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Andreev, G. Gorki Leninskie. Selek. i Semen.
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Research in plant breeding in the Gorki Leninskie, Experimental base of the Lenin Agricultural Academy of Sciences.

Translated from the Russian

To the south of Moscow, on the 30-th kilometer along the Kashir roadway, lies the farm on which is located the Experimental station of the Lenin Academy of Agricultural Sciences - "Gorki Leninskie". It is situated in a picturesque spot along the banks of the river Pakhri, on a wide hill, amidst a mixed park-forest. In the center of this area is a small park, surrounded by a fence. Here still stands an old homestead with pillars. This is the place where V. I. Lenin spent his last years.

For farming purposes the station is comparatively very large, as close as it is to Moscow. It has at least 550 hectars of plowing land. Aside from the plots assigned to experimental plantings, large areas are devoted to production sowing. There is a variety of productive cattle and horses.

The station possesses an adequate number of buildings for production, administration, and residental purposes. It is supplied with automobiles, tractors, agricultural equipment, and machinery. The production facilities at the station are also adequate to permit the conducting of experiments on a larger scale - should there be need for it.

Here, under the guidance of the academician T. D. Lysenko, president

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of the Lenin Academy of Agricultural Sciences, a small group of scientific research personnel works under the leadership of Dr. Donat Aleksandrovich Dolgushin and the member-correspondent of the Academy of Science, Dr. Artavaz Arshakovich Avakian. The necessary staff of technicians supplements the outfit. The subjects under research deal with problems of developing plants, as used in practical plant-growing. In this article we shall attempt to provide a brief survey of the scope of research done on the premises, without aiming at covering the subject in full.

One of the principal experiments is devoted to work on kok-saghyz, Taraxacum kok-saghyz, a rubber-bearing plant. The work was begun several years ago. Its aim was to learn how to produce kok-saghyz, since the prevailing methods did not insure satisfactory results in production. In practice one was confronted with the handicap of obtaining crops that were sparse and very poor. It was essential to study the peculiarities of the development of kok-saghyz, with particular reference to the problem of working out a method producing "close" crops.

Kok-saghyz does not tolerate a deep filling-in of its seeds. In order to obtain good crops the seeds have to remain at the topmost layer of the soil, and at that in humid soil. The drying out of the upper soil layer destroys the shoots or the young growth. A favorable

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set-up of conditions for growth is practically precluded within the limits of former methods.

The plants grow slowly in the first stages, and weeds rapidly obstruct and clog the young growth. The struggle with weeds used to require an enormous amount of manual labor during the busiest period of spring planting. Under ordinary conditions kok-saghyz became invariably overgrown with weeds. Observation showed that in order to safeguard its existence and obtain a "close" growth of the plant, its placement was of primary importance - it had to be done in groups, clumps, nests. The experiment of sowing plants in "nests" produced very good results.

Details of nest-sowing were further explored. Seeds were mixed with damp humus and the sowing was done in pinches of this mixture which was spread over required distances and patted down by hand or foot. The result was that the seeds were lying at some depth, in a damp layer of soil, assured of nutrition from the humus, and situated in groups, nests. The method resulted in close growth.

The nest-method of planting also produced excellent results in actual production areas where it was widely practiced. It assured a considerable increase in yield and engaged the labor of only 10-15 workers per hectar.

It was further necessary to work out a method which would insure a good harvest of roots, while at the same time not exceed the claim

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on labor per hectar in the growing of kok-saghyz above that spent on any other field crops, potatoes, in particular. This problem was again solved in planting by the nest-method. It was found that the planting of kok-saghyz in nests insured such a development of plants and also such yield of roots per hectar that it was possible to place the nests in-between rows and the spaces between the nests, allowing the length - and crosswise use of cultivators between the rows.

40,000 nests per hectar insure a very high yield of roots. The sowing in nests may be done in square-marked fields, but the nest-method is preferable to the row-method of planting, when using the manual method of hoeing within the row between the nests. In the former row-planting method it had been necessary to cultivate exclusively, by hand not using a hoe. The problem of in-between rows of cultivating kok-saghyz was now solved with a minimum expense in labor.

The third most important problem in the growing of kok-saghyz is the matter of gathering its seeds. The manual method places too high a demand upon labor. D. I. Filippov constructed a simple machine for gathering seed on the premises of the station. This equipment was of two types - for manual use and of the horse-driven kind. The manual equipment takes the place of 15 laborers, the horse-driven one - that of 25 field-hands. The peculiar construction of the equipment contributed unexpectedly to the radical improvement of the quality of seeds. It was found that the machine gathered only the ripened seeds of kok-

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saghyz, while in applying the manual method all ripe and unripe heads were thrown into one pile, the subsequent sorting process not eliminating fully the sickly and unripe seeds.

Finally, the experiments showed that nest-sowing led not only to a reduction in labor, but also to a minimum loss of the roots remaining in the soil, since the latter were picked in bunches and not separately.

At present a special, steady brigade of workers, consisting of 12 people and 2 horses, is assigned to the work of sowing, cultivating, the gathering of seeds and roots on a plantation of 24 hectars. Each woman-worker takes care of two hectars of kok-saghyz during the season.

The labor spent on the growing of a hectar of kok-saghyz, under this method, does not exceed that spent on a hectar of potato plantings. The work of further improving the methods with the view of increasing the yield of kok-saghyz continues. An ordinary horse-driven plow is adapted for marking the seeding area. The front control of this marker provides for a precise crossed marking. The wide grip and light weight of the machine provide for a high productivity in marking, i.e. 6 hectars in 8 hours, using two laborers and one horse.

A cultivator of simple but very original construction has been produced. One horse pulls three of these cultivators, joined to each other; the cultivator may be manufactured in any blacksmith shop, it is that simple.

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One of the characteristics of kok-saghyz is its high polymorphism. This equally applies to the content of rubber in the roots which varies from hundreds of parts of one percent up to 10 percent in some instances. The task of increasing the content of rubber in the seed culture of kok-saghyz is difficult and may not be solved in quick order. The experiment of vegetative propagation of kok-saghyz, by means of root cuttings, showed that the characteristic of a high content of rubber in the roots is preserved very stably in practice. It follows therefore that it is essential to use the methods of planting kok-saghyz with root cuttings.

A clonal selection of kok-saghyz is conducted at the station for the increase of the size of the root and content of rubber in it. In the plots of clonal selection there is a "family" possessing a particularly heavy root with a substantial content of rubber. It is possible that within the next few years highly productive varieties of kok-saghyz may be created.

T. D. Lysenko published an article concerning the sowing of kok-saghyz by the clonal method. We shall therefore limit ourselves to the results of the latest experiments performed with this method. The reasons for the numerous failures in the sowing up to now became apparent only following the study of the peculiarities of the roots of kok-saghyz in resting periods.

Research established the optimal periods for root cuttings and

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sowing. It is appropriate in this connection, to refer to a most interesting experiment conducted on a field of one-half hectar planted with kok-saghyz for the past 3 years. A cutting (slicing) of the crowns, together with the rosette below the root "collar" (1,5-2 cm), is made from the growing plants of the kok-saghyz. Such cutting is done regularly every other day throughout the vegetative period. Following such cutting, the plants maintain the ability to sprout from the part of the root remaining in the soil. The experiments clearly indicate that following the cutting, which is done between the middle of July up to the time frost sets in, there is good sprouting. Cuttings, however, made between May and the middle of July, lead to rotting and the destruction of the roots. In the beginning of July a single sprouting takes place which gradually increases and reaches its maximum by the end of the month. It seems that the nutritious elements contained in the root are in a state where they are immediately spent - in the period of the destruction of the roots. While in the period when sprouting proceeds well, the nutritious elements in the root insure regeneration.

The experiment permitted choosing the best periods for digging up the roots and for the preparatory work of cutting slips off the roots for sowing purposes, as well as for selecting the actual periods for the planting of the latter. The establishment of accurate shcedules for the digging of roots and the preparatory work for sowing the the root cuttings, and fixing the dates of planting (sowing) play an

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important role in the success of normal growth. The schedules are determined according to regions, depending upon the respective climatic conditions.

The tests conducted on the cutting of roots lead to the possibilities of new methods in fighting root-and root shoots of weeds. Isn't it possible to assume that their biological peculiarities will further lead to the determination of the periods of their cutting, which will destroy the cut roots and rooting systems? It is most important to establish the exact periods in the life of weeds when cutting will aid mass propagation and not prove beneficial but harmful. Such experiments have already been begun at the station. As a result of the first tests, some important features were discovered in weeds. Some weeds showed unknown before ways of propagating, and the ability to survive under unfavorable conditions. The entire new material on the biology of weed plants leads us to follow with greater justification the method of cultivating fallow land, as recommended by V. P. Williams. The experimental work conducted on kok-saghyz points to the vast significance of the study of biological peculiarities of plants for purposes of practical agricultural methods. Lysenko particularly stresses to research workers the importance of the rest period of plants and their organisms. An exact knowledge of the reasons producing a dormant state, the conditions preceding it, as well as those which follow it, will provide the agriculturist and selector

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with powerful means of controlling the development of economic plants and aid the solution of many hitherto unsolved problems for growing economic crops. An interesting experiment is performed at the station in this connection with respect to the germination of freshly-dug potato tubers. It is necessary to find a method for their summer planting for the benefit of the southern regions of the country, where the germination of potatoes from spring sowings leads to degeneration, but where the duration of the vegetative period permits a second harvest. It is possible, however, to trans plant the young tubers of early spring sowing in the summer and thus obtain a healthy, non-degenerated seed material. The transplanting of freshly-dug tubers is already practiced in the southern republics, Middle Asia, and Trans-Caucasia, although the method of germination of freshly-dug tubers calls for improvement.

The experiments produced some important results. It became apparent that a process of physiological second ripening takes place in the young tubers, during which time the absorbed nutritious elements are directed into the tubers to form nutritious replacement material. And only when this process if completed, are the tubers physiologically fit to germinate. It was also found possible to speed the process of second ripening; this was achieved by cutting the leaves of the root-bearing plants several days before harvesting. The dug tubers should be mixed with dry earth and placed in a warm spot;

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for 10 - 15 days. Tubers, so prepared, are suitable for germination. Their dormant period is dependent upon the fact that the nutritious elements within the tuber are in a non-absorbant state. And in order to transfer them into an absorbent state it is necessary to make air accessible to the pulp of the tuber; here, however, the skin presents an obstruction. If the skin is peeled off, air will penetrate to the tuber; a fermentation process of transfering reserve elements into absorbent ones takes place, and eyes begin to protrude. The peeling of the skin of the tuber is however a tedious process and injured tubers will rot besides. It therefore became necessary to find a safe method for providing access of air to the pulp of the tubers without removing the skin. This was found in fresh liquid manure. Prepared tubers are cut into parts and dropped for 5-10 minutes into liquid manure.

Many varieties, such as Lorch, Ubel, Fpron, Early Rose, respond well to such preliminary treatment and produce good germination.

Recently it became "fashionable" to employ a method recommended by physiologists, aimed at increasing the yield of fruit and berries by spraying the plants with so-called "growth substances".

An increase in the yield as a result of this spraying is clearly apparent. The essence of the activities of these substances has, however, remained unexplained to the authors of works on "growth substances". The ordinary explanation of their activity does not stand up to criticism. It is assumed that once the "growth substance" pene-

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trates into the plant it plays the role of a physical stimulus to growth and to the increase in the quantity and size of the fruit! This, however, is entirely wrong.

The metaphysical mentality of certain physiologists is evidently unable to comprehend the characteristics of the organism without envisaging the presence of the physical carrier of this property. According to this plant, all life processes in a plant are supposed to be caused by special substances - the organizers of the process. If one accepts the fact of heredity, one presupposes the existence of genes in the organism, the physical carriers of heredity. So long as there exists a growth of plant and its organs, it is necessary to look for some elements contributing to the growth of the plant and to the growth of the plant's organs.

There is no doubt but that life would be much easier and more peaceful by accepting the simple reasoning of these concepts. And it is much more complicated and disturbing to a genuine research worker to comprehend the conditions responsible for the processes of development that cause and produce certain characteristics and symptoms. It is much more difficult to master and control these processes. Nevertheless, the latter is the only right path and consequently the only possible path for the worker to follow.

Lysenko presented the following supposition for the understand-

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ing of the meaning of the factors that influence the activities of growth substances. Growth substances act to the not properly pertaining plant as outside chemical and physical agents, during the spraying of plants and their organs, and interfere with the normal processes of organ formation. In their simplest form, they may assist, for instance, in providing increased access of air to the organs and points of the latter's growth, which results in the growth not being limited but activated. Normally, plants "attempt" to isolate the dormant bud as quickly as possible, or to form fruits with seeds, since both seeds and the dormant bud are adapted to the preservation of the organism under unfavorable conditions.

The spraying with growth substances, done inopportunely to the natural process of organ formation may, at its worst, prove harmful to plants, and at its best - of no benefit to an increase in yield.

Work has been started at the station on experiments designed to establish the real significance of the action of "growth substances". We deliberately are using quotation marks for the term in view of the fallacious explanation given its activity by their authors and not prompted by the results of the activities of the substances themselves.

The first plantings of TAU-SAGHYZ (Scorzonera tau-saghyz) were made in 1947. Tau-saghyz contains in its roots considerably more rubber than does kok-saghyz. The purpose in working on tau-saghyz is to find methods to produce this wild plant. The direction has been

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already indicated. Here too, the method of nest-sowing is used. The grouping of the plants in nests contributes to the best conditions for individual species under inter-specific varietal competition and to a safer survival under unfavorable conditions of growth and development.

Lysenko's general theoretical conception concerning the absence in nature of inter-varietal competion is well known. A study of this rule may lead to very practical discoveries of extreme importance. This is unavoidable since an accurate understanding of the rule of this process provides the worker with means of controlling the process. The presence of an inter-varietal competition has up to now been accepted as a self-evident truth.

Inasmuch as the latter assertion is wrong, practical agricultural work was deprived of the opportunity to utilize inter-varietal competition and the absence of competition within the species for practical purposes. Nest-sowing confirms this. It was natural to assume that plants in nest-sowed areas will bear the impact of competition between the species and therefore be subject to unfavorable conditions of growth. In actual practice, agricultural science did not attribute sufficient attention to nest-sowing. Guided by an inaccurate theory, agricultural science was clearly unable to propose nest-sowings as a powerful means for increasing the harvest. This at a time when agricultural science was already making practical use of nest-sowing in other instances, such as vegetable raising.

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The theoretical study of the problems of competition is of considerable significance to practical work. Some experiments have, therefore, already been started at the station with respect to the regularity of action in inter-varietal competition and the absence of the latter between the species.

A small plot has been devoted to a simple, interesting experiment on summer wheat. The plot is heavily obstructed with weeds. The entire space is divided into small allotments of equal size, following one another. Nothing was planted on the first allotment and it was choked with weeds. The next plot was planted with wheat, the nest-sowing method being used. The number of nests on all allotments remained thesame throughout, but the number of wheat grains planted in each hole was increased on each succeeding allotment. The first allotment had one seed planted in a hole, the second two seeds, the next ones - 4 seeds, 6, 10, 16, 20, and 30 seeds in each hole. In the allotments where one seed was planted in a hole, weeds were growing as wildly as in the first allotment where no wheat was planted. But in each following allotment and increased seed planting in nests, the amount of weeds diminished, while the wheat plantings became stronger. On the allotment where the number of planted wheat seeds corresponded to the usual standard quantity of sowings, the condition of the plantings was entirely satisfactory. Still

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further, where the number of seeds was larger yet, up to a certain point, in a nest the growth of weeds was altogether suppressed. The plants did not interfere with each other and germinated well.

This would indicate the fact to be a common occurrence. Norms of sowing were established long ago to provide for a reserve (surplus) in order to safeguard the plantings from being choked by weeds. Were it not for the latter, one could have managed with a smaller norm of seed material. Nevertheless, this clearly evident factor is not taken into consideration by some scientists who expound the presence of a so-called inter-varietal competition and its pre-eminence with regard to the actually existing competition between the species. At that, the principle of the existence of the species is supposedly seen in the so-called inherent drive towards a competitive struggle on the part of each specimen with others belonging to the same species.

Another experiment conducted in connection with the same plan follows: Summer wheat was planted in the spring on small plots, mixed with winter wheat. The sowing was done in nests. Their number was the same on all allotments. Only in the first allotment 5 seeds of summer wheat and 20 seeds of winter wheat were planted into each nest; the second allotment recieved 10 seeds of summer wheat and 15 of winter wheat for each nest; the third one - 5 and 15 respectively, next - 5 and 10, 10 and 10, and finally, 5 seeds of summer and 5 seeds of winter wheat to each nest. (A similar experiment was made with

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summer wheat and rye with an even more fractional proportion of the number of seeds of summer wheat to rye in each nest.)

In planting summer wheat with rye it became clearly apparent that the fewer seeds there were planted of summer wheat, the smaller the number of remaining wheat plants in the allotments and the weaker and more depressed its specimens. On the other hand, where the number of seeds of summer wheat had been larger, their growth was better and the number of individual specimens, remaining on the allotment greater. Here then is a clear picture of competition between summer wheat and rye. The presence of a larger number of plants of summer wheat in each nest insured their better survival in their competition with rye. It is to be further noted that the individual plants of summer wheat did not interfere with each other.

The sowing area where summer wheat was planted, along with winter wheat, presented a different picture. Summer wheat thrives almost equally well in allotments where it is planted alone as it does when planted mixed with winter wheat. Since, however, these two kinds of wheat are closer related to each other than are summer wheat and rye, the competitive struggle is not as pronounced as it is in a planting with rye.

A third experiment was held on allotments where wild oats were planted in nests mixed with winter rye, in a diverse proportion of their number of seeds in each nest. Here the picture of a competitive

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struggle was still more pronounced. In cases where the seeds of wild oats were few - in the nests - they almost invariably perished. Whenever they reached the number of 20, however, they suppressed the rye and formed a thick stand of well developed stalks.

Other varieties and species were also used in the experiments. The tests were detailed and accompanied by manifold control sowings. A general conclusion derived from the experiment is: there exists a competitive struggle between species, but there is none within a group of the same species.

Similar cases may be observed also in natural conditions, as well as in the sowing of cultivated plants, and of those growing wild. Only a reluctance to observe such cases accounts for their not being noted. Nature shows abundant proof of instances that indicate the lack of competition within species.

It is absurd to assume the presence of a competitive struggle between specimens of one species, since such struggle leads to the extinction of specimens. Nature is not arranged in a manner that permits a species to destroy itself. The individual specimens of a species will perish in a competitive struggle with another species or in fighting unfavorable conditions of life. But in growing within a group, a nucleus, a nest, etc., specimens of one species are better equipped to withstand the struggle for their preservation by not allowing specimens of other species to grow, depriving them of neces-

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sary space, and suppressing them. Moreover, a favorable "micro" is created by a group of identical specimens which frequently also establish "macro" conditions for their own survival. Simultaneously, these conditions prove harmful to specimens of other species. It is possible, therefore, that conditions of root feeding will favor specimens of one kind of species, if grown in groups, and act unfavorably with regard to specimens of another species. Some specimens of a species (frequently a large proportion) perish while growing in a group and engaged in a struggle with other species under unfavorable conditions, but this circumstance contributes even more to the security and safety of the rest of the specimens. Nature demonstrates the tendency on the part of specimens of the same species to propagate themselves in as large measure as possible. Aren't plants always producing more seeds than were originally planted?

