural practice is well acquainted with the effectiveness of the so-called local application of fertilizer. Much factual information has already been accumulated on methods of depositing superphosphates in the soil simultaneously with seed sowing. Superphosphates ground with organic fertilizer are particularly effective. In

Omsk Oblast, superphosphates ground with humus and poultry and sheep manure were deposited while winter and spring wheat was being sown. A deposit of one centner of this fertiliser, containing 30-50 kilograms of superphosphates, will increase harvests to the same extent that 2-3 centners of unground superphosphates might do. Results were equally as good in other experiments conducted by scientific research institutes. Simultaneous sowing of seeds with fertiliser in this way makes possible the utilisation of huge fields for agricultural purposes.

2. <u>The Nest Method of Tree Planting</u>

During 1949, experiments for working out the nest method of tree planting, using agricultural field crops as nurse crops, were conducted in various zones of the Soviet Union, covering an area of over 2,000 hectares. These experiments clearly indicated the possibilities of the new method of tree planting. Beginning with the spring of 1950, this method will be used by kolkhozes and sovkhozes for field shelter belts and other tree plantings.

By using the nest method for tree planting, better conditions are created for the growth and development of trees, especially for varieties which grow slowly when they are young. During its first two years of growth, the oak receives beneficial shading from all sides. In addition, the young oaks are protected from destructive wild steppe growth, particularly couch grass, and especially from severe dry winds. Under these conditions, experiments have shown that young oaks develop and grow in shelter belts as well as in the nurseries where they receive the best of care. From this, one can expect that during the first 5-10 years the oaks in shelter belts will be considerably more developed, taller, and will have a trunk larger in diameter than 5-10 year old oaks grown from 1-3 year old trees transplanted from nurseries.

The nest method of tree planting requires considerably less labor and resources than methods generally used up to the present. For one hectare of forest zone, approximately 3 man-days are needed for hand nest planting of acorns. For sowing of secondary trees, approximately one to two man-days are needed per hectare. For sowing seeds of bushes, practically no manpower is needed since the sowing occurs simultaneously with the sowing of rye. Thus, a total of 4-5 man-days is needed per hectare for sowing by the nest method. In replacing hand sowing of acorns by machine sowing, the number of man-days is reduced further. Almost no labor is needed to care for plants sown by this method.

During the first years of tree growth, the shelter belt area is also used for growing agricultural crops. Nests of trees are distributed in such a way that it is possible to use the usual types of agricultural machines and equipment during sowing and harvesting.

Tree cultivation in steppe and forest steppe areas, now being conducted on millions of hectares, is new and experimental work. At present, experience in this work is being accumulated. A very important role is being played by the academy and scientific research institutes, whose agrobiological experiments and research must supply the basis for further development in shelter belt utilization.

Experiences during 1949 showed that during its first year of growth, the oak thrives well when it is completely surrounded by nurse crops of grains and other field plants. Research has led us to surmise that during its second year of growth the oak will not only thrive well but will need the shade provided by nurse crops. It is from this premise that the academy developed the nest method of planting.

At present, however, it is not known in what way root formations of various nurse crops will affect the growth of mycorhiza, living on the roots of the oak and of utmost importance to it. If it is found that mycorhiza develop poorly due to the presence of nurse crop roots, then, beginning with the second year, the nurse crops will not be planted. This is a ~~supposition~~ theory which will be tried out in 1950 by experiments in scientific research institutes and also by sovkhoses on 2-year old oak plants, so that in 1951 when a larger area is planted with oak trees, science will be able to give better advice on this question. This is only one of several problems which science must solve.

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