Other experiments were conducted at the station to determine the competition between the species. Tests made of plantings of winter rye and winter wheat, in proportions of 1 to 99 percent, indicated that the smaller the amount of wheat in the mixture, the greater was its suppression by rye. The relative number of plants of wheat on an allotment is smaller than the quantity of the seeds originally mixed in the planting. While the smaller the amount of rye among wheat, the taller and more powerful it grew. The relative number

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of rye plants among wheat is larger than the quantity of its seeds at the time of the mixture's planting: rye is consequently strongly suppressing the growth of wheat.

Rye among wheat does not disappear; on the contrary, it multiplies and dislodges wheat. Whenever wheat is mixed with rye, however, it rapidly disappears. These facts are well known in agriculture. Cases of the development of the so-called "сурепик" in the production of wheat are known, as well as the so-called palingenesis (regeneration) of wheat into rye. The proper understanding of the significance of mixtures in varieties is of great importance in selective seed-growing. The conduct and the presence of a mixture is subjected to a definite rule. It is to be assumed that the greater the distinctions between a variety and a mixture approach in a type of varieties in species, the stronger the expression of the antagonism between them, and the sooner will the mixture disapear within the variety in the course of the next reproductions, or, it will on the contrary, propagate itself more rapidly. If, however, the mixture multiplies in the original variety, this indicates that its sowing productivity is higher than that of the original variety. If the mixture possesses at the same time fair, technological qualities in yield (seed, for instance), this will not harm the variety but instead serve to improve it. The distinction between the original variety and the mixture may

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be insignificant if there is no competitive struggle. In such case, the differences are reduced to ordinary morphological ones, in so far as the mixture may be distinguished within the variety. Such occurrence reminds one strongly of the old local varieties of wheat which were "contaminated" by mixtures. It was apparently no contamination but a regularly formed mixture which exhibited in such form the old variety with all its positive qualities. It is doubtful whether a "cleaning" from "contaminating mixtures" will improve an already established variety.

The new accurate theoretical understanding of the problem of the competitive struggle between species of plants opens altogether new, yet unexploited possibilities for the improvement of seed varieties. In the mixtures of perennial grasses, the presence of competition within the species and its degree evidently play a decisive role with regard to the stand of the grass, the durability of the field, the yield in hay and seeds.

In experiments conducted at the station, a mixture of clover of three different kinds, with lucerne and Timofeevka, produced in the first year a yield in seeds of clover of 116 percent above the average yield of the three varieties, when separately grown (each var. also mixed with Timofeevka), and over 36 percent higher than the yield from the best type clover of the three varieties, if grown separately (and mixed with Timofeevka).

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The winter wheat Eritrospermum 1160 is produced from the young hybrid variety of the summer wheat 1160, by the transformation in training - of its hereditary characteristics under winter conditions. At the Gorki Leninskie, Eritrospermum 1160 was planted for over six years. It was multiplied here. A carload of its seeds was sent to Odessa, the place of its origin. The var. Eritrospermum 1160 was planted in the collective farms of the latter region and proved to be an improvement over the standard variety.

The principal characteristic of Eritrospermum 1160 consists in the constant presence of the so-called mixture, "non-typical" for the variety, in its plantings. In experiments performed in 1947 on winter wheat at the station, Eritrospermum 1160 was planted using seeds of three kinds of different origin. Comparisons of the seeds from the ordinary sowings, those of inter-varietal crossings, and seeds obtained from free pollination between the varieties were made. In all three instances, Eritrospermum 1160 remained unchanged in type, although it produced a varied yield. The harvest derived from the last type was considerably higher than the yield from the wheat of inter-varietal crossing, and much higher than its harvest from propagated sowing. In other words, it appeared that ordinary inter-varietal cross-pollination had improved the productive qualities of the variety. The cross-pollination of the inter-varietal type increased the harvest still more. Cross pollination appeared

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to have agreed with Eritrospermum 1160.

The strains of winter wheat grown in the nursery and considered best in productivity were those of several varieties obtained from freely cross-pollinated inter-varietal kinds. Nothing like it was obtained from artificial crossings of these varieties.

Observed were also other interesting features. Several strains of Lutescens 329, obtained as a result of free inter-varietal pollination, proved to be of very early ripening.

The best yielding qualities among all strains in the nursery belonged to those that represented a mixture in form and variety, with regard to morphological traits, but did not differ in their periods of ripening. These strains were obtained from free inter-varietal pollination. The question arises: if these strains do not lower their high productivity in subsequent reproductions, while remaining as morphological mixtures why is this wheat not classified as a variety along with approved, morphologically aligned varieties?

In cross-pollinated cultures every reduction in the possibilities of crossing leads unavoidably to negative results. While the use of crossed cultures in selection of free crossing produces positive results.

There are known cases when as the result of the prolonged cultivation of selected varieties or strains the descendants of old

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varieties of self-pollinated kinds, the lines or strains, and their descendants lost their frequently outstanding economic qualities.

Numerous cases of this kind and the results of the research performed at the station force the admission that inter-varietal free pollination in self-pollinating varieties plays an equally positive role as does the highest cross pollination in crossed cultures.

At present more and more selectors and seed growers refuse to view a variety as a descendant of a homozygotic self-pollinated specimen. In seed-growing, however, this principle has remained unviolated. It determines the content of seed growing. This principle represents apparently a substantial handicap to the work of a pronounced increase in the yield of qualities of varieties. It seems to us that the time has come when a revision of the principles of seed growing is in order, and along with it, a revision of the methods of selective work. The method of inter-varietal free pollination should become the strongest medium in raising the yielding productivity of the varieties.

The variety - populations of self-pollinating cultures should be granted recognition.

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In the Leninskie Gorki, varieties of rye, cross-pollinated in experiments several times, were grown for the 10th consecutive year in 1947 (from one to eleven years of self-pollination). The article written by comrades Avakian and Feiginson, summarising the results

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of this experiment was published in No. 3 of the Journal "Agrobiologia" for 1946.

The results of the experiments performed in 1947 permit the recommendation of the widest inter-varietal cross-pollination of varieties of rye, for the purpose of improving its yield, increasing its resistance to frost, and the size of its grain.

The first experiments conducted on the utilization of seeds of cross-pollinated varieties of rye, for the purposes of producing new varieties, permit the assumption that new varieties may be available already in the third year following selection, the greatest possibilities existing with regard to seed material of a high degree of cross-pollination. The selection in this case must be based on mass choice (selection) in order to preserve the wide range of variations in plants of which the varieties are composed. In this manner, the population is supported in a condition of high biological adaptability of separate plants, as well as of the entire population. On the other hand, there has been such an improvement in the yielding qualities of some varieties of rye, as a result of their cross-pollination over a period of many years, that their yield is vastly superior to that of thestandard yield. These seeds may be put on the market as new varieties, carrying the claim of a substantially higher yield, and new names should be assigned to these varieties. The claims on the

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part of the authors of the original varieties upon their rights are, not valid in our opinion, since the difference between the yields of these new seeds and the old original ones (elite and superelite) are within the limits of common varietal differences observed in a variety of tests made on rye.

With regard to experiments concerning the role of wide-cross cross-pollination of different varieties in cross cultures, it is necessary to point to an instance that occured during the tests at the station: the first experiments made in comparing the varieties of red clover, cross-pollinated with a large quantity of different clovers, demonstrated the advantage of such re-pollination. The cross-pollinated varieties proved to be more resistant to frost and more powerful in development. Aside from this, they preserved not alone the single-and double-cut types but also the variety's type. The theoretical premises of works on the biology of fertilization, the vegetative hybridization, and the training of plants were stated by Lysenko as follows:

"Heredity - is the capacity of a live organism to live, grow, develop, propagate itself. In order to understand the properties of heredity, it is necessary to study the conditions required by the organism for the building of a live body, i.e., a body possessing the characteristics of heredity. Agricultural methods in exercising control over the environmental factors pertaining to vegetative

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organisms,, discover ever new wyas of increasing the productivity of plants. This is the only way in shich the nature of organisms (hereditary) may be controlled and directed, with the view of transforming it. Proceeding from these general premises, the Michurin genetics have worked out concrete ways and means towards controlling the nature of vegetative organisms."

In proceeding from a general theoretical conception one may tell that the change in the environmental development of the parents reacts upon the for-ation of the characteristics of descendants. Such experiments are conducted on many objects. In the experiment with summer rye, when freely pollinated and in the grade-testing with winter varieties, the entire progeny from this cross-pollination was summer rye (in cases where summer rye had been) planted in the spring. If, however, the sowing had been done towards winter this progeny produced many winter plants. For purposes of control, summer rye, sowed in the spring, was artificially cross-pollinated with varieties of winter rye. The result of this cross-pollination was a summer progeny.

To indicate the significance of environmental changes in the parent-development for the trait formation in their progeny, one may cite the following test performed on corn.

It is an established policy with regard to growing corn in ordinary conditions that the pollination of white-seeded corn varieties with the pollen of varieties of colored seeds, for instance, violet-colored corn, will produce colored hybrids as a rule.

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Under conditions non-characteristic to corn, however, that were created at Leninskie Gorki, the picture changed radically. As a result of the pollination of white-seeded corn by violet-seeded hybrids, the seeds produced were both white and violet in color, with an entire scale of intermediate colorings.

The results of the experiments in cases where white-seeded corn was pollinated with a mixture of yellow and violet varieties, permit to offer the conclusion that it is possible to obtain hybrid seeds but with a dual coloring - a violet color laid on a yellow background.

The conditions under which fertilization takes place play a considerable role in the formation of traits and characteristics of the progeny. For instance, if only a few poppies are pollinated by 500 pollen grains of a poppy, the grains will germinate well and the plants grow normally. If, however, the 500 pollen grains will be used for the pollination of 500 flowers, the grains will do poorly and the flowers be weak, unattractive, and show poor growth.

From the point of view of formal genetics, there were equal opportunities for fertilization. This example indicates, however, that a large amount of the pollen on the stigma produces conditions of normal fertilization and the formation of a normal progeny.

An identical case was established in the following test: the crossing of winter wheat Gostianum 237 with summer wheat Eritrospermum 1160 produces a non-viable progeny. All plants perish soon after germination; if, however, during pollination a small amount of

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the mother pollen 237 is added to the pollen 1160, or if even the pollen of some other winter variety is used, the hybrid plants will grow and develop normally. The plants will, of course, be all hybrids, since they are summer varieties, the mother plant being of a winter variety. In order to establish that the pollen of the second parent is not only present in pollination but also participates in the fertilization, it is necessary to locate the characteristic traits belonging to the second parent in hybrid plants of one generation. It is also essential to determine at what moment and state of development the pollen of the second parent aids the viability of the progeny.

The following experiment was performed for this purpose: during pollination, the wheat variety Lostianum 237 was carried onto both parts of the stigma by the pollen from the two varieties of wheat 1160 and 237. In another case - the pollen 1160 was carried onto one part of the stigma and the pollen 237 onto the other part of it. If in the second case, the progeny is non-viable, and in the first - viable, this will prove that the effect of the added poller of the winter variety is manifested during the course of the simultaneous growth of both varieties. If, however, the progeny will prove viable also in the second case, it will establish that the reaction of the pollen of the second parent is displayed during actual fertilization.

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The extent of the significance maintained by the condition of the parent plants particularly that of the mother plant, the formation of traits and characteristics of the progeny is demonstrated by the results of experiments made by the pollination of stigmas in the various stages of their development.

Several varieties of winter wheat were pollinated by rye at different periods, corresponding to the different stages of development in the stigmas. In the first period the stigmas were as yet unopened, in the second period - two or three days remained before flowering; the third period corresponded to the beginning of the flowering period, the fourth 2-3 days following florescence; in the fifth period the old stigmas were pollinated at a time when all florescence had ended. The blossoms of the wheat were castrated in all stages beforehand.

In the first two periods the hybrid seeds matured well, in the third period only individual seeds matured while in the fourth and fifth periods none of the seeds matured. This proves that the influence of the mother plant is of little significance when the stigmas are young.

The pollination with rye was performed in the same periods only without previous castration. In this case only a few hybrid seeds matured in the earliest period, while in the rest, when the maternal pollen was present, and there existed a "control" on the part of the

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and there existed a "control" on the part of the mother plant, the hybrid seeds did not mature.

In the experiment of pollination with mixed pollen in different periods there is an indication of selection with regard to the pollen, dependent upon the condition of the stigmas in the periods of pollination. Interesting results were obtained in the experiment of pollinating the variety of summer bearded wheat "Smena" by the pollen of the variety Lutescens 62, with the addition of the pollen of the maternal variety "Smena". Pollination took place in identical periods to conform with the condition of the stigmas. 75 percent of the hybrids of the first generation pollinized in the earliest period were bearded, i.e. were of the maternal type; the second period produced only 48 percent of bearded plants, the third - 46 percent; the fourth only 16 percent. This latter period corresponded to the end of the blooming period.

The influence of the maternal pollen was observed in the following experiment: the pollination of the hard wheat (Gordei form 10) by the pollen of the soft wheat (Diamond) produced 26 hybrid grains. Of these 23 were non-viable, failed to mature or died in germination. When, however, the Gordeiform 10 was pollinated with a mixture of the pollen of both Diamond and Gordeiform 10, 50 percent of the seeds proved viable, in ten instances the plants reverting to the maternal type, in 11 to the hybrid type. As the result of the

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vast material collected from experiments on the biology of fertilization, one may reach the conclusion that the change of conditions under which the development takes place (in this case - conditions of fertilization) produces hereditary changes in the progeny.

The task of specialists-selectors consists now in working out concrete methods of controlling the process of fertilization, as applied to the practical aims of selection. Here the inability to cross may be conquered in a different manner. The pollen, serving as a guide, may aid in strengthening or weakening the paternal or maternal traits in the hybrid progeny, etc.

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Translated from the
Russian by
S. N. Monson

With each year the high standard of agro-technical methods and the high fertility of soils in state and collective agriculture have become a more common occurrence. Yields of cereal crops should also increase drastically. The yield of panicled crops - millet and rice - represents no problem (within limits of 150 centners per hectare), but depends solely upon agro-technical conditions. The radical increase of wheat, however, above the customary "avan-guard" yields, is curtailed by the inadequate productivity of the wheat stalk itself, the more so, because on very highly fertile soils our varieties show a tendency to lodge. In a branched wheat the stem is branched, has a very high productivity and is preserved as a durable straw. The capacity of the stem to branch is increased on highly fertile soils. This quality along with good tillering will, evidently, permit wheat to reach yields as high as are obtained from panicled crops.

At present, we are faced with the problem of producing branched wheat yielding 100 centners. The branched wheat is seldom found in a cultivated state, possibly because it demands highly fertile soils and on ordinary soils is no different from common wheats. Aside from that, branched wheat must be subjected to selective treatment. It is imperative to change it into a winter crop, because it is a summer crop or at best a weak winter crop. Winter crops, however, possess a greater capacity for tillering. It is further essential to improve its bread-baking

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qualities. Its other characteristics - such as resistance to disease, etc., are as yet unknown. If there are any unfavorable characteristics, these should be eliminated promptly.

The sowing and crossing of branched wheat with winter wheats was done in hothouses in the winter. Following their ripening, the hybrid seeds were immediately planted; this was done to speed up the process. The plants of the branched wheat seedlings, that were thus purposely speeded up, were added to the sowing area of winter wheats. The stalks were emasculated in order that unimpaired pollination by varieties of winter wheats could take place.

This free inter-varietal pollination succeeded perfectly.

A mass method or experiment compensates, as a rule, for lack of time; it makes it possible to establish a point which under ordinary circumstances it would take years to ascertain. For this reason large scale testing was undertaken.

At present special sowings of branched wheat are made with a view of transforming and training it into a winter crop.

Every method of selection known to agro-biological science will be applied to this end.

The success of the enterprise is determined by the confidence based on the knowledge of the means and the desire to reach this goal. The people at the Gorki Leninskie Station are convinced of the ultimate success in solving the problem, once it is subjected to experimentation.

One of the most important and interesting experiments by A. A. Avakian is called for convenience sake - "lukovichki" ("small onions").

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An onion, grown from the seeds of "sevok" ("arbajeika") does not, as a rule, bear any flowers. The planted black onion seed ("chernushki"), produces no flowers in the first year. From the planted "sevok" (seedling) grows the mother onion. The latter, if planted the following year - sends up a stalk, "Strelkuet"; forms flowering parts and produces seeds.

It seems therefore essential for plants to go through a definite path of development, following which they acquire the capacity to flower and are ready to bloom.

One can speed up this process. To accomplish this, the awakened "sevok" (seedling) has to be exposed to cold for some time or the growing seedling subjected to the reaction of low temperatures. In such case plants from the seedlings will send up stalks.

The experiment consisted in its first part in the following: the buds were cut off at the point of the "strelka"; in their place at the top of the "strelka", at the point where the peduncles are attached; small "lukovichki" (small onions) resembling the seedlings, appeared. The mother-onion-tuber had produced onion-babies. The "lukovichki" from the "strelka" and the babies were now divided into two groups. One group was planted in the hothouse and grew in its atmosphere all along. The other group was kept during germination in the cold at first and was then returned into a warm room. The onion "babies" sent up stalks equally well in the warm air and after being exposed to cold.

The plants from the "lukovichki" did not send up stalks in the warm air, but formed a mother-onion-tuber. Those taken in from the cold, however, acted in the same manner as did seedlings after being exposed to cold. This meant that plants produced from the "babies",

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formed from points of tissue growth, that had passed through the necessary stage preparatory to blooming, re-acted indifferently towards the cold and sent up stalks. Plants derived from the "lukovichki", on the other hand, behaved as would plants from seeds. They had not gone through the necessary stages preparatory for blooming and were unable to flower without special adaptation to cold.

A similar picture occurs in the case of garlic. The latter never forms seeds on the "tsvetonosy", (flowering stem), but produces only small serrated teeth. In the lower part of the plant, on the teeth, many more baby-teeth grow up. In planting simultaneously teeth from the "tsvetonos" and those from babies, the former were unable to produce "tsvetonosy" in the first year of planting but formed solely teeth from which in the following year grew plants that sent up stalks, while the others at once produced "tsvetonosy" that sent up stalks.

This experiment established a most important theoretical fact - the individual development of a plant from vegetative reproductive organs, ("lukovichki" from "tsvetonosy"), (when produced from somatic cells of a plant), is homologous to the individual development of plants from seeds (which were produced from the sexual cells of a plant). This fact determined the conduct of the second part of the experiment.

From an onion which "splits" in its progeny, according to the color of the tubers, from uncolored to intensely colored ones, to transitional forms between colored and uncolored, both "lukovichki" and seeds were obtained. From "lukovichki" were raised tubers, as varied in color as were the tubers obtained from seeds.

It appeared that the seed progeny (i.e. sexual) and vegative progeny (obtained from the somatic cells of the plant) possess a similar characteris-

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The conclusion had to be drawn that many individual peculiarities of sexual cells and vegetative organs of reproduction depend upon the characteristics of the somatic cells, from which originated the sexual cells, as well as the vegetative organs of reproduction, which may be observed in the character of the individual development of the progeny. The heredity produced by sexual cells reflects on the heredity of the entire organism of the plant. Hereditary traits of sexual cells are neither isolated from the body of the growing organism nor form conditions influencing the development of the organism. There does not exist any special embryonic plasma that is isolated from the hereditary influence of conditions affecting the development of an organism.

The experiment with "lukovichki" is related here only in general outlines. Its author (A. A. Avakian) is conducting it in close detail, using special control tests on a variety of material and other plants suitable for the conduct of experiments (for instance, - lilies, which form seeds as do "lukovichki" along the entire stalk).

Experiments on vegetative hybridization are being continued at the Experimental Station of the VASKHNIL in connection with solving the problem of obtaining "directed" hereditary changes in the grafting of progeny, and problems of establishing definite regularities of the inheritance of characteristics and traits in vegetative "crossings". The frequency of the number of hybridizations in grafting is being determined, so is the greater or smaller degree of the changeability of hereditary traits, as a result of vegetative crossing, the grafting methods and training of the graft. Methods of the "absolute" receipt of vegetative hybrids are also determined.

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Tomatoes and other Solanaceae are used as objects; tomatoes in general have become classical objects for experiments in vegetative crossings.

One may observe on experimental lots and in hothouses the seed progeny of the vegetative hybrid tomato, "The Best of All", crossed with the black Solanaceae, obtained as a result of repeated experiments in 1939. The same hereditary changes in the shape of fruits, color, type of raceme, taste of the fruit, and early ripening - are observed in the seed progeny of this hybrid, as was the case in 1939.

The seed progeny of this hybrid of 1939 is being experimented on in the form of strains of progenies of individual plants which have the characteristics of varieties. They are distinguished by their early ripening, (there are ultra-early ripening varieties among them), by the shape of the fruits (from round ones to elongated-pointed ones), by color (raspberry and red), by taste, (exhibiting a decidedly pleasant taste and sweetness).

As a result of graftings of the unfertile tomato Albino on the red-fruited potato-like tomato, the grafting of the Albino produced fruits that were white, yellow, orange, and red; yellow with red and red stripes, as well as fruits of varied shape: smooth, ribbed, elongated and round. Thus, on the graft, the form possessing the recessive characteristics of fruits, fruits with dominant characteristics were obtained. In the seed progeny of these fruits one observes a complicated splitting, according to the various traits. It was noted that fruits with recessive traits produce plants with dominant and recessive traits, for instance red tomatoes from seeds of a white fruit, something that never occurred

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in sexual crossings. An identical picture in splitting is observed with regard to traits of vegetative organs: leaf, stem, and color of a plant.

A similar kind of changeability is observed in the seed progeny from the vegetative crossing of other varieties of tomatoes: the potato-like variety with the Golden Queen, the Early Ruby with the apricot-like variety, etc. It has been established that the plant itself does not change externally as a result of graft, but that in its seed progeny there will be splitting on many points. Figures have been established concerning the frequency of securing vegetative hybrids for many graftings.

Tomatoes may at present be called a study object for obtaining vegetative hybrids and the production of vegetative crossings.

The vegetative hybridization represents a typical example of the training of hereditary traits and their changeability, as a result of changes of the external environment.

Food represents an external factor for the organism. In the process of grafting, the graft obtains the food from the wilding, i.e., a food foreign to it. From this it builds its body and sexual cells which produce changes in hereditary properties.

In the experiment of changing heredity by training, a change in the conditions of development equally occurs because of the placement of the plant into external conditions, unnatural to its hereditary demands, while the nature of its nourishment is changed at the same time. Lysenko states: "The change in heredity is usually the result of the development of the organism under conditions of external environments, which in one way or another, do not correspond to natural demands, i.e. heredity.

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The change in environmental conditions brings about the change in the development of growing organisms. They represent the source of changes in heredity."

Many experiments were and are being conducted with regard to training at the Experimental Station. Much data on changes in heredity, under the influence of training, has been assembled by other researchers as well. We shall dwell upon the description of several similar tests conducted at the Experiment Station covering the training of hereditary properties. Some strains of vegetative hybrids of the tomato "Best of All", crossed with the black Solanaceae, were subjected to training for frost resistance by way of sowing the seeds directly into the soil. Such planting - in nests - was done one month earlier than is usually the case in planting tomato seedlings.

The planting, repeated for several generations gave positive results. At the station, seeds of two strains were planted on lots; all were subjected to the change; by August they managed to produce a yield of red tomatoes ample from a productive point of view.

The change in heredity, as a result of a change in feeding, is well demonstrated in experiments performed in improving a degenerating potato.

The degeneration of the potato plant represents a hereditary change of its racial properties. Degeneration takes place because of the formation of the tubers in hot and dry weather.

In summer plantings of the potato in the south, the tuber formation is transferred to the period when cool weather prevails and there is sufficient moisture in the soil fur tuber forming. Summer plantings of potatoes represent therefore a way of obtaining non-degenerated seed potatoes.

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The nature of the feeding of potato plants in hot and dry weather changes radically from the customary one. This causes the disruption of the normal metabolism peculiar to the race. Every disruption of the metabolism produces the formation of elements which, if not harmful, are, in any event, unusual. The nature of the individual development of the potato plant is changed and this leads to the hereditary change of the racial properties.

Inasmuch as another type of individual development of the potato, deviating from the racial norm, serves as the cause of degeneration, in this instance, one may suppose that the degenerated potato may also be improved, provided its individual development returns to its customary norm, i.e., provided the conditions of feeding will facilitate this.

The practice of planting potatoes in the summer shows that they do not degenerate but even improve in "race".

Special experiments point to a real and speedy way of improving the degenerated potato. The potato tuber of a degenerated plant was grown and then grafted from its eyes for test purposes. One group was grown under typical conditions that stimulate degeneration; the other part was grown under cool and moist conditions, and was assured an adequate supply of nitrogen for food. As a result, these two groups of plants differed in the degree of degeneration. The first group showed typically degenerated plants. The second one produced plants that were degenerated to a much lesser extent. In addition, considerable variations in degree of degeneration were observed in the latter group. In some plants, which at first had shown symptoms of degeneration, the latter gradually disappeared and the leaves began losing all traces of degeneration.

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In the following year, the tubers of each plant of both groups were planted as progeny-families. Each family originated from an eye of the same original tuber. All the families of the first group of plants proved much more degenerated than those of the second group (which were grown under favorable conditions, conducive to improvement). Among the families of the second group a considerable part of plants appeared perfectly healthy. Within every family differences in degree of degeneration in the individual plants were frequently observed. Plants within a family were not the same.

The reason for this, seemingly not understandable fact, becomes clear if the following important circumstance is considered. All parts of the potato plant are subject to degeneration: the tuber, the eye on the tuber, the bud, different cells - all in different degrees, depending upon their selective capacity for food consumption. Selection is also not the same with regard to various cells, eyes, etc. Selection is seen in the tendency to use food that matches their racial characteristics. So long as selectivity is visible in different degrees, the racial properties also change in a variety of ways. This explains the difference in the degree of degeneration.

Experiments show that the degenerated potato improves rapidly under proper conditions. Two years prove adequate for growing an almost healthy seed potato, and the degenerated plants found among the improved material may easily be destroyed.

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The experiments also demonstrate that young hybrid potato varieties improve more rapidly than the older varieties. The variety "Lorkh", for instance, frequently improves within only one year.

Among old varieties changes of conditions of feeding of a less radical nature produce equally deep racial changes, extending far beyond the limits of racial properties.

Such degenerated material is more difficult to improve. The improvement calls for a deep change of racial properties, that differ in many respects from the original race.

Tests conducted on the variety "Early Rose", showed that while the improvement produced healthy material, it strongly varied in many racial characteristics and differed from the original variety.

Training was applied in experiments conducted on methods of selecting cereal crops. They lead one to assume that in selecting summer wheat material of a heredity altered by training, a much more gratifying source for the selection of new, better varieties than hybrids among varieties is found. It follows that in order to produce summer varieties, it is expedient to utilize winter wheats. Their sowing under summer conditions, in a pre-vernalized state, leads rather quickly to their hereditary transformation into summer crops. It may make it possible for summer wheats to preserve some useful traits of winter wheats, such as frost-resistance, stability, etc.

Hybrids of summer and winter wheats are easily subjected to training because their heredity is no longer stable as a result of hybridization.

The following work is being conducted at the station with regard to training for higher winter-and frost-resistance of winter wheats: hybrid

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grain obtained from the crossing of the winter wheat 2411 with the summer wheat Lutescens 62, the varieties Marquis, Kitchener, and Thatcher, performed by the method of free pollination of the emasculated stems, are sowed in winter plantings for training. A similar seed material is sowed in summer plantings to acquire summer properties in summer varieties. We already stated above that various modern theories concerning the so-called hormone development of plants were recently expounded by physiologists.

At the Experimental Station much attention is devoted to tests designed to give an experimentally critical review of the numerous "hormone theories of development", since the distribution of the latter, as is the distribution of the theory of corpuscle heredity, interferes with the spread of research on studies of the actual processes of development of growing organisms. We shall not dwell here upon the description of these works because their author, A. A. Avakian, will shortly publish his article on the subject in the magazine, "Agrobiologia", and so refer to his first accomplishments himself.

A large amount of material on the theory of the stage-development of plants has been accumulated in the process of experimental work, in connection with the criticism of the hormone theories of growth, flower formation, ascocarp .., etc. Work is being continued in this direction and will form an important and considerable part of the research performed at the station. Hothouses are filled with numerous experimental plants. Here are grafts of various Cruciferae, grafts of beets, many accompanying/controlled by material. The schematic description of the method of arranging the experiment, could alone form the subject ~~for~~ of a special article, not to mention the description of the experiments in their entirety.

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The work is primarily directed towards research on the second light stage development.

One may, for instance, tentatively state that food, in order to pass through the light stage, may be accumulated within the plant organs as a reserve nutritional element, even prior to their undergoing the stage of vernalization, and that it will be utilized by the plants at a later date. Interesting, incidental peculiarities in two-year old plants have been observed in the course of their passing through the light stage.

It is, however, not possible to provide full information on the work and we are therefore limiting ourselves to this brief reference. The object of this article is not to inform about the experimental work performed at the station. We have refrained - for certain reasons - from describing many experiments that are only in the primary stage or those of smaller size, and have only endeavored to present the general direction taken by research at Gorki Leninskie.

In conclusion it is necessary to mention the following important circumstance which applies to the method used in the experimental work of the station: it is characteristic that the development of the subject under investigation is always observed under the influence of changing conditions.

End of Article

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Hunlum, J. Zur geographie des maisbaus
(On the geography of maize cultivation).
Kobenhavn, Hareks, 1942. 317 p.
59.22 H88

Translation 3 : Corn

3

Translated in part from the German by
Rebecca Feinleib

SOVIET UNION (p. 108-109)

The Soviet Union, too, has quite a large corn (maize) crop when compared to the international corn production; it varied during the decade of 1930-1940 between 2 1/2 and up to 4 million tons. However, seen from the Russian point of view and compared to the enormous harvest of other grains of the country, these results are not very remarkable. The corn sowing, namely, occupies normally only 3 to 4 per cent of the total Russian grain area. Table 29 gives a clear conception of the place corn occupies in the grain economy of U. S. S. R. (See page Ia.)

Corn is given there far smaller planting areas compared to the four usual European cereals, and even to those given to the millet planting. Yet the millet yield is generally the same as the corn yield: that is, 2 1/2 to 4 million tons. While the annual yield of the decade 1930-1940 for barley reached from 6 to 11 million tons, for oats 13 to 22 million tons and the yields of rye and wheat reached, respectively, 16 to 30 and 30 to 50 million tons.

Whenever comparing the corn culture to other grain cultures in Russia, one has to keep in mind that the Soviet Union is the heaviest grain growing country of the world. The hectare yield of corn, however, is much higher than that of millet and wheat and even some higher than the hectare yield of rye, barley and oats. In the period of 1934-38 it amounted in average

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APPENDIX

Table - 29
The Grain Crop in the Soviet Union

	1909-13	1924-28	1929-33	1934	1935	1936	1937	1938	1939
Wheat area in thousand square km.	300	270	336	352	371	390	414	415	409
Rye " " " " "	251	267[1]	266	240	235	219	231	216	178
Oats " " " " "	169	165[1]	173	180	183	181	176	179	184
Barley " " " " "	105	70	80	85	87	91	92	92	93
Millet " " " " "	?	?	68	82	55	-	-	-	-
Maize " " " " "	13	34[1]	38	37	32	31	28	21	25
Maize crop in million tons	1,335	3,618	3,731	3,843	2,795	4,140	3,890	2,690	-
Hectare crops of maize (cwt.)	10.1	10.8[1]	9.9	10.4	8.6	13.4	13.8	10.3	-

[1] 1925-28

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to 11.3 cwt. The yearly harvest yield fluctuations are by far smaller than those of neighboring Roumania, in spite of the fact that the most important Russian corn belt is situated in southwestern Ukraine on the border of Bessarabia, where the harvest fluctuations are extraordinarily large, due to the deficiency of precipitation in summer. So in the Ukraine there are very important harvest yield fluctuations; they vary through the more steady corn yields from the second large corn belt, which is situated in the rain-rich regions of the Black Sea, East Coast, North Caucasus and Georgia. Corn cultivation is divided quite evenly between Ukraine and Caucasus.

Far less important is the corn culture of Turan, though it is a very important local grain variety. However, before the World War corn occupied 6 to 10 per cent of the grain area and in Ferghana 10 to 20 per cent and over of the same.[1] Yet gradually corn is supplanted by cotton in those areas. Some corn sowing can be found in the far eastern regions and there the production has doubled[2] since the World War (I).

In Ukraine the corn occupies 6 per cent of the arable land against 9 per cent in North Caucasus and 19 per cent in Trans Caucasus (1926)[3]. The most of the corn sowing in Ukraine is done in the southwestern and southern regions and according to V. Timoshenko,[4] since the World War corn has been

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[1]Th. H. Engelbrecht, 1916, Map No. 26.

[2]Sowjetwirtschaft und Aüssenhandel (Soviet Economy and Foreign Trade), No. 10, 1937, p. 8.

[3]T. Ellinger, 1928, p. 234.

[4]Vladimir Timoshenko, 1932, p. 201.

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used much more frequently there for crop rotation than ever before. However, even lately corn did not occupy in any region, more than 20 per cent of the cultivated soil.[5]

In the North Caucasus there is abounding corn sowing, both in the Kuban steppe and also in the East steppe[6] and in mountain regions. In many mountain regions corn fields compose over a half of the cultured soil.

In Trans Caucasus the greater part of corn sowing is concentrated in Georgia, where corn occupies about 60 per cent of the arable land. In the Black Sea areas cornfields amount up to 90 per cent[7]. Corn proceeds in the mountain regions up to 1,000-1,300 meter altitude.[8] Intermediate culture[9] is applied only to 6 per cent of the Russian corn land; thus the last is of far less importance there than in Roumania.

Corn is an important food[10] for some regions of Ukraine and especially of the Caucasus. In addition it is largely used as cattle fodder and is applied also for fuel alcohol manufacturing.

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[5]In North Ukraine the corn occupies from 1 to 6 per cent; in South Ukraine from 10 to 20 per cent of the arable land. Only between the lower Dnieper flow and the Dniester does the corn sowing reach 20 to 30 per cent of the arable land (D. N. Prianishnikov, 1930, Map XV).

[6]Since corn, compared to wheat and oats, requires only 60 per cent of the moisture necessary to build up the dry matter unit, it is of special interest for the dry regions. In addition corn is able to use the rainfalls of the later part of summer. (Prianishnikov, 1930, p. 311)

[7]N. Michailov, 1937, p. 144.

[8]H. Crohn, 1926, p. 33.

[9]"Annuaire international de statistique agricole" ("Yearly international of agricultural statistique"), 1939, data for 1935.

[10]W. Zimmermann, 1941, p. 295.

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Russia was one of the most important exporters of corn before the World War; but after the revolution, only in some individual good years did its corn export exceed 100 thousand tons.

The effective north limit for Russian corn cultivation does not run farther than in other European countries. The reasons are: (1) insufficient amount of rainfall and (2) the prevailing continental climate rendering the summer too short for corn culture even in the southern regions. Nevertheless, Prianishnikov[11] asserts that early ripening corn could mature even in South Siberia, namely, in the southern parts of the Barnaul region, Biisk and Chinusinsk. The course of the northern and eastern corn limits depends greatly on the amount of precipitation: If rainfalls could be doubled, early ripening corn varieties would easily grow near Moscow; for the yearly temperature fluctuations are there about the same as in North Dakota.

Isolated cornfields exist even on the 58° northern latitude,[12] however, corn growing north of 51° to 52° northern latitude is of no importance whatever. In the atlases on Russian agriculture there is a density map of corn culture[13] where one can see that north of 52° northern latitude the corn culture extends over a few hundred hectares only[14] and the corn belt takes real shape beginning south of 50° northern latitude.

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[11] D. N. Prianishnikov, 1930, p. 318.

[12] P. C. Mangelsdorf and R. G. Reeves, 1939, p. 7.

[13] Rastenievodstvo of U.S.S.R. (Plant growing of U.S.S.R.), 1933; map on Kukurusa (corn).

[14] Compare: D. N. Prianishnikov, 1930, p. 318: "The 52° latitude is usually considered in our country as the approximative northern limit of corn cultivation for kernel production."

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The data of Engelbrecht[15] show that the northern limit of the Russian cornbelt did not change substantially after the World War.

CZECHOSLOVAKIA (p. 117)

The taking possession of the Protectorate of Bohemia-Moravia increased the corn crops of Great Germany, although the larger part of the Czechoslovakian corn plantings were situated in the present Slovakia, along the Danube and in regions now ceded to Hungary. The corn area of Czechoslovakia embraced in 1938, 1,800 square kilometers; and the yield amounted to 365,000 tons, which represents an impressive increase for the decade 1930-40.

Intermediate culture is applied to the half of the Czechoslovakian corn areas. Generally, plantings of corn and beans are used or corn, beans and sunflowers; furthermore, melons and pumpkins are utilized in the intermediate culture. On the whole, corn occupies in Czechoslovakia as in Austria, 6 per cent of the grain cultivation area.

POLAND (p. 117)

Less important was corn for Poland, where it does not yet occupy 1 per cent of the grain area, and where the harvest fluctuated by 100,000 tons yearly. Only for Galicia and the southeastern provinces of Stanislavovski and Tarnopolski is the corn culture of real importance (90 per cent of Polish corn culture is done in these provinces). The hectare yield in Poland showed a large fluctuation, namely: between 8 and 15 cwt. (100 kilograms) for the decade 1930-40.

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[15] Th. H. Engelbrecht, 1899, p. 42.

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On the whole, however, the corn yield there is somewhat higher than in Bucovina.

ALBANIA (p. 117-118)

Greece and Albania do not belong to the corn countries of importance. Most of the coast regions of these countries are not suited for corn culture on account of the subtropical winter-rainfall-climate. Nevertheless, corn is Albania's principal grain crop, and it occupies two-thirds of its grain area. This situation can be explained by two facts: first, Albania finds itself in a transition zone, where the summer is by no means rainless; secondly, the rain there is replaced to some extent by the dew.[16]

The harvest in Albania as a rule amounts to 100-150 thousand tons, but it does not cover the demand. The agriculture in Albania is still very primitive. Herbert Louis[17] reports that a plain wooden plow, provided, of course, with an iron arrow-head and sideblades, is in general use. The plow is pulled by oxen and can only scratch the earth. The most important tool is the mattock, with which the cornfield is worked. The sheep husbandry produces some fertilizer, but the crop rotation is scarcely known. It must be noticed in addition that an Albanian will cross relentlessly any corn or wheat field if only it offers some short cut.

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[16]Carl Patsh, 1926, p. 871: "The principal grain of the plain and particularly of Albania is corn, which because of very abundant dew during one hot rainless season thrives so that horse and rider hide in it."

[17]Herbert Louis, 1927, p. 49-50.

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The Louis data relate to the middle of the twenties of the present century; at this time the hectare yield in Albania amounted to 10-11 cwt.[18] The yield improved somewhat to the end of the thirties, and it is possible that the sowing methods altered for the last 15 years. Of course normally corn is harvested in Albania only once a year. But Louis reports that it would be possible to grow ripe corn twice a year in South Albania in Muzakia; he adds, however, that the corn planting there is of limited importance due to the devasting effects of raging malaria and repeated floods. He emphasizes, besides, that corn in Albania is of an extreme importance for daily food, for the last consists of cornbread and flower bulbs, onions, tomatoes or whey. Cheese from ewe's milk is something special, and bacon is a rare dainty morsel.

BULGARIA (p. 120-122)

The hectare yield of corn in Bulgaria is quite low, as compared to the same of Yugoslovia, Hungary and Italy. Furthermore, it fluctuates here considerably from year to year, though not as much as in the other Balkan countries. It amounted in the decade 1930-40 from 7 up to 14 cwt. [See illustration 44, p. 120: The corn area of Bulgaria for the year 1938: 669 thousand hectares, from which 214 thousand hectares or 32 per cent are located in the province of Vratza. Every dot corresponds to a cornarea of 2,000 hectares ("flächentreu" surface....?). Ref. Statistique agricole, ensemencement et recoltes, Royaume de Bulgarie (Agricultural statistics, sowings and harvests. Kingdom of Bulgaria, Sofia, 1938.)].

[18] 1928: 10.8; and 1929: 10.4 cwt. per hectare (no data on earlier time are available).

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The northwestern province of Vratza has the highest hectare yield; Burgas, as a rule, the lowest; sometimes as low as one-third of the first. The hectare yield figures of corn in Bulgaria are often lower than those for wheat, a fact that otherwise occurs very seldom. Swedberg's[19] explanation of this fact might be correct: he quotes that corn is sown there on much inferior soil than wheat. Cultivated even on the fertile but very porous black soil, corn in certain years does not have enough moisture: the summer precipitations consist of short and very heavy rains, which in itself (if not the soil porosity) would be favorable, since it combines much sunshine with abundant rains.

The corn area of Bulgaria enlarged greatly in the present century, however in the recent decade there are scarcely more than 7,000 square kilometers.[20] Wheat requires half of the grain area and corn one quarter. In return the wheat harvest is as a rule at least double as compared to the corn harvest: it varies between 1 to 2 million tons against 1/2 to 1 million tons of corn yield.

Corn is a very important grain for all of Bulgaria, however the largest part of the crop (about two-thirds of the last) relates to the regions situated north of the Balkan mountains; which corresponds to the fact that about two-thirds of Bulgarian areas under 700 meters of altitude are to be found in northern Bulgaria.[20] On the lowest areas of the Danube plain the corn plantings

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[19] S. Swedberg, 1940, p. 249.

[20] See table by M. Markoff, 1912, p. 93.

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are in many points as important as wheat plantings. The northwestern province of Vratza yields sometimes more corn than wheat, and in certain years this province yields one-third of the whole corn crop of Bulgaria. Likewise, in the province of Sofia in southwestern Bulgaria the corn crop surpasses the wheat yield, yet this yield constitutes only a small part of the Bulgarian corn harvest. The provinces Shumla and Burgas on the Black Sea yield comparatively small quantities of corn. In these regions the corn is supplanted by sunflower which is favored there because of the Black Sea climate.

If corn is of less importance on the plains of Roumelia than north of the Balkan Mountains (even from the relative viewpoint: the ratio to the total extent of the arable land), it is due to the insufficient precipitations compared to those of the Danube plain. This is true not for the whole year, but occurs in the growingperiod (on account of transition to a subtropical winter climate).

Beans, pumpkins, watermelons and potatoes are grown frequently between the cornplants;[21] however, the intermediate cultures are not as general as in Roumania.

As in other countries, corn growing is of most importance to the small farmer. Leibrock[22] attributes it to the fact that corn is a barter crop and that it requires quite hard work during the harvest. In a small

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[21] O. Leibrock, 1938, p. 73. See also Anmuaire international de statistique agricole, 1940.

[22] O. Leibrock, 1938, p. 72.

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household, however, the farmer and his family are able to perform the whole work themselves, inasmuch as the labor can be distributed over a quite long time period. Moreover, there is no necessity to harvest as soon as the corn is ripened, since the kernel does not fall from the cob.

A small part of the corn crop is exported (see table 30 - page 10a); the greatest part is used as fodder and namely according to Roucek[23] for cattle; Swedberg,[24] however, declares that corn is used there as fodder for pigs and hens. The last is more probable.

In return the corn foliage (?) (maisstroh) is used greatly as cattle fodder and the stems serve in many peasant households as firewood.[25]

Yet the export of corn from Bulgaria is not unimportant: it amounts generally to 100 thousand tons; in 1924 it reached a maximum of 211 thousand tons, in 1939 a minimum of 2 thousand tons. Compared to Yugoslavia and Roumania, the export is quite moderate; yet Bulgaria contributed in 1932-34 an average of about 1 1/2 per cent to the net world export of corn, that is, more than the United States. Frequently were corn export figures equal to those of wheat.

In 1932-34 the figures of corn export amounted to 3.8 per cent of the whole export figures of the country. In 1935-37: 2.5 per cent.

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[24] S. Swedberg, 1940, p. 251

[25] O. Leibrock, 1938, p. 73

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Table - 30
Corn Yield and Corn Export of Bulgaria

	1914	1924-28	1929-33	1934	1935	1936	1937	1938	1939	1940
Corn area in thousand km.[1]	(6.0)	6.4	7.3	6.9	7.2	6.7	6.8	7.0	6.2	---
Corn crop in thousand tons	(776)	605	888	790	1009	872	859	532	951	1070
Corn export balance in thous. tons	(207)	121	135	126	5	104	99	59	2	--
Yield per hectare (cwt.)	(12.9)	9.5	12.2	11.5	14.0	13.0	12.6	7.6	15.4	--

[1] V.N. Krebs, 1926, p. 837.

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HUNGARY (page 129-131)

In 1937 Hungary cultivated 35 percent of her grain area in wheat and 30 percent of the same in corn. Normally the wheat area is somewhat larger than the corn area, nevertheless, for the last years, corn had to be considered as the principal grain crop of Hungary. In any case, the corn yield was in the five years of 1934-38, larger than the wheat yield: namely, 2310 thousand tons corn and 2220 thousand tons wheat. During the previous five-year period the wheat crop was the higher one, but during the decade 1930-40, the corn yield increased on a larger scale. Table 32, in addition, does not show such a large area of green corn; this is an area of about 800 km.^{2}, yielding over 200 thousand tons yearly.

The climate of Hungary is perfectly suited for corn planting. The yearly temperature fluctuations being almost ideal. The average temperatures for Budapest and Szegedin range in May - September essentially within the same intervals which proved in Rumania as optimal (see p. 284); only May is rather cool. On the other hand, the precipitation is suboptimal in most of the regions during the growing period, especially in July. Mentioning the European corn regions,--Huntington, Williams and van Valkenburg[26] emphasize that Hungary has an especially large hectar yield and "Taken as a whole, its climate also shows the nearest approach to the optimum for corn".

[26] E. Huntington, F. E. Williams and S. van Valkenburg, 1933, p. 72.

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Table - 32
The Corn Culture of Hungary

	1911-15[1])	1924-28	1928-33	1934	1935	1936	1937	1938	1939[2])	1940[3])
Wheat areas in thousand sq. km.	15.1	15.3	15.9	15.4	16.7	16.3	14.8	16.2	(18.7)	(17.5)
Corn areas in thousand sq. km.	8.6	10.5	11.2	11.2	11.5	11.4	12.0	11.7	(12.6)	(13.6)
Wheat yield in thousand tons	1995	2037	2137	1764	2292	2389	1964	2603	(3078)	(2068)
Corn Yield in thousand tons	1506	1818	1792	2098	1432	2593	2759	2662	(2335)	(2964)
Hectare yield for corn (cwt.)	17.5	17.7	16.0	18.7	12.3	22.8	23.1	22.7	(18.5)	(22.0)

1 The Trianonterritory
2 Annexed parts of Slovakia included
3 Included Ruthenia

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The sowing takes place during the intense temperature increases in the month of April and up to May; the proper growing period follows in May and June jointly with the rain maximum, which as a rule falls in short heavy showers. During the ripening period in the month of September the rains are comparatively moderate. July is the warmest month (average to 20-22 1/2° Centigrade). But on the whole there are no important variations of temperature during the summer months.

The harvest takes place mostly from mid-September up to the end of October. After the harvest the corn is dryed in special long airy houses, or rather sheds so-called Tshardeks or Górés, which can be found in most of the corn farms.

As mentioned above, wheat and corn are the principal soil products, but Babcock and Vance[27] remark, that especially in the south in Backa (Batshka), sugar beets, rye, barley, oats, hemp, hop, Setaria and at times lucerne are drawn into rotation, in addition to wheat and corn. In some places, however a three-year crop rotation is practiced: Corn-Wheat-Panicum sanguini.

Toward the north-east, in the sand regions of Debreczen a four-year crop rotation is usual: namely Lucerne,-Wheat-(or rye)-Corn-Sugar beets[28].

The Hungarian Statistics do not give any direct information on intermediate cultures on the corn fields[29]; however repeatedly used for intermediate cultures on the fields of Hungary are pumpkins, beans and sunflowers; in the same way as in Rumania these plants are generally used for intermediate cultures.

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27) K. W. Babcock and A. M. Vance, 1929, p. 10.
28) H. Buss, 1929, p. 29 and following.
29) Mr. Stefan Fabiny, department head in the ministry of agriculture unfortunately was likewise unable to give me some information on this account.

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In Hungary, as nearly all over the world, corn production is typical for small and medium-sized enterprises. This fact, which depends on the large labor effort required by corn growing appeared yet more drastically after the distribution of the large estates, which took place during the years after the war: (1920, 1924, 1936[30]), on the large agricultural enterprises, the peasants and the day labourers recieve a share in the yield instead of money.

The largest part of Hungarian corn is utilized as fodder; in contrast to Rumania, the Hungarians do not use corn as a bread cereal they use, of course, corn as a food, but according to Kurt Treiber[31]) almost entirely sweet corn[32].

For fodder purposes they grow flint pod and dent corn, and as mentioned before, both ripening, and also green corn; in this case corn is often sown a few weeks later[33]). And as elsewhere in central and south Europe you can see in Hungary in the same region and at the same time corn fields of different stage of development.

Corn growing is important for all of Hungary, but especially for its south-eastern part, extended around Danube and Theiss.

In the north the corn growing often occupies less than 20 per cent of the arable land, Hungaria, as a rule carries on some corn export; however, when the yield is bad, it imports corn; sometimes in considera ble quantities.

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30) Revey, 1940 and following. 31) Kurt Treiber, 1934, p. 35.
32) K. W. Babcock and A. M. Vance (1929, p. 13) yet assert; "when a variety of corn, translated as sweet corn, is encountered in the central European plains the reference is usually to the early-maturing corn grown for human consumption throughout the region. This corn was evidently originally a type of 'flint'. 33) K. W. Babcock and A. M. Vance, 1929, p. 9.

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Table 33 shows the development of Hungarian corn export. The yield of 1935 was a failure; consequently the high import in 1935 and 1936.

Illustration 51. Hungarian Corn yield for the year of 1937.

The total production amounted to 2759 thousand tons. Every dot on this map corresponds to 10 thousand tons corn.

(source: Annuaire Statistque Hongrois (yearly Hungarian Statistics) 1937)

pp. 137-138

Illustration 54: Corn granary (Maisgórée) in Hungaria. August 1941.

Illustration 55: Sunflowers on the edge of a corn field with intermediate pumpkin culture; in the northern Theiss-plain. August 1941.

Illustration 56: Dr. Rudolf Fleischmann at the experimental fields with corn and beans in Kompolt, Hungaria. Corn and beans with separate, result in a better yield than sown as intermediate cultures. August 19 41.

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Table - 33

The Hungarian Corn Trade

Thousand tons	1909-13	1924-28	1929-33	1934	1935	1936	1937	1938	1939
Export surplus	(224)	78	43	28	--	--	190	111	(47)
Import surplus	--	--	--	--	248	213	--	--	--

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RUMANIA (pp. 125-159)

Rumania, relative both to production and also export, is the most important country of Europe; in those regions which belonged to Rumania during the inter-war-time the corn crop was essentially behind only compared to the crops of the United States and Argentine. In the same time period was Rumanian corn export one of the world largest: second only to the one of Argentine. (See table 35, next page)

In a survey on the extension of the world corn culture, Rumania, naturally, will be of special interest.

One of the important purposes of the present work is to find out the dependence of Rumanian corn yield on its climate. This dependence motivates even more a detailed study of the expansion and importance of Rumanian corn culture.

Crop Growing. For a long time corn was the principal grain crop of Rumania; according to Pittard[34], the corn culture doubled for the last half century before the world war; and after the world war the corn area was constantly increasing year by year on an extremely large scale. Midst of the decade 1930-40 Rumanian corn area was almost one and half times larger compared to the area planted in war-following years. In 1924 corn was planted on 36 thousand sq. km., in 1936, however, the area amounted to 53 thousand sq. km. (1938: 50 thousand sq. km.).

These figures represent a tremendous expansion of Rumanian cultivation surface in general and especially of the corn area, which normally occupies 80 per cent of the cultivated land.

34) E. Pittard, 1917, p. 147.

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Table - 35

The Corn Culture of Rumania

	1909-13	1924-28	1929-33	1934	1935	1936	1937	1938	1939	1940[1]
Wheat area in sq. Km.	(18.5)	32.3	30.5	30.8	34.4	34.3	35.5	38.2	40.8	(20.2)
Corn area in sq. km.	(20.9)	40.6	47.2	50.1	51.7	52.6	51.6	50.0	49.3	(35.8)
Corn yield in thous tons	(2730)	4047	6503	4846	5379	5612	4750	5117	6051	(4236)
Hectare yield of corn (cwt.)	(13.1)	10.0	11.7	9.7	10.4	10.7	9.3	10.2	12.3	(11.8)

1) New Frontiers

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From 1924 to 1938 the cultivation area of Rumania expanded from 119 thousand sq. km. to 134 thousand sq. km., which means 40 to 45 per cent of the country's total cultivation area. (See Illustration 53 for relative importance of the different regions.)

Illus. 53. The Cultivated Land of Rumania.

The map (1937) shows the percentage of the cultivated soil compared to the total area; it is based upon data obtained from each one of the provinces. In the whole, 45 per cent of Rumanian surface is cultivated and some parts of Rumanian lowland belong to the most cultivated regions of the world.

Illus. 57. Well developed Rumanian corn; no intermediate cultures. The thickness of sowing is typical for many regions of southeastern Europe; notice the aerial roots.

In the course of the development the grain culture kept, on the whole, its dominating place within the field cultures of Rumania, which is proved by the fact that in 1924 it occupied 86 per cent and in 1938, 84 per cent of the total cultivated area.

In southwestern and northeastern Wallachia and in south Bessarabia the grain plantings normally occupy up to 90 per cent and over of the cultivated soil. (Illus. 58)

Illus. 58. The Grain Areas Presented in Percentage to the Total of Cultivated Soil. 83 percent of Rumanian arable-land is used for grain culture; the grain crop is prevelent in Rumania as otherwise only in Turkey, Japan and a few other individual countries of the world.

Though the total grain growing of Rumania showed an amazing development, the corn growing was still leading and, the increase of the corn area was much more intense than the one of the wheat area; so the

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relative stand of corn to the end of the decade 1930-40 much higher than in the after war years.

The table 36 shows clearly that the expansion of corn sowing is due not only to the increase of the whole planting area, but occurs distinctly at the cost of other grain areas: the cultivation of barley and oats in the respective space of time declined enormously, especially from the relative viewpoint. In 1938 barley was sown only on 3/4 of the soil it occupied in 1924, at the same time the oats sowing decreased by one half.

In return, during these fourteen years the wheat area expanded by 21 per cent and the corn area by 38 per cent. (See Table 36, next page)

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Table - 36

Rumanian Grain Growings

	1924	1931	1938
Arable land in sq. km.....	118.7	134.9	134.4
from which:	100 %	100 %	100 %
Grain area.....	86.0%	85.3%	83.8%
Corn.....	30.5%	35.5%	37.2%
Wheat.....	26.7%	25.7%	28.4%
Barley.....	15.6%	14.2%	13.5%
Oats.....	10.4%	6.5%	4.8%
Rye.....	2.3%	3.0%	3.6%
Millet.....	0.4%	0.5%	0.2%
Dhurra.....	0.1%	0.1%	0.1%

End of Translated Section

July 18, 1951

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Tverdovskii, V. Seed supplies of the Soviet Union.
Interagra 2:326-329. 1948 28 In825

Not used
Contains no mention of growth substances

Translated from the Russian by
S. N. Monson

Seed Resources of the Soviet Country

The communication of the Gosplan of the USSR (State Planning Commission), published officially on April 15, concerning the results of the achievements of the government plan on the restoration and development of the nation's economy in the first quarter of 1948, indicates a vast growth in industry, transportation, and agriculture. The first quarter served as a preparatory period for agriculture with respect to spring sowing. This preparation, according to the communication, proceeded on a larger scale than in the preceding year.

The repair of tractors was accomplished in time and in many districts and republics of the Union even ahead of time. In the first quarter, the collective farms completed the seeding for spring sowing to conform with the established program of widening the sowing areas. Up to the first of April the size of the seeded area of grain crops exceeded that of the previous year one-and-a half times. Taking into account that the sowing area of the USSR will in 1948 increase some 15.5 percent (in grain seed alone some 11 percent), it is evident that the Soviet farmers have provided for a large supply of seeds.

However, not quantity alone is involved here. The seeds are also of high quality. Soviet farmers assured themselves of a supply of seeds that will produce good races.

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Tverdovskii, V. Seed supplies of the Soviet Union.
1948

In the present year over three quarter of all primary grain crops will be sowed with graded seeds. In 1949 the transition to a uniform sowing, regionalized with graded seeds of winter and summer crops of higher yields, will be completed.

This tremendous work of creating a powerful seed-growing base will be the result of a wide network of scientific-research institutions, government grading stations, regional seed growing economies, and finally, of grading "lots" of the collective farms themselves. The country possesses an enormous seed growing economy which unites close to 250,000 seed growing units.

The farmer knows that one variety differs from the other. Two different varieties of the same crop, within the same conditions, may act differently. It is therefore necessary to sow not only graded seeds in general, but those of the highest yield, best adapted to local conditions, and most resistant to all kind of disease. In the present year, the Soviet farmer will use new varieties greatly superior to the older ones. New varieties of grain, oil, technical, and leguminous crops, differing from the older cultures in general productivity and yield, will be widely spread.

In the past years selectors have produced and the government commission of grade-testing has regionalized 121 varieties of summer wheat, 29 varieties of oats, 54 varieties of summer barley, 90 varieties of winter wheat, and many others. The famous Soviet selector, Dr. Alexander

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Shehurtzin has produced 30 different kinds of grain crops, primarily wheat. Selector Lukianenko of the Krasnodarsk Selection Station has in the past few years produced 13 new varieties. The selector Gramochevski in Azerbajian produced 24 new varieties suitable to local conditions.

In the East much attention is paid to a new variety of summer wheat produced by the Siberian Grain Institute, "Milturum-553". According to tests, this wheat surpasses in yield the prevailing varieties by 2-3 centners; at a medium yield it produces no less than 20 centners per hectare. This year hundreds of thousands of hectars will be sown in Siberia with new economically valuable varieties.

The variety of summer wheat "Moskovka", produced by the Institute of the Non-Black Earth Belt (it's author is prof. V. Pisarev) is particularly valuable. The variety "Moskovka" will be distributed in 1948 not only in the Moscow region, but also outside of it. Its characteristics are: non-exacting as to soil, high resistance to disease, excellent baking qualities, does not lodge or crumble, of a yield which surpasses the prevailing variety in the district on an average of 5 centners per hectare.

In the dry steppe regions of the Ukraine and the Rostov region new prospective varieties of winter wheat, produced by the Odessa Selective Genetic Institute, have gained a wide distribution. They were the result of the hybridization of drought-resistant and productive varieties with frost-resistant ones. In this year alone, the grade "Odesskaya 3" will be planted on one million and a half hectars in the Ukraine.

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In the Northern Caucasus, in regions where wheat plantings are frequently affected by rust, thereby reducing the yield, a stable and highly productive variety, the "Novo-Ukrainka-83", produced by the selector Lukianenko at the Krasnodarsk Selection Station has established itself. In almost all geographical regions, that have their peculiarities in soil and climate, new grades have been produced that yield good crops and are adapted to local conditions.

The grades of high yielding oil crops of the sunflower plant have gained a wide distribution this year along with new improved varieties of long-fiber cotton, flax, and other cultures. Of special importance to the national economy are the new varieties of potatoes which are totally resistant to disease.

Strict supervision has been established in all collective and state farms with regard to the protection of grade purity, the proper usage of graded seeds, and the quality of the seed material. Each kilogram of graded seeds is subject to strict documentation. Some 4,000 seed-control laboratories analyze several times each year the seeds of the collective and state farms with respect to propagation, humidity, contamination, etc. If seeds are not equal to the standards established by the government they are, as a rule, not permitted to be grown. The spread of fungi and bacteriological diseases of plants is anticipated and controlled by the treatment of seeds prior to the planting.

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End of Chapter

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Tverdovskii, V. Seed supplies of the Soviet Union.
Interagra 2:326-329. 1948.
English summary
Cereal varieties

English Summary

In 1948, more than three quarters of the acreage in principal species of grain will be sown with assorted seeds. Next year this practice will be extended to the entire acreage of winter and spring crops. The realization of this task has been made possible by the vigorous support on the part of the vast net of Soviet scientific research stations, government seed improvement stations, regional seed growing farms, and seed growing sections of the collective farms. The Soviet Union has a vast seed improvement service, carried on in about 250,000 stations and institutions.

In the current year Soviet farmers in all parts of the country are using seeds better adapted to local conditions, yielding better crops, and more resistant to diseases than those which they have been using until now. Soviet selectionists and the Government Plant Selection Commission have, in recent years, distributed in different regions 121 varieties of spring wheat, 29 varieties of oats, 90 varieties of winter wheat and 54 varieties of spring barley.

Special mention must be made of a new variety of spring wheat, used in Siberia, which exceeds in yield any other popular variety by 440 to 660 lbs per hectare on fields with a crop of at least 4410 lbs. Hundreds of thousands of acres in Siberia will be sown with this variety of spring wheat this year. Another very valuable variety of spring wheat is "Moskovka", sown in the Central Area, which is characterized by a high disease resistance

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and an excellent baking quality, together with a yield exceeding that of other varieties, current in that area, by 1120 lbs per hectare. In the drought-afflicted steppes of the Ukraine and the Rostov Region, a new promising variety of winter wheat, produced by the hybridization of drought - and frost-resistant varieties, is being used.

In almost every geological region with particular soil and climatic conditions, new varieties of grain, excelling in high yields and adapted to local conditions are being used.

Strict control of preservation of the purity of the seed material, of its correct use, and of its quality is being exercised. The selected seed material is being supervised by approximately four thousand seed control laboratories, which forbid the use of seeds whose qualities do not conform to the norms laid down by the Government.

The wide extension of seed culture in the Soviet Union, and the rapid increase in its sown acreage constitute a great victory for Socialist agriculture.

End of Summary of Chapter

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Nikitin, I.
Agricultural Scientific Institutions in 30 Years of Soviet Rule. Socialist Agricultural Economy
18(12):57-61, 1967. 281.8 So73

Translated from the Russian
S. L. Monson

5

Socialist agricultural production is being built on scientific foundations. The Communist Party and the Soviet government devote particular attention to agricultural science and contribute towards its development in every way. In 30 years of Soviet rule hundreds of institutes, experiment stations and fields were organized in our country. Large scientific cadres were drawn for training from the worker - and peasant classes. Soviet agricultural science's accomplishments are truly enormous in the field of plant growing, animal husbandry, mechanization, and other branches of work.

The first experimental field was organized in Russia in 1800, at the scientific farm of the Gori-Goretski Agricultural Institute (now the White-Russian Agr. Inst.). The former operated up to 1863.

Scientific work abroad began its development somewhat latter than in Russia. The first experiment station was set up in England - at Rothamsted in 1842; in 1851 an experiment station was opened at Lekhorn near Leipzig, Germany; in 1857-66 at Nancy and Vincennes, France; in 1870 - in Italy, in 1872- in Belgium, in 1875 - in Spain. The first experiment station opened in 1875 in the USA was located at Connecticut; Canada's first station was established in 1887. In 1864 an experiment station was also established in Russia at the Riga Polytechnicum. It lacked, however, an experiment field and did not apply the vegetational field method but

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conducted only laboratory analysis. It was actually a laboratory devoted to soil chemistry. Upon the initiative of the famous Russian scientist-chemist D. I. Mendeleev, collective experiments were organized in 1867 in the St. Petersburg, Moscow, Smolensk, and Simbirsk gubernii, where the reaction of mineral fertilizers upon field crops were studied. These experiments were conducted only for two years, and then discontinued. All research work on agriculture stopped after that.

Only in 1881 the Trostenetskaya Experiment Station was established on public funds. It was followed in 1882 by the Pelokrinitskoye experiment field, in 1884 by the Studenetskoye experiment field, and in 1885 by the Poltava experiment field, and several others. All of these were discontinued a year or two after their establishment, except for the Poltava experiment field station which remained in existence as an experiment station of field crops up to 1929 when it was reorganized into the forage branch of the Ukrainian Institute of Swine husbandry and later into a division of the All-Union Forage Institute.

It is apparent from this that the first experiment field stations were organized in the southern part of the country - in the regions of sugar-beet sowing. They served the economic needs of country estates primarily and were engaged chiefly in the study of agricultural methods and practices and the introduction of fertilizing. Animal husbandry was not studied at all, nor was there any trace of the study of the problems of agricultural mechanization.

In 1895 there were altogether only 27 experiment institutions within

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the territory of Tsarist Russia, of these 10 were experiment stations, 15- experiment fields, 2- laboratories, and 2 - seed-control stations.

The latter were actually seed-control laboratories and not stations in our present definition of the term. Of this number one experiment station and one seed-control station were situated in Poland.

It follows therefore that in 1895 there were only a total of 25 experiment institutions within the present borders of the USSR, including the seed-control and other laboratories, while there were but 22 experiment stations and fields for the entire limitless expanse of Russian land.

At that one half of the experiment institutions of that period was organized by the zemstvo, (rural self-government agencies), various societies and individuals. The expenditures made by the Tsarist government were insignificant, amounting altogether to 190,000 rubles. Equally insignificant was the number of scientific personnel assigned to the experiment stations, consisting altogether of 57-58 people. Each experiment institution had an average of two scientific-technical workers, of whom only one possessed a higher education. In 1913 there were 122 experiment institutions within the territory now occupied by the USSR; of these were 44 experiment stations and 78 experiment fields; there were altogether 214 experiment agricultural institutions in Tsarist Russia, which included a variety of laboratories. The majority of experiment stations was organized between 1910 and 1912. By that time many experimental institutions, organized in 1895-96, were discontinued for lack of consistent financial support. Because of the latter situation the results

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of the work of these institutions were pitifully small. Support extended by the Tsarist government for the financing of the entire network of experiment institutions amounted to 2,554,000 rubles. The scientific-technical personnel numbered about 440 people. There was an average of 3-4 people per institution, of whom only two had a higher education. The largest experiment stations of that period - the Kerenchuk, Shatilov, Saratov, Engelhardt - stations - had a permanent staff of from 4-6 scientific workers, including the laboratory personnel and "method-observers".

The scientific institutions engaged primarily even at that time in the study of problems of agricultural technical methods and the fertilization of field crops. The study of animal husbandry was conducted in only one experimental livestock farm and in several dairy laboratories; problems of fruit growing were dealt with in one experiment truck garden. Problems of mechanization were taken care of at only the Adzam experiment station where a research machine department had been set up, that studied primarily horse-driven ploughs and harrows. All work was still in an embryonic stage.

Experiment stations and fields were also all located chiefly in European Russia. The border regions and those of the various nationalities possessed either an insignificant network or none at all. The experiment stations served primarily the private estates and kulak eco-

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nomics, the real mass of the population not deriving any benefit from the work at all. Conditions prevailing within the network of experiment institutions, immediately prior to the Great October Socialist Revolution, were practically the same.

A new era began in agricultural science from the day the Soviet rule established itself. The Bolshevist party and the Soviet government maintained the principle that the development of a people's economy, including an agricultural economy, was to be built upon a scientific, planned foundation.

In order to bring planning and organization into scientific-research, all experimental work was started on a zonal principle. Regional experiment stations were placed at the head of experiment institutions, with the former subordinated to the experiment divisions of the Narkomsem (Peoples Commissariat of Agriculture) of the respective republics. A total of 21 regional experiment stations were organized. In addition 11 institutions of all-Union importance were established. The scientific center was maintained by the Government Institute of Experimental Agronomy.

Aiming at the organization and direction of scientific-research work to satisfy the needs of a developing socialist agricultural economy, and in order to coordinate scientific work and the best scientific supervision, as envisaged by our great teacher, V. I. Lenin, the Soviet of People's Commissars of the USSR created on June 25, 1929 the Lenin All-Union Agricultural Academy , this to be assisted by a network of general academic

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institutes and specialized branches. The entire network of experiment institutions of the districts and regions was subordinated to these branch institutes. All scientific and administrative direction of the network of experiment institutions and their financing was concentrated at the Academy. This set-up played an enormous role in mobilizing scientific material within the separate fields of agriculture, the individual crops, and species of domestic animals.

The experimental institutions were, however, losing contact with the field organs, and on July 16,1934 an order of the SNK (Soviet Narodnikh Kommissarov) ordered the reorganization of the Academy of Agricultural Sciences and the organization of a regional and district network. According to this new order, almost every region and district was to establish regional and district experimental stations for field study, animal husbandry, gardening, and vegetable growing, along with a network of experiment fields and points directly subordinated to the regional, district territorial administration, and through the latter to the corresponding specialized main administration of the Narkomsem (People's Commisariat of Agriculture) of the respective republic or the Narkomsem of the USSR. The branch institutes were directly subordinated to the productive administration (points) of the Narkomsem of the USSR and those of the southern republics.

The allied narkomats (People's commissariat), such as the NKP of Food and Industry, Soviet Agriculture, Health, the Administration of the Extreme North - and other departments developed their own network of experimental

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agricultural agencies which were directly dependent upon them.

In the establishment of scientific methods, the regional and district experiment stations, along with their network, were attached to the branch institutes. For instance, the Institute of Northern Grain Economy and Leguminous Crops was to supervise the work of the following district experiment stations on field crops: the Moscow, Smolensk, Ivanov, Kalinin, Archangelsk, Chuvash, Kirov, White-Russian, Karelian, Gorki, Sverdlovsk.

The Kuibishev Ukrainian Institute of Grain Economy was to supervise all district experiment stations on field crops in the Ukraine. The Michurin Scientific-Research Institute of Fruit Growing was to guide the network of experiment institutions on fruit and berry crops in the Central USSR. The All-Union Scientific-Research Institute of Flax intended to supervise all experiment institutions studying the latter crop.

The Lenin All-Union Academy of Agricultural Sciences was to extent its scientific supervision over the entire system of scientific-research institutions dealing with Soviet agriculture.

At present a vast network of scientific-research institutions relating to all branches of agricultural economy has been established in the USSR. The number of each of these is listed in Table I.

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TABLE I

Type of Institution	As of Jan 1, 1913	As of Jan 1, 1947
I. Total number of scientific - research institutions	122	921
Among those:		
Institutes	-	111
Branch Institutes	-	16
Experiment stations	44	425
Experiment fields	78	81
Support bases, points d'appui	-	280
Laboratories	-	5
Botanical Gardens	3	3

The total number of scientific-research institutions, as divided into separate special fields, is distributed in the following manner in Table II.

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TABLE II

Complex and Grain Institutes and Experiment Stations	223
Selective experiment stations of Grain Crops	70
Of Technical Crops (cotton, flax, sugar-beet, tobacco, etc.).....	109
Fruit, Citrus, and Grape growing (viticulture)	122
Leguminous Crops and Potatoes	51
Hydro-technique, Melioration, Peat	59
Agricultural Forest Melioration	37
Polar Agriculture	17
*Plant Protection	25
*Mechanization and Electrification	12
Animal Husbandry (including Apiculture, and Silk-Worm Breeding	129
Veterinary	40
Other experimental institutions (agricultural chemistry, physics, microbiology)	27

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* These institutions are highly specialized. Aside from these, all branch institutes and a large number of experiment stations carry on research on plant protection work, as well as on the mechanization of processes to produce crops under study.

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Aside from the numerical growth it is important to note the immensely grown power and increase in equipment at contemporary experiment stations compared to those of pre-revolutionary days.

Today's complex and specialized plant-growing experiment stations which consist of a number of scientific departments on agricultural practices, agricultural chemistry and fertilization, selection, plant protection, mechanization, etc.) are provided with greatly perfected laboratory and economic equipment and possess not only single staff members but tens and hundreds of scientific and technical personnel. Many of the former district experiment stations were transformed into institutes. For instance, the Omsk district experiment station was transformed into the Siberian Scientific-Research Institute of Grain Economy. The Saratov district experiment station - into the Scientific-Research Institute of Grain Economy of South-Eastern USSR. The Odessa district experiment station into the All-Union Selective-Genetic Institute; the Kamenno-Steppe Government Selection Station of Grain Crops - into the Dokuchaev Institute of Agriculture of the Central-Black Earth Belt. Pre-revolutionary Russia did not possess a single scientific-research institute devoted to the study of agriculture. 111 institutes were organized in the 30 years of Soviet rule, among them such giants as the All-Union Scientific-Research Institute of Plant Growth (VIR), with its network of branches and stations, a staff of 963 people and a budget for 1947 of 13,861,000 rubles; the

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All-Union Scientific-Research Institute of Fertilization, Agricultural Practices and Agricultural Soil Study (VIUAA), with a staff of 428 people and a budget of 8,302,000 rubles; the All-Union Scientific-Research Institute of Mechanization and Electrification of Agriculture (VIME) with a staff of 414 people and a budget of 8,652,000 rubles; the All-Union Scientific-Research Institute of Plant Protection (VIZR), with a staff of 451 people and a budget of 7,975,000 rubles.; the All-Union Scientific-Research Institute of Cotton Crops (SOUIZNIKHI) with a staff of 829 and a budget of 7,946,000 rubles; the All-Union Scientific-Research Institute of Animal Husbandry (VIZ) with a staff of 236 and a budget of 4,412,000 rubles; the Michurin Scientific-Research Institute of Fruit and Berry Crops with a staff of 231 people and a budget of 2,257,000 rubles; the All-Union Scientific-Research Institute of Tea Economy and Sub-Tropical Crops with a staff of 427 people and a budget of 5,057,000 rubles.

In addition, the network of branch institutes and experiment stations was widely developed to cover the study of all basic branches of socialist agriculture, - grain economy, cotton, flax, and other bast crops, sugar beet, rubber, and all species of animal husbandry, as well as veterinary science. The enormous network of scientific institutions devoted to agriculture is properly distributed throughout the territory of the USSR. In organizing it consideration was given to the servicing and study of the productive agricultural regions of all Soviet Republics, as well as to the

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newly added regions, while with regard to leguminous crops, the servicing of the industrial centers and large cities of the USSR was ~~next~~ Kept in mind.

Simultaneously with the growth of the scientific-research network grew the scientific cadres of rapidly trained personnel drawn from the worker - and peasant classes. At present the scientific and technical personnel of the entire network consists of 58,518 people. Of this number - 10,396 are scientific workers, (32 academicians, member-correspondents, and active members of various academies; 378 professors and Ph.D-s, and 2226 graduate students in agriculture and other sciences).

The agricultural VUZ-i (Institutes of Higher Education) carry on, in addition, vast scientific work, possess well equipped laboratories, and a large number of highly qualified personnel. There are 86 agricultural VUZI under the Ministry of Higher Education of the USSR. Of these - 60 are devoted to Plant and 38 - to Animal Husbandry and Veterinary Study.

Over 600 problems are being studied at the agricultural VUZI, covering over 3,500 topics on various problems concerning agriculture. 5122 scientific workers are engaged in the work, among them are - 20 academicians and active and members-correspondents of various academies; 698 - professors and doctors; 2001 graduate students.

Aside from the network of scientific-research institutions, experiment stations, fields, and support points conducting manifold scientific-research work on all branches of agriculture, there also exists a large network of plots where variety-testing of field, leguminous, and other crops is

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conducted. The work at these variety-testing points is not limited to the comparative study of the relative yield of varieties of agricultural crops, but many of these are also working on problems of agricultural practices with regard to varieties. These plots should therefore also be included into the general network of experiment institutions devoted to agriculture. The organization of variety-testing points was begun in full after the October Revolution and was connected with the widely spread work of producing new varieties demanding experimentation with regard to their respective yields and other qualities, depending upon the different natural-historical regions.

The network of variety-testing points for 1947 is listed in Table 3 below:

TABLE III

Points of variety-testing, according to Crops	In 1947 Number of points	Budget in thousands of Rubles
Of Grain, Leguminous, Oil-Crops and Perennial Forage Grasses	1056	47,100
Of Cotton	92	-
Of Flax	89	
Of Hemp	22	
Of new East Crops	15	
Of Rubber Plants	9	12.126
Of Sugar-Beet	52	
Of Tobacco and Makhorka	50	

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TABLE III(cont'd)

Of Sub-tropical Crops	20	
Of Mulberry	22	
Of Leguminous Crops and potatoes	427	5,800
Of Forage Grasses and Root Crops		
Total	1664(?)(1854)	65,026

In 1947 - a staff of 3598 scientific-technical personnel worked on the indicated variety plots; among them were 1729 scientific workers and of those 46 were "candidates" with science degrees.

For the purpose of daily scientific aid to collective farms on problems of fertilization - 550 agricultural chemical laboratories were active at the MTS (Machine and Tractor Service Station) in 1947.

In order to control the quality of sowing seeds in the various republics, regions, and districts - 2127 seed-control stations and laboratories were organized in 1938. In 1947 there were 3924 stations and laboratories at work, of which 174 were intended for republics and 3750 for other regions and inter-regional use. Let us sum up our data. Prior to the Great October Socialist Revolution there were in Tsarist Russia 214 scientific-research institutions devoted to agriculture, on which a total of 2,534,000 rubles was being expended. In the years of Soviet rule the network of

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agricultural scientific-research institutions increased several times and was represented as follows:

Scientific-Research Institutions (institutes, experiment stations and fields, and support points)	921
Agricultural VUZ (higher education institute), carrying on scientific-research work.....	88
Variety points for all Crops	1664
Agricultural Chemical Laboratories	350
Seed-Control Stations and Laboratories	3924
Total:	6947

Engaged at work in scientific-research institutions (institutes, experiment stations, etc.) VUZI, and variety points there are now, - in place of the 440 people working in 1913, - a total of 62,238 employees, of whom 16,990 are scientific workers, and among the latter are 52 academicians, member-correspondents and active members of the Academy; 1076 professors and doctors, 4273 - candidates of science.

It is evident therefore that agricultural science has been really called to life in our country by Soviet rule and been placed at the service of the working class. Soviet agricultural science has in various fields taken advanced and leading positions in world science. It would have achieved even greater results had there been no bandit fascist attack upon our country by the Germans.

In the areas occupied by the invaders the greater part of scientific-research institutions was destroyed completely, while the rest suffered in very large measure. Valuable equipment was looted. For instance the

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Smolensk regional experiment field station, the oldest in the country, (the former Engelhardt Station) was destroyed, so were the Lenin Zonal flax experiment station (the former Pskov Station), the All-Union Selective-Genetic Institute (Odessa), the Kuibishev Ukrainian Scientific-Research Institute of Grain Economy (formerly Dnepropetrovsk), and others.

At the All-Union Scientific-Research Nikoian Institute of Tobacco and Mahorka, the former All-Union Scientific-Research Institute of New Bast Crops, the Central Experiment Station for the study of Rice, the All-Union Scientific-Research Institute of Oil Crops - all laboratory buildings were burned down and all equipment destroyed. The scientific-research institutions located in the Ukraine and White Russia were particularly hard hit, - among them the Polesskaya regional experiment station of fruit growing, the All-Union Scientific-Research Institute of Bast Crops, and many others.

At present the greater part of scientific-research institutions destroyed by the invaders has been restored and the collectives of scientific workers are carrying on a vast scientific-research work and are assisting the collective farmer in the reconstruction of post-war agriculture.

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Tsitsin, Nikolai Vassil'evich
Puti sozdaniia novykh kul'turnykh rastenii
(Otdalennaia gibridizatsiia)
[Methods of creating new cultivated plants
(Distant Hybridization)]
Moskva, 1948. 21 p. 463.62 T78

Translated from the Russian by
S. N. Monson

Stenographic Report of Lecture
Delivered by Author Jan. 9, 1948

A superficial survey of the vegetative and animal world on our planet will disclose the extraordinary variety of species of plants and animals in nature. Even representative specimens of the same species, inhabiting different parts of the earth, differ radically from each other.

The eminent biologist Charles Darwin first proved that all the many varieties observed in nature among species are the result of a historical process, an evolution, arising from an uninterrupted method of natural selection, that nature continuously engages in a process of developing new forms and species while the old ones are simultaneously destined for destruction.

This natural evolutionary process of creating new forms and species under conditions depending upon the outer environment is, however, very slow indeed, and occurs in the course of changes in generations. Many years of form-creation have to go by before finally one or the other new species makes its appearance.

There is no doubt but that natural hybridization hastens the creation of new forms and species in nature.

The new properties and qualities of a hybrid gradually acquire stability and the capacity of transmitting inheritable

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characteristics in conditions of repeated hybridization.

If this process, with regard to new kinds of plants and species of animals were to occur easily, the work of a selector would be simple. He could isolate any number of new kinds and varieties by a simple method of selection, as was done by the famous American selector Luther Burbank in the early stages of his career, which led to the vast dispersion of the rich plant world of Southern California to other regions.

While natural hybridization between representative specimens of various species is a rather common occurence in nature, it, nevertheless, is not always accompanied by a new third individual type. Besides, this third individual type, produced as a result of the fusion of two individual types of various species, is frequently sterile and does not breed descendants. Only upon a repeated hybridization of the hybrid with one of the original forms of hybrids (maternal or paternal) does it acquire fertility and forms a new organism which frequently may not resemble either of its parents in its biological and morphological traits.

There are also instances when even repeated hybridization of inter-specific hybrids does not produce adequate results. In order that a repeated hybridization take place naturally a series of favorable conditions is essential, which is not always possible in a natural environment.

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This is the reason why man in his life span seldom observes changes in the properties and symptoms of one or the other species, while engaged in the study of nature's continuous formative process.

In observing the natural process of the creation of new types and forms of vegetative and animal organisms in nature, in studying its laws and making them serve man, we are able to create new types and kinds of plants and species of animals by intervening in transforming nature.

Soviet science firmly takes the position of active transformation of nature. "We may intervene in nature's actions and as a result of sensible interference successfully hasten the formation of new types and direct their growth towards bringing most benefit to man" - wrote the distinguished transformer of nature, I. V. Michurin.

"Our present task consists in finding a way, a method that would enable us to intervene with greater ease and more successfully in nature's functions, thereby disclosing its "secrets". On the basis of my personal experience, dating back over 60 years of uninterrupted work, I believe that this path leads through artificial hybridization."

Cross pollination in sexual propagation represents one of the most essential points in the development of the growing

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organism. This form of pollination was developed as a result of many evolutionary changes and at the present time it has become an inalienable property of growing organisms on the higher evolutionary steps. Hybridization provides new material for selection with the aid of which the selector is able to create new forms of organisms, radically transforming their hereditary nature.

Selection, which represents one of the widest branches in agriculture, is exercising considerable influence on the development of socialist grain economy. Selecting has been widely developed in the Soviet Union. It is sufficient to point to our 69 selection stations, not to mention the numerous scientific research institutions and agricultural experiment stations also engaged in selective work.

A special place is assigned to DISTANT HYBRIDIZATION which permits the combining of the most valuable characteristics of various species in one type, and which may not be compared with any other hybridization in that it provides an enormous variety of hybrid descendants - the initial material for further artificial selection.

The use of the method of distant hybridization (that of cultivated plants with wild species) represents the main and principal new direction in selective work. The Institute of

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of Grain Economy of the Non-Black Earth region (belt) (the village of Nemchinovka, below Moscow) differs from many other scientific institutions and selective stations of the Union in that it engages in the study and research of this new method.

The main object of our study is devoted to WHEAT.

Wheat - is the principal grain culture in the world and it takes first place in acreage under crop. All through history and among all peoples this culture was treated with love and appreciation, given careful attention and protection. In the course of thousands of years, agriculture produced many species and varieties of wheat, known to us today. The creation of a new and improved type of wheat is the dream of every selector, and successful efforts in this direction are greatly appreciated by society.

It has been historically proven that mankind has worked at cultivating wheat for over four and a half thousand years, and in our time the world possesses numerous valuable varieties, many of which have firmly established themselves in modern agriculture. Nevertheless, all these varieties and forms of wheat, available at the present time, are only the forerunners of an ideal type of wheat towards which humanity aims.

To no other culture does man present similar claims, since the role of wheat in public nutrition grows steadily from year to year.

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What are these claims? To begin with, wheat must be highly productive, with a heavy, well-formed grain, a large yield of flour, a satisfactory thrashing capacity. It should not lodge or crumble; it should withstand drought. Winter-wheat, in addition, should be able to resist the influence of low temperature, wetting, should be immune to fungus diseases, specifically - rust, smut, mildew, fusarium, etc.

With the transfer to the rotary process in milling, the demands regarding the quality of grain were considerably changed. The baking industry now demands a glass-like wheat, rich in albumen, with a large yield of bread, the latter required to be of good porosity, pleasant color, etc. We could mention many more features desirable in wheat that would bring it closer to the ideal type.

Such product has, however, not been produced as yet by man. Most often it happens like this: the variety is satisfactory in harvest quality but its baking grade is poor; a variety may be resistant to drought but very inadequate with regard to its resistance to low temperatures. A grade may be of high productivity but subject to fungi disease, etc.

The greater part of known species of wheat represents the result of an ordinary selection of local varieties. There are some valuable selective types produced by man synthetically with

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the use of the selective method. It has, nevertheless, not been possible to fix in these types the entire complex of traits useful from the point of economy.

In the past decades the principal method used in many countries to produce new kinds of wheat has been hybridization. This method has been responsible for the best world-known grades. For instance, the variety of the summer grain crop of the Canadian wheat "Marquis", which covers almost 3/4 of the grain acreage of Northern America, is a hybrid, towards which our Siberian summer grain crops have contributed in large measure.

The USSR also cultivates many excellent grades of hybrid wheat. Still, all the hybridization took place chiefly among the varieties and types within one species. The predominant part of varieties represents a mixture of different forms of soft wheat with the addition, in separate instances, of other closely related kinds.

Selectors, in their desire to combine separate valuable traits and characteristics of individual types, and using for the purpose hybridization methods within the species and between species, have, nevertheless, not succeeded in obtaining those types of wheat which would prove fully satisfactory to our socialist economy. When then do we choose the method of DISTANT HYBRIDIZATION, i.e., the hybridization of cultivated plants with wild ones?

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Ivan Vladimirovitch Michurin says: "by crossing wheat with wheat, you will get wheat and nothing else. It is necessary to find new ways in selecting components that are stronger than wheat."

This statement of Michurin's has been accepted as a basis in our scientific research. In our search for strong producers for the creation of a new type of wheat we turned to nature itself which has a multitude of plants yet unexplored and used. and amazes man by their elasticity, steadiness and other valuable characteristics, that far exceed the properties of any cultivated plants. This is altogether comprehensible.

The process of evolution in cultivated and wild-growing plants proceeds differently. While cultivated plants, though originating from those grown wild were changed over a period of thousands of years to meet man's requirements, this has frequently been achieved at the expense of the plant itself. As a result, the cultivated plants have acquired over a span of centuries properties and qualities which are demanded by man and not the plants themselves. The wild-growing flora has in the meantime, however, stored within itself such properties and traits that are necessary for the plant itself in its fight for survival and distribution in nature.

Charles Darwin wrote that "man selects for his own advantage,

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nature -- for the benefit of the being to be protected. Every trait so selected goes into play, and the being steps into life, under well adapted conditions."

The result is that all cultivated plants have reached us in a state of fragility and delicacy, in a relatively weak state, unable to survive without the aid of their constant protector - man, while in wild-grown plants there is contained a tremendous force, capable of withstanding any adversities of the outside environment. "How fleeting are man's wishes and desires - wrote Darwin, how short his time...and how pitiful the results he achieves compared to those stored by nature over many geological periods. How can we be surprised at the fact that nature's products have a more "real" character than have those of man, and that the former are infinitely better adapted to the most complicated conditions in life."

This is actually true. In spite of the experience gained by agriculture over many thousands of years, the assortment of world plants is comparatively poor in terms of cultures. No more than 50-60 agricultural plants (cultures) have gained a wide industrial distribution. This means that man is only approaching the stage of rational use of the vegetative products of the soil and the exploitation of unused wealth of vegetation in an inexhaustible natural flora.

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It is known that nature produces over 200,000 species of Angiosperms of which only 250 are being used in agriculture. Natural vegetation resources represent, however, gigantic green "mines" which can and should be utilized by man as an unlimited potential source for the creation of a new world of cultivated plants.

To let wild-grown plants, occasionally even weeds, serve man - is the direct task of the selector. The wild-growing flora should enter the history of selection as one of the most powerful means of transforming the nature of cultivated plants.

I. V. Michurin drew his material for the creation of new kinds of fruit and berry cultures from natural vegetation stocks. The famous "Bastard Cherry" was the result of a cross between the cherry "Rogneda" with a wild black cherry. The excellent myrtle-leaved cherry "Ideal" had its origin in a wild-grown cherry of the Samara steppes of which the flower was fertilized with the pollen of a Pennsylvania American cherry. The famous Michurin plum "Thorny Reine Claude" was derived from a cross of the "Green Reine Claude" with a wild thorn, while the splendid pear "Russian Experen" is the result of the fertilization of the "Bergamot" by the pollen of a wild Ussuri pear.

The finest grades of Michurin ashberries originated from the common bitter ashberry; new, unexcelled species and varieties of

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apple trees are descendants of diverse wild-grown species of Siberian and Far Eastern plants. The wild Actinidia that grows in the forests of the Ussuri region and in Eastern Manchuria was changed by Michurin's hands into a cultivated plant and serves as a sort of a substitute of the grape in the North.

It is known that the principal source for the creation of new selected kinds of apple trees in Northern America was found among the frost-resistant varieties of the Siberian wild apple trees. The best grades of American pears were obtained from crosses with varieties and kinds of the wild Ussuri pear. A small heap of seeds of the lucerne collected by Americans in the Semipalatin region led to a wide distribution of the culture of lucerne in the USA, which at present covers tens of thousands of acres.

The wild-grown flora represents an inexhaustible source of hidden natural forces and the selector will find in it the support needed in aiding him to direct the vegetation of cultivated flora, into serving the interests of mankind.

Michurin was right in writing: "In order to secure a continuous flow of economic plants from nature, it is necessary to search untiringly for such plants so as to create new cultures, utilizing the accumulated experience of research workers, and increasing this experience by a further study of mountains,

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forests, steppes, and bogs of our boundless borders, the mountainous Caucasus, in particular, as well as the Far Eastern regions of the country that hide in their depths a vast multitude of unexploited species of plants."

Following the path outlined by Michurin and aiming at discovering new wild plants suitable for the production of a radical change and innovation in the culture of WHEAT, our attention was drawn to the most injurious weed in our fields - couch grass (Agropyrum).

What does Agropyrum consist of? Its name implies "the fire of fields". We call it "witch-grass", "sucking-grass", "wolf", and in olden times, it was referred to as "God's punishment". The farmer has for ages cursed this grass. Its appearance in the fields was equalled to green pestilence and drove people to despair. Often a farmer, exhausted by his fight with couch grass, would abandon his homestead and go in search of new land.

Couch grass is to be found everywhere, all over the world. It grows in swampy sections near sedges, on solonchak, solonetz, on "borovoi" sand, on stony mountain slopes, hot steppes, and in the shade of trees and shrubs. It is difficult to find a plant as sturdy and persevering in its fight for existence as is couch grass. It has an enormous capacity for propagation. The tips of its runners, protected by scaly leaves, are so strong that they

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are able to penetrate any soil; it is most resistant to droughts and frost, very unpretentious with regard to soil, withstands well fungus disease. And finally, couch grass is a perennial.

Its qualities stand out particularly when compared to wheat. There is no kind of wheat that is not subject to disease of some sort, while there are species of couch grass almost totally resistant to any disease.

Moreover, even if artificially infected, couch grass preserves its immunity to disease. Wheat suffers yearly from untold harm from frost, dry wind and other unfavorable climatic conditions, but couch grass withstands them all. While wheat grows only on selected, well cultivated fertile soils, couch grass as, for instance, the solonets kind, prefers solonets soil to black earth.

And finally, with regard to its productivity, they are plant-antipodes. The grains of wheat and couch grass are not to be compared in size. One thousand grains of wheat weigh 50 grams, the same amount of couch grass only 5-6 grams. If one compares however the harvest derived from one clump of either wheat or couch grass, the picture is radically different. The advantage offered by couch grass lies in its being more bushy and having a larger number of grains to one spike. One spikelet of wheat contains from 3-4 grains, one of couch grass - from 10-12 grains. Couch grass possesses altogether such a number of

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economically valuable biological traits and qualities that any field culture may well envy them.

To take these properties from the wild couch grass and pass them on to wheat - represents an exciting and rewarding task to the selector. The solution of this problem opens unparalleled possibilities in agriculture with respect to the radical change of the nature of the plant, in this case, specifically - wheat.

19 years ago, (1929) we first attempted to cross wheat with couch grass. We tolerated the scepticism of many research workers who considered our search an utopia, suffered many failures in overcoming the barrenness of the first generation of hybrids. Much perseverance, effort and work were required before couch grass was changed from the worst foe into man's friend and made to serve agriculture.

The year 1930 has been a historical date for us. It was the year we first were able to obtain the long-awaited wheat-couch grass hybrids.

In the succeeding years, by crossing cultivated grades of wheat with various species of couch grass, we secured a series of new varieties of winter and summer wheat which exceeded the best currently known standard varieties in many respects. At present we possess many of these hybrids. These have inherited from their parents - couch grass and wheat - such traits as

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resistance to fungus diseases, frosts, droughts, and in addition exhibit a high productivity.

The following main aims were pursued in the crossing of couch grass with wheat:

1. The development of such forms of summer wheat that would in their aggregation of economically valuable traits, their quality, technology and hardiness - prove superior to present varieties.
2. The development of such kinds and varieties of winter annual wheat that would prove sufficiently frost-resistant and adjust to northern conditions.
3. The development of the most interesting and original, in its conception, new culture of perennial wheat.

We naturally met many difficulties while solving these problems. To begin with, a thorough and close knowledge of the plants to be crossed was required, a study of the diversity of their species, that of their principal morphological traits, the biology of their florescence, their general conduct in the various stages of development. In spite of the comparatively adequate knowledge concerning these plants, we encountered - in the course of many years of work - repeatedly new symptoms, difficult to explain and unnoticed until now.

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Having studied - in general outlines - the biology of florescence among the separate sub-species and varieties of couch grass, as well as their morphology, we considered this to be sufficient preparation for the attempt to engage in conscious hybridization; the future showed, however, that our knowledge was inadequate.

We believed, for instance, the species Agropyrum glaucum to possess many varieties fitting into the established scheme of botanical classification: v. Genuinum (so-called "grey"), v. villosum - "furry", v. virescens - green. In the course of further investigation it became apparent that the species - glaucum - is not uniform in many of its traits (winter and summer crops, degree of longevity, its structure of root system, etc.). We established, for instance, radical differences in the nature of the structure of the root system in only one sub-species of the couch grass, -i.e. A. glaucum v. genuinum (grey couch grass).

Along with the forms of plants, regenerating yearly from their central part, we discovered forms that regenerated at expense of new rooting runners, (while the main root stock completedly died), as well as forms that combined both types of root system, with respect to structure and nature of its life activity. The behavior of plants equally varied with regard

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to such important features as winter and summer crops. We established that whenever the trait of winter crop predominated, there prevailed a large number of summer crop forms of plants.

In studying the traits of longevity, we discovered in couch grass an entire scale of forms annual, biennial, 3- and 4, and more perennial forms. Our observations established in these cases facts of wide milti-morphism.

Let us cite an example from our observations on perennial rye, Secale montanum. In 1944 we isolated 32 clumps from the plantings of perennial rye that formed ears the year they were seeded; however, we subsequently observed in annual forms - 3.1 per cent, biennials - 12.9 per cent, 3-year plants - 22.2 per cent.

The poly-morphism of many wild-grown plants, with respect to qualities of summer and winter crops, of both annual and perennial type, compelled us to examine couch grass rather closely. We finally reached the conclusion that couch grass for purposes of hybridization has to be selected individually, taking into account the biological and morphological traits of each clump.

In the early stages of our research we used couch grass as a component for crossing with wheat, judging it on its systematic symptoms. This, however, led us into complicated features in

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formation which we were unable to explain for a long time. Where we expected to find only perennial forms, a series of generations produced annual forms, or a predomination of summer crops was observed where a regression of this trait had been expected.

Our description of biological and morphological varieties observed in wild growing plants led us into errors from the start and frequently puzzled us. At present, on the basis of the acquired knowledge on the polymorphism of couch grass, we are in a position to provide an explanation concerning many features which at first appeared unexplainable.

It is necessary to point to another important characteristic in couch grass - the presence of gluten in its grain.

There are varieties in couch grass almost deprived of gluten (5 per cent) and others that have a large content of it, up to 70 per cent. In view of an inadequate study of this feature, we were unable to obtain hybrid plants with the necessary percentage of gluten, and the varieties grown possessed as a result poor baking qualities. We now have solved this problem as well.

The detailed study of couch grass is continued along the line of proving its maximum physiological resistance to high and low temperatures, the excess or shortage of moisture, salinity, etc.

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Much attention is paid to the study of root systems, as pertaining to the crossing of couch grass plants, with particular emphasis on the characteristics of heredity (fibrous, creeping, its character and degree of regenerative restitution) in hybrid generations.

The accumulated experience permits us to solve our problems more correctly and with greater speed.

In this connection, we refer to the valuable directions given by Michurin who wrote in his article "To my co-workers". 1). "In order to select pairs of plant-producers more expediently, it is essential to gather greater knowledge concerning wild-growing plants in both central belts of the world, as well as of the cultivated forms of fruit-bearing plants and, if possible, the latter's closest relatives; and 2). It is essential to learn, at least approximately, the degree of individual strength in the hereditary transmission of genes to descendants, the species and varieties of plants in the roles of the chosen pair-producer-plant in their different age growth, and in different climatic and soil conditions."

What then are the results available at present of DISTANT CROSSING OF COUCH GRASS WITH WHEAT?

We shall examine two varieties, experimented on in production, belonging to the summer crop of wheat-couch grass. The first kind, known as No. 22850, possesses an entire complex of agricul-

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tural traits, differing from the standard soft wheat - LUTESCENS 62. It does not lodge even at surplus moisture, does not crumble if overripe, mills easily, and takes first place in milling and baking qualities. This grade is not subjected to fungus diseases, and provides a comparatively good harvest.

No. 22850 is well known among the farmer-kolkhozniki of the Moscow region. In 1945, the harvest of this wheat produced 54 centners (50 kg.) from one hectar in the Kolkhoz "Red October" of the Russky region.

In many kolkhoz its yield reached from 36 to 52 centners per hectar last year.

The hybrid No. 22850 possesses another specific characteristic. Since it likes moisture, it furnishes even in wet years a grain of high glasslike consistency, while it is well known that the glass-like trait of grain drops radically under moist conditions. For instance, the glass-like grain "Kubanok" gets usually starchy in wet years. The hybrid No. 22850 presents an unusual exception in this respect. We are of the opinion that this glass-like trait has been inherited by this hybrid from couch grass which preserves the glass-like form of its grain in equal measure in the southern, as well as in northern regions.

The second summer wheat-couch grass kind, - Flora-5, which exceeds the standard "Lutescens 62" in yield and resis-

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tance to drought, judging from our tests of varieties and production, seemed to offer great possibilities for a number of regions in the non-black earth zone. This grade is also distinguished by a high milling and baking quality.

We possess interesting varieties of annual winter wheat-couch grass hybrids. One of them, No. 599, which we named "Shchurdinovka", and concerning which government tests are being completed in the kolkhoz, recommends itself through its economic merits not alone in the non-black earth zone, but also in the southern USSR and Middle Asia. This variety possesses a stable immunity against bunt or stinking smut, even if artificially contaminated. We never observed a case of a plant affected by covered or loose smut.

The variety "Shchurdinovka" does not lodge and yielded in experimental conditions up to 50-60 centners per hectar. A group of kolkhoz in the Moscow region had a yield of 36-37 centners per hectar, an increase of 16-17 per cent above the normal standard.

In the kolkhoz "Pobeda" of the Russky region, the medium yield reached 45 centners per hectar. In the Almatin region this variety, when grown in a kolkhoz - yielded for 3 years from 6-7 centners above the control, and the kolkhoz of the district, appreciating its merits, sowed over 2000 hectars of this variety in the fall of 1947.

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Among the new varieties of winter hybrids, tested for productivity in 1947, one may name Nos. 1, 5, 186, and 6446, as well as others. Their main characteristic consists in the large number of grains per spike, up to 50-80 grains and the high technological qualities of grain, flour and bread. These are all high-yielding varieties.

Following a lengthy and difficult period of experimentation, we succeeded to produce at present a perennial wheat. The first product of this culture was the variety No. 34085. On the basis of the cycle of its development it may be equally reffrred to summer, as well as to winter crops, while according to the character of its florescence, it belongs to either the self-pollinated or cross-pollinating plants.

The traits of this grade are: longevity, non-lodging, resistance to drought, salinity of soils and fungus diseases. Judging from its content of gluten, this grade has few competitors among the well-known grades of wheat. No. 34085 has, however, also some negative properties: toughness in milling, a rib-like grain, and what is most important, a poor capacity to withstand frost in its second year.

The practical experiments conducted in the kolkhoz of the southern regions of Kazakhstan and Kirghiz demonstrated that perennial wheat may be harvested without re-seeding in the

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course of 2 to 3 years, frequently exceeding the yields of local varieties of wheat in these regions.

The results of tests of this wheat proved rather adequate, when performed in the Kirghiz selection station. The fall sowing of 1939, for instance, done on an area of 900 square meters, produced in 1940 a first yield of grain of 24.7 centners per hectar, and in the second harvest of the same year - 3.4 centners; in 1941, the same area, without re-sowing - produced a third harvest of 23.9 centners, and the fourth in the same year - 3.2 centners.

This indicates that within two years four harvests were obtained, producing a total of 55.2 centners per hectar.

This first variety of perennial wheat did not possess, however, the entire sum of traits and properties essential to a cultivated plant. It was necessary to continue the work of selection for the production of a new more perfect grade of perennial wheat, suitable for cultivating in production.

At present there are available new grades of perennial wheat which lack the deficiencies of the first samples of this culture, at least to a considerable degree.

Among the best grades of perennial wheat we consider our No. 2.

This wheat is able, even in the conditions of Lower Moscow

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(Nemchinovka) to yield harvests without re-sowing - over a period of 2-3 years.

It withstands disease, provides good clumps, does not lodge, mills easily, and possesses good milling and baking qualities. The yield of this wheat may be rather high. The following figures will support this: In the course of three years of vegetation 100 plants were tested each year. The medium fertility per plant, according to years, is expressed in the following figures: the number of grains per plant for one harvest of the first year varied between 220 and 900; in the second year - from 150 - 800, and in the third year - from 100-750 grains, at an absolute weight of from 21 to 35 grams per 1000 grains.

We possess at our Institute small areas of the 1945, 1946, and 1947 plantings of this propagated wheat.

Among these: are plantings of 1945 (50 sq. meters) which will in 1948 yield a third harvest without re-sowing; plantings of 1946 (of an area up to 1000 sq. meters) will yield a second harvest in 1948; and finally, the plantings of the fall of 1947, on an area of close to 2 hectars.

Beginning with the fall of 1948, tests of this wheat will be made in the various parts of Soviet Union.

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Our selective nurseries study simultaneously over 2000 new forms of perennial wheat. Although up to now, in studying perennial wheat, we took into account only the traits of longevity, yield, quality of grain, morphology, etc., we have now introduced the practice of selecting plants of perennial type according to the nature their fertilization, with respect to self-pollination, cross-pollination, and optional. All this will aid the speedier solution of the problem of producing still better varieties of perennial wheat.

Let us consider briefly the selection according to quality of grain in varieties under test. The importance of gluten is well known, since it determines essentially the quality and value of bread. If there is gluten, the bread is good, without it - bread is poor.

Up to the present time it was believed that the sole possessor of binding-gluten is wheat, and for this reason such cultures as rye, barley and oats were disdainfully referred to as "grey breads".

We have examined a large group of wild-grown herbaceous plants testing them for gluten content, and as a result learned that the majority of wild-growing plants have an enormous content of gluten. The quantity of gluten in couch grass reaches 59 per

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cent Elymus arenarius - 70 per cent, Egilops - 90 per cent, etc. This research led us to look for gluten in such herbaceus plants as barley and rye.

In pursuing our study of gluten we were confronted with the following problem: why are all barley and rye species of wild-grown type endowed with binding gluten and why shouldn't there be any of it in the cultivated grades of barley and rye? Why did these cultures lose this valuable property as a result of cultivation by man?

It appeared that no one ever had undertaken to select rye with regard to its gluten content, in the belief no doubt, that rye does not possess binding gluten and is not capable of having it. As to barley, the selectors deliberately produced brewing grades with a low content of albumen.

Our very first analysis revealed the presence of gluten in indogenous grades of barley, and next in rye.

The discovery of the presence of gluten in grey breads is of tremendous economic significance, since it permits the increase of the bread resources of the country - through the production of glutenous forms of barley, rye and oats - at the expense of less exacting cultures than is wheat, thereby lessening the tension of the bread balance in years of poor harvests.

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With the aid of a culture such as rye, for instance, it is possible to effect a radical change in the economic value of rye bread by adding to it binding gluten and tehhnological properties; this would easily solve the problem of winter crops in the East and North of our country.

No less alluring is the prospect of producing glutenous forms of barley, and naked-seed varieties at that.

One of the methods used in providing rye with binding gluten is the crossing of cultivated rye with couch grass. It is known that owing to binding gluten the dough of wheat flour does not spread, acquires good viscosity, germination, and may be shaped into any form. There is gluten also in the culture of winter rye but it does not possess viscosity and the dough of rye flour therefore does not keep the desired shape and has a tendency to spread.

Upon establishing the fact that various species of couch grass possess a high content of binding gluten, even in greater proportion than in wheat, it became apparent that this most valuable characteristic, which is hereditary and stable through generations, has to be utilized by producing a new kind of rye that will contain binding gluten.

The first rye-couch grass hybrids were obtained by us 12 years ago (1936). However, we next were confronted with an

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unsurmountable difficulty: the hybrids proved sterile and in the next 5 - 6 years we were unable to overcome their sterility and to obtain even one grain. In the seventh year of stubborn research we secured the first grain, which opened the way to further selective work on rye-couch grass hybrids.

Still, the inadequate number of grains obtained in the beginning could not satisfy our demand of selective material. In using the factors of polyploidy, we finally, in 1947, succeeded in developing a method which helped in totally eliminating the sterility of rye-couch grass hybrids of the first generation.

This fact that we were able to overcome sterility in rye-couch grass hybrids presents a great victory in Soviet selective work.

At present we received dozens of new perennial tri-specific rye-wheat-couch grass hybrids in a variety of combinations. We havein this manner successfully solved the task of conquering sterility of the hybrids of the first generation and have received specimens of the second generation of these most interesting hybrids.

In the recent past there were obtained perennial hybrids from the crossing of cultivated winter rye with wild forms of perennial. This opening the possibility of introducing perennial varieties of rye into agriculture.

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Our research was not limited to what already had been found and become familiar.

We are attempting to draw into the orbit of crossing new and ever new plant objects in order to enrich Soviet agriculture with new economic cultures.

Ten years ago our attention was directed to a most interesting wild-growing herbaceous plant - Elymus. What sort of plant is this? It is commonly named "wild rye" (Elymus arenarius), "vologhotz", osterotz", kolosniak", "sandy oat" or wild barley". Its genus contains over 50 species. In our country Elymus is distributed in the Kola peninsula, in the sandy hillocks of Central ASIA, in all southern latitudes of the European part of the USSR. This plant is exceptionally hardy. The hardest frosts, scorching hot air, dead stores of moisture in soil, nothing, it seems, can offset its capacity for development, growth and fertility. The long, powerful, branching root system of the Elymus with its numerous rootlets digs deep into the earth, while the tough leaves protect the plant from destruction by insects.

We first discovered Elymus on the open sands of the half-desert lands of Kazakhstan and were amazed at its giant growth and vigor. The soil was red hot from the heat which stood at 70° C, but the Elymus towered above the sands without appearing

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oppressed. Our attention was particularly aroused to this green phenomenon when we counted in each of its ears up to 1000 grains (seeds); and we there and then decided to cross Elymus with cultivated herbaceous plants wheat, rye, barley, prompted by the tempting prospect of endowing the latter with the extraordinary properties of this wild plant.

Several years went by before we were able to find the proper ways for crossing them. We pollinated hundreds of thousands of flowers in a variety of combinations but did not succeed in obtaining satisfactory results for a long time. And only in the war years we succeeded in obtaining the first unprecedented hybrids of Elymus (the species E. arenarius and E. giganteus) with the cultures of wheat, barley and rye.

Cytological research showed the hybrid origin of these new plants. One of the principal traits of Elymus is its high fertility, which is hereditary, as we were able to prove. There is no doubt but that we shall be able to acquire in the new hybrid breads from 500-600 and over-grains per spike in a final result. Even if the future hybrid varieties of wheat, rye, and barley will produce only 200-300 grains per spike, we may still gather a harvest of 150-160 centners per hectar, at least. In this manner, we shall have solved, in a revolutionary

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way, one of the tasks of overcoming the so-called "limits in productivity".

Equally interesting and promising has been our research work on hereditary connection - hybridization - of woody plants with grasses. Prior to our research, grafting was primarily done within the limits of woody with woody plants and grasses with grasses.

We can tell that throughout the history of man's work on grafting, this was done in the most diverse directions. A vast planting material was used for grafting purposes. However, only towards the end of the XIX century and the beginning of the XXth did vegetative grafting become an inalienable part of the main methods in scientific selection through the outstanding works of I. V. Michurin.

We may still be far from achieving planned unprecedented hybrid plants, but we can already anticipate their fairy-like potentialities. The production of hybrids from woody and grass plants will produce a vast number of the most diverse forms, with an entire scale of inter-transition with regard to traits, natural and acquired, that will be drawn into this crossing of plants. To put it more si ply, in overcoming the difficulties and upon acquiring the necessary knowledge in this field, we shall be able to change grass plants into woody ones and woody plants into grass plants.

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Among the first plant specimens in this group subjected to our experiments were the yellow acacia (Caragana arborescens) and the pea (Pesum sativum). Our attention was directed towards these two plants because of the following considerations:

The bean family is particularly rich in the variety of its species and forms. It has up to 12,000 species. Among them are grasses, liana, shrubs, trees. In this family we shall be able to find a variety of plant forms, from dwarf-like grasses to giant trees. One of the representatives of this family, the yellow acacia, is particularly valuable for our experimentation. The yellow acacia is an upretentious, widely distributed plant. In the north it is distinguished by its resistance to cold, in the south to salinity, and in both spheres its unsurpassed resistance to drought. The cultivated pea, however, does not possess these traits. The yellow acacia far exceeds in yield that of the cultivated pea. In the past century, the Siberians referred to the acacia as to the "pea tree", and this was not accidental. The seeds of the yellow acacia were used as a food item by the population, and in the feeding of cattle (fodder) and birds. And this is easily understood since the seeds of the acacia contain a larger amount of albumen than do such cultivated plants as the pea, the lentil, the bean, etc. The seeds of the yellow acacia are also of much interest to the milling and baking industry. One can prepare flat cakes, biscuits, cookies from the flour of its seeds. Upon a technological treatment of the seed; the flour

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of the yellow acacia, when mixed with that of wheat produces a tasty, nutritious bread, attractive in color.

To pass on the many traits of the yellow acacia to the cultivated pea is an interesting task. The main object is, however, (as we observed in our test of crossing the yellow acacia with the cultivated pea) to change a grass annual plant, such as the pea, into a perennial, shrub-like or woody one. Speaking figuratively, we wish to force the pea to grow specifically on trees and not where until now nature has meant it to be. Aside from that, this may lead to forms - non-lodging - in annual and perennial varieties of the pea.

The search for woody and grass plants which could through direct hybridization between them produce hybrid seeds did not lead to successful results over a period of years. Tens of thousands of flowers of these plants, pollinated among themselves in a natural and artificial manner, produced negative results. Our failures in the direct hybridization of the yellow acacia with the pea lead us to the use of the tested Michurin method of preliminary vegetative crossing.

To graft the pea, as any other "grain-seed-bean" to the yellow acacia proved to be a rather difficult task at the start. To achieve this, much persistent labor was required. A few years ago the first real grafts between the yellow acacia and the pea

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were obtained. In the succeeding years, we managed to graft with full success such plants as the bean on the yellow acacia, chick pea (Cicer arietinum), lentil, etc.

Another, no less interesting object in our research is the Cyphomandra betacea, or the tomato tree, which was presented to us as a gift by the late Alexei Maximovitch Gorki from Sorrento. This is a sub-tropical plant, perennially green, of rapid growth. On this plant, we grow within a space of seven years, real tomatoes (through grafting), egg plants, Solanum nigrum (nightshade), pepper, physalis, potatoes, Busenholtz, thorn apple (Datura stramonium), etc.

All these plants graft successfully on a tomato tree, as well as on the Mexican shrub Solanum; have a good florescence and bear fruit well. The fruit obtained from annual and perennial wildings of the tomato is altogether normal, and the seeds of these berries do not differ in the least from those of the common tomato. We obtained the same picture from the hybridization of flowers in grafting Cyphomandra to the eggplant. Eggplants, when pollinated by Cyphomandra, produce fruits that resemble in shape the Cyphomandra but are in size much smaller than ordinary egg-plants.

Recently we began paying much attention to the selection of grass and woody components of the Rosaceae and Compositae families. In directing our new studies into the fields of hybridization and

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the grafting of grass plants with woody plants, we began the study of problems connected with the preliminary vegetative connection and the consecutive hybridization of plants of a variety of families. Some success has been achieved in this direction already. Let us recall that a successful grafting, as already told by Michurin, is a true indicator of the affinity of two grafted - one to the other - plants. Thus our desire to overcome not alone the non-crossing cases, but first the non-graftable sepcimens.

In examining some fibrous wild-growing plants, we paid attention to the milk weed Compho-carpus fruticosus of the Asclepias (swallow wort) family, and the Oleander of the Apocynum family (Apocynaceae). These plants have nothing in common with each other. The Gomphocarpus is a weed, found in the Transcaucasian region and Central Asia. It is a perennial of shrub type, well branched. The Comphocarpus grows from seed in its first year, in nursery environment, reached a height of almost one meter; it blooms and fruits. The Oleander grows in its native environment, in the Mediterranean countries, is widely spread along river banks, irrigated and drained passages (canals).

In the Soviet Union, oleander is grown in open soil, as an ornamental plant in the sub-tropics. We grafted Comphocarpus to oleandor and oleander onto Gamphocarpus. The success was similar in both cases. We are continuing work in this direction. If ways will be found to eliminate the obstacles to the

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hybridization within families, then our conceptions of the existing flora will truly be dimmed in the light of the potentialities ahead of us.

Soviet biological science has achieved tangible results in the field of transforming the nature of cultivated plants on the basis of distant hybridization. The close attention paid to research by our party, Comrade Stalin, and the Soviet government, creates favorable conditions for new discoveries and changes along this noble field.

Eleven years ago, in a personal interview with I. V. Stalin, I heard the following words addressed to me - "Experiment boldly, do not fear errors, we shall give you every support".

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Efimov, A. L.
Fumiganty i ikh primenenie v praktike karantina rastenii. [Fumigators and their use in plant quarantine]. Moskiva, 1940. 70 p. 423 Ef6F

Trans. 7: Plant Protection

Translated in part by R. G. Dembo

GENERAL PART (p. 3-10)

The Physiological Effect Of Fumigators

Fumigants are called such poisons which, penetrating in the form of a gas into a living organism, destroy it.

When a fumigant penetrates into an organism through the breathing system it usually causes the following types of poisoning.

The destruction of the respiratory system. Such gases, as for instance sulphuric anhydrid, chlorine and others, when penetrating into the trachea, tracheole, alveole, affect their sides and cause neurosis. With stronger poisoning a liquid penetrates from the body cavity into the respiratory system and death follows from suffocation.

The disturbance of the function of tissues from the direct effect of fumigants. Many fumigants (hydrocyanic acid, bisulphide of carbon, paradichlorobenzene and others) in gas and vapor form do not disturb entirely the respiratory system, but, by penetrating into the tissue cells, displace the reactions of the inner cells in such a degree that the cells are unable to fulfill their normal functions which reflects upon the entire organism and with a strong poisoning death occurs (for instance the paralysis of the nervous system).

Some fumigants have a poisoning effect upon the skin (cyanic salt, hydrogen sulphide etc.).

Usually the fumigants cause a combined poisoning, but some poisonings are stronger, some are weaker.

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The fumigants penetrate into the plant tissue in a double manner either the stoma or directly through the incrustation by means of diffusion.

The fumigants penetrate through the capsule into the cell of the infection and even into the seeds of plants.

Requirements for fumigants

The evaluation of fumigants is carried out according to their special physicochemical characteristics the most important of which are:

Volatility. We understand under volatility the maximum gravimetric amount of the fumigant which could be in vapor form under given strictly definite conditions (temperature and pressure). The volatility of fumigators is usually expressed in milligrams or in grams to one cubic meter of space.

Volatility increases with the increase of temperature and with the decrease of pressure, but decreases with the decrease of temperature and increase of pressure.

The higher the boiling point of the fumigant the lower is its volatility and vice versa, but this is not a rule and it does not pertain to all fumigants, because the volatility depends on the molecular weight of the liquid. It may happen that with two liquids, one of which has a high boiling temperature and a great molecular weight, and the other - a low boiling temperature and a small molecular weight, the volatility will be greater withthe first which is evident from the following table:

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Substance	Boiling point in C°.	Molecular weight	Elasticity of vapor under 20° C.	Volatility under 20° C. in g. for 1 m²
Benzol	80	78	76	350
Monochlorbenzol	130	112.5	9	600
Aceton	35	58	185	586
Chloroform	61	119	160	1,100
Methanol	65	32	94	164
Chloropicrin	112	163	18.3	184

The best fumigator is the one which possesses volatility during which mortal concentrations of poisoning vapors are formed for the pests in the air. It is desirable that the volatility of the fumigator would be higher than it is required for the concentration mortal for the pests.

The concentrations of fumigants in the air are expressed:

by the gravimetric quantity of the fumigator in respect to the space, for instance, 350 gr. of bisulphide of carbon for 1 cu. meter of air, 20 gr. of sodium cyanide for 1 cu. meter, 10 mm. for 1 liter etc.

by the volume of vapors and liquids in respect to the space, for instance, 20 cu. cm. to 1 cu. meter; 5 cu. cm. to 1 liter etc.

by the percentage, in volume, in the content of the fumigator's vapor in the air, for instance 0.02 percent etc. and finally

by the relation between the fumigator and the air expressed in particles, for instance, 40:1,000,000 etc.

<u>The velocity of evaporation</u>. During disinfestation of buildings it is quite desirable that the fumigator would evaporate as soon as possible. Otherwise the fumigant becomes either inadequate for building disinfestation

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(for instance, paradichlorbenzol), or it requires large doses and a long exposure, or the creation of special conditions which further speedy evaporation.

The evaporation speed depends mainly from the fumigator's boiling point or of its individual components. The accelaration of the fumigator's evaporation could be achieved:

by increasing temperature of the fumigated room;

by increasing temperature of the fumigant itself;

by decreasing pressure (during the vacuum fumigation);

by creating a larger space for evaporation.

The latter measure is achieved by one of the following methods:

by moistening of fumigants of various kinds of tiny substances, as sand, sawdust, etc.

by spraying the fumigant in the disinfested room;

by pouring the fumigant into a wide dish etc.

We have definite requirements for fumigants as to their evaporation speed depending on the application purpose. During the disinfestation of rooms it is required that the evaporation speed would be most high with the exception of cases when rooms which are insufficiently hermetically sealed are fumigated and when it is expedient to slow down the evaporation speed of the fumigator and to increase its concentration. During soil fumigation we require average or low evaporation speed, because for the destruction of pests which live in the soil or of fungus and bacterial diseases which are in the soil a continuous effect of the fumigant is required.

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Adsorption. Under adsorption we understand a physical-chemical process of adsorbing fumigator's vapors by the surrounding substances.

A considerable adsorption is undesired because it indicates the poor spreading of the fumigator's vapors in the mass of the disinfested material (grain, soil, etc.).

The higher is the adsorption of the fumigator the higher the applied doses.

It is quite undesirable that the fumigant would be adsorbed by food and fodding products, because such products become either poisoned and hence unsuitable or they acquire the smell and after taste of the fumigator for a while.

Specific gravity of the fumigant's vapors. This quality of the fumigant, which means the relation of the weight of 1 liter of vapor like fumigant to one liter of air, enables us to indicate the best method of using the fumigant.

Fumigants whose vapors have the specific gravity more than 1 are more spread downwards, therefore such fumigants should be sprayed or poured in the disinfested room, introduce into the soil etc. higher than the place where there are pests and, on the contrary, with fumigants whose vapors are lower than one, the evaporation should be lower than the level upon which the pests (or infested materials) are located.

Inflammability. This quality is highly undesirable because it decreases the practical value of the fumigant and at the same time complicates the very process of fumigation.

Along with the indicated physical qualities its basic chemical qualities are important for the characterization of the fumigant.

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The best fumigant in respect to chemical qualities is the one which has the highest vapor firmness during fumigation;

can be kept for a long time, does not change and does not lose its toxicity under the influence of light, heat, carbonic acid and moisture of the air and of the soil;

is most convenient and more safe in preserving;

has the ability of light neutralizing and degasing;

is easily recognized;

does not negatively affect metallic objects, colors, tissues, food products and other materials.

The negative qualities of the fumigants are the following:

the interaction between the vapors and gases and the moisture, or with various materials on account of which the vapor concentration decreases which is highly undesirable: the fumigants which react well to water possess,as a rule, a poor penetrating ability;

Corrosive effect upon the metal parts and colors and also the harmful effect upon the tissues, food products and other materials.

Methods in applying fumigants in plant quarantine

Fumigation, or the gas method of controlling insects, mites, rodents and in some cases controlling fungus and bacterial diseases, is widely applied against many quarantine pests and is often considered the only method of controlling them. The essense of fumigation consists of creating a poisoned atmosphere around the pest as a result of which it dies.

Fumigation of storehouses is carried out with the purpose of eradicating various pests (insects, mites, rodents) and also causes for diseases which damage food products, grain and planting material, fabrics, various wood industry, etc.

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During fumigation of a storehouse, the latter should be hermetically closed. Otherwise it would be impossible to produce killing concentrates of the poisoning vapors or of the fumigant's gases for a long duration, and fumigation would not produce the necessary results or it will require an increased amount of fumigant. Besides, the room not being hermetically closed creates a danger of poisoning human beings and animals by poison vapors.

Fumigation in chambers. For disinfestation against harmful fruit insect and mites, vegetables, flower and other plants, and also for the infestation of seed materials of agricultural and industrial production special fumigation (disinfestation) chambers are applied.

According to effect the fumigation chambers are divided into two types: non vacuum which work under the condition of normal atmospheric pressure and vacuum in which fumigation is carried out in a vacuum.

Non vacuum chambers are built very simple. They represent a room with walls through which gases are not able to penetrate and with hermetically closed doors (covers). The fumigated non vacuum chambers are of various systems and size. So called removable and portable chambers (collective farms) look like large boxes or cars with a tightly closed cover. Within such a chamber there is a telescopic truck upon which the fumigating materials are placed; quite often a hand or electric ventilator is placed in order to cause into motion the fumigant's vapor.

Since fumigation has been carried out in the open air, some of them have a heater which enables to keep the necessary temperature within the chamber.

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The removable chambers are ventilated by opening the covers at a distance of 10-15 meters with the help of a rope thrown through a bloc.

Stationary non vacuum chambers which are used at the present time, in a series of collective farms (especially in the South), differ from the removable by their high cubic capacity and represent brick or concrete structures for ventilation and are equipped with Holland steam heating system. Some chambers have a special gas.

Planting material, seeds, fruit and other materials undergo non vacuum fumigation. Such kind of materials, as, for instance, piles of cotton fibers (pressed under a strong pressure), seed material in bags where the fumigant's vapor penetrates with difficulty or is connected with a prolongated exposure (12-24-48 hours and more) undergo often vacuum fumigation.

The principle of vacuum fumigation consists of placing fumigated materials into hermetically closed rooms - vacuum-tanks from which the air is pumped out by a pump. As a result of that the air both in the tank and in the fumigated materials (cotton, bags with seeds etc.) thins. The fumigant vapors are introduced into the space of vacuum tank after the vacuum decreases by introducing some air into it. After having penetrated in the thickness of the fumigated material, the fumigant vapors occupy the space which was previously occupied by air. This enables to decrease the fumigation exposure many times.

Powerful vacuum-chambers represent complicated structures which consist of a series of rooms in which individual parts of the entire assembly are distributed: a tank hall with large cylinders - steel vacuum tanks with loading and unloading divisions; machine, gas generator and boiler divisions: room for vapor heating system; a special

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large heating room for the heating of materials subject to fumigation during winter months; laboratories, offices and recreation rooms.

For fumigation of small parties there are small vacuum-chambers.

The technique of fumigation in vacuum-chambers is the following.

The cars loaded with the materials subject to fumigation are folled into tanks and the latter are tightly closed with covers. Then vacuum-pumps are applied which pump out the air from the tanks bringing the vacuum up to 640-650 mm. Afterwards cyanic hydrogen is introduced into the tank from a gas generator. For this purpose the faucets in the tubes which unite the jars with the generator are opened.

Before that, some amount of water measured beforehand, sulphuric acid and the solution of sodium cyanide are introduced into the generator. The cyanide hydrogen which is formed as the result of reaction enters from the generator into the tank.

Ten to fifteen minutes after the cyanide hydrogen was let into the tank an air faucet is opened and air is let into the tank. During this process the supplus of cyanide hydrogen found in the generator and in the gas dilator also enters the tank. Then the faucet which unites the gas generator with the tank is closed and the air is introduced into the tank through a special faucet until the vacuum decreases up to 100 mm. Afterwards the fumigated materials remain in the tank during a definite time.

When the exposure comes to an end the tank is ventilated. For this purpose the vacuum-pumps are applied and, when the vacuum within the tank reaches 650 mm., the air faucets of the tank are opened. When the pressure in the tank equals the atmospheric pressure, then a

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powerful electrical ventilator is let into the unloading department, and the workers, in gasmasks open the cover of the tank and roll out small cars with the help of a rope. These small cars are unloaded under a cover, in the open air.

During the exposure the generator is cleaned with water. Its content passes through a pipe into a settling well and it is being unharmed by a solution of green vitriol.

Under our conditions the vacuum chambers are used mainly for disinfection of cotton, cotton seeds, food supplies (beans-cacao etc.).

The speed, safety and dependability of work during the vacuum fumigation compensate fully the expenses in constructing the vacuum chambers, especially in places where the materials imported from abroad into the USSR undergo quarantine.

Fumigation under a tent or under other covers is applied for the disinfestation of citrus, tea and other fruit and decorative trees and bushes against coccidae, scales and other pests.

This kind of fumigation differs slightly from the method of fumigation in closed rooms. The difference is only that during this method the closed space is formed by a substance which is gas impermeable or by veneer boxes.

The method of fumigation of trees and of bushes has been introduced during the recent years on wide scale in our subtropical regions.

Soil fumigation is a method comparatively old, but it has been worked out insufficiently. Fumigant in a liquid or gaseous form is introduced into the soil infested by pests or by a disease. The fumigation of soil in vineyards for the eradication of phylorera and also in controlling the larvas of cockchafer and other pests which live in the soil is widely carried out.

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The best results in soil fumigation are obtained during mulching of the fumigated soil by special paper (mulch), sawdust etc. A high cost of soil fumigation (especially with mulching) enables the application of this method only upon fields with valuable plants (for instance, vineyards), conservatories, and also during the eradication of nidi of quarantine pests and diseases.

Bisulphide of carbon, chloropicrine, polichloride and para-dichlorobenzene are widely used as soil fumigants; dichlorethane, melted cyanide and cubic groups of dichlorethane are introduced in wide practice in recent years.

The fumigation of hothouses, conservatories and their plants is carried out with hydrocyanic acid. This is called the "dry" method, because cyanic calcium, cyanic melt or "cyclone" are applied as a powder.

The technique of fumigation of the indicated object does not differ from the fumigation of grain storehouses and fruit-vegetable storehouses. The basic difficulty in carrying out fumigation of conservatories and hothouses consists of the selection of effective doses of fumigant so that they would not have a harmful effect upon the plant.

For disinfestation of hothouses and conservatories and also conservatory soil in controlling the bacterial canker of tomatoes and of other diseases chloropicrine and formaldehyde are usually applied.

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Translated from the Russian by
S. N. Monson

"The transformation of annual cultivated forms of plants into perennial ones should proceed primarily along the line of hybridising them with perennial representatives of wild-grown flora".
Tsitsin

The first weak attempts to create perennial plants were made in the XIX and early XX centuries. During that period Hildebrand carried on a series of experiments with Verbascum, Cochlearia g., Glaucium flavum, and other plants in an attempt to prolong their life. The famous researcher, Piram de Candolle changed the annual Reseda ordorata into a perennial. The idea that all annual plants are derived from perennial ones has frequently been expressed. Satalin, for instance, in 1890, proved that annual rye originates from perennial. This encouraged scientists to eventually learn how to "force a prolonged growth of all organs of a plant, since the capacities involved dwell in every cell, in every organ" (Klebs). Rottstein succeeded even in forcing annual red beans to last through the winter.

The problems of prolonging the life of plants engaged the attention of such prominent scientists of the past century as Schleiden, Moll, Negeli, Alexander Braun, and others.

A considerable part of their experiments was directed upon the transformation of normal course of plant development, upon the prevention and limitation of flowering, fruiting, and the resulting exhaustion of the plant. In successful cases all "points of growth" in annual and biennial plants subsequently acted as perennials under tests.

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The elimination of fruiting and the creation of favorable environmental conditions made possible, for a brief period, the prolongation of the life of shortlived plants; death nevertheless, came to claim them shortly thereafter.

The question of the causes for the dying of plants was discussed over a period of decades. Experience has shown that all plants have limited existence. Still, the fact that some points in growth possessed the ability for development led to the thought that a plant may also have the ability for unlimited survival. Noll pointed out that shortly before the death of a palm its cambium, and also the young runners and top points of growth remained fresh and viable, i.e., were in a condition to make a new start along a new cycle of development. It was established as a result of an analyticial study of these changes that tissues gradually differentiate within a growing body. A gradual drop in strength of growth takes place in these tissues, ending in their complete dying out. The dead tissue becomes the focus of disease of the vegetative organisms under the influence of external factors. Their spread to young tissues leads to the loss of the plant. Sooner or later, whether in a short time or after hundreds of years, each perennial plant dies, so long as it does not possess the capacity of throwing off its old, dying parts or organs. On the other hand, if this capacity is present along with the ability for regeneration, perennial plants may last for ever.

Aside from that, one of the first and fundamental causes for the dying of plants was seen in their production of seeds.

The principal cause of the premature death of plants lies, however, in their lack or insufficient ability for regeneration. Here is the principal

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difference between short-lived and long-lived plants. All experiments, observations, and research have indicated that active influence may deeply alter the course of natural development of vegetative organisms and direct it upon new paths. The value and significance of these works is derived from here for the benefit of serving history and the future development of science.

The inadequacy of the methods of influencing plants, limited by the general scope of science, and the fact that the problem of regeneration and restitution had not been sufficiently studied, were responsible for the failure of these studies. They carried, for the most part, a scientific-perceptional character and were bound by the tight framework of a physiological study of the life-cycle of development of the different plants. With exception of the above mentioned single and uncomplete attempts, that followed all former research, it had proved impossible to solve the problems of creating perennial plants or to place even one in the service of humanity.

The academician A. R. Zhebrak writes in his recently published book (1944) "The Synthesis of New Species of Wheat" ... "one may assume that the solution of the problem of producing perennial agricultural crops of plants is also to be achieved through the increase of the number of chromosomes. We have for this purpose begun work towards increasing the number of chromosomes in such an important economic plant as is wheat".

In discussing further the results of his labors, the author does not refer to any case where a perennial hybrid of wheat had been obtained, but

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indicates that he secured three new amphidiploid types (species) of wheat with somatic amounts of chromosomes - 42, 56, and 70. The author states inaccurately that "the second of these amphidiploid types belongs to an altogether new group of chromosomes. That similar types of wheat had never before been obtained, in spite of many efforts to achieve this."

It is to be noted, in the interests of truth, that several years prior to this author's work, B. V. Tsitsin produced numerous hybrids with the same number of chromosomes (56) in somatic cells by applying the method of "distant hybridization". The Tsitsin hybrids are characterized by high economic and useful traits and a normal fertility. As will be seen further, one of such wheats, No. 34085, possessing 56 chromosomes, competes successfully at this time with the common wheats in the southern parts of the Union. Aside from that, wheat No. 34085 is also a perennial.

Next A. I. Derzhavin obtained an amphidiploid of a perennial type by crossing wheat with perennial rye. This form of wheat also contains 56 chromosomes.

The All-Union Institute of Grain Economy at Saratov obtained intermittantconstant amphidiploid hybrids by crossing wheat with rye; the number of somatic chromosomes (2n) was 56.

This indicates that the securing of amphidiploids with an assembly of 56 chromosomes, and even a larger amount, may be considered an average occurrence in a variety of crossings. A. R. Zhebrak obtained his 56 chromosome amphidiploids in one of similar cases.

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Utilizing the methods of distant hybridization developed by him, Tsitsin, first in history, solved successfully the problem of creating a perennial plant. Working in the most difficult field of transforming cereal crops grown delicate by cultivation over a span of thousands of years, he created a fundamentally new culture - perennial wheat which did not exist in nature before. The path he suggests for the transformation of annual cultivated plants into perennial ones is the only one to be considered accurate.

Historical Information

The ideas concerning the character of future work were formulated by Tsitsin, in the shape of an orderly working hypothesis. He selected the method of distant crossings of cultivated breadstuffs with those wild-growing kinds that possessed a complex of useful characteristics-absent in cultivated types - in order to increase the productivity and biological stability of agricultural crops.

Among wild-grown crops, couch grass possessed outstanding characteristics. The numerous representatives of the genus Agropyrum attracted the attention of researchers also from the point of view of their genetic closeness to the genus Triticum.

The first "reconnoitering" crossings were made in 1928. The work, performed in Saratov, rapidly assumed large proportions but was accompanied by failures during that year, as well as in the following, 1929: they were unable to obtain a hybrid seed. Only in 1930, the first long-awaited hybrid seed was produced at the state farm "Gigant" of the Rostov region, by the crossing of Tr. vulgare, var. lutescens 0,62 with the species A. glaucum (Dess). In 1931, crossings were again made in the Saratov region which

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also produced successful results. In the last experiments conducted by Tstisin, he established the possibility of crossings of wheats with Agropyrum elongatum (Host), A. trichophorum, A. junceum, as well as with one of the varieties of couch grass, the creeping A. repens.

The succeeding years were devoted to combatting the sterility of the wheat-couch grass hybrids. Simultaneously, masses of hybrid varieties were accumulated.

As in the first period of work, wheat-couch grass hybrids today are also radically divided according to their life cycles.

Forms of annual and perennial development are constantly observed. The appearance of the latter indicated the possibility of combining the characteristics of long-lived, wild-grown crops with the economically useful qualities of annual cultivated plants. This in itself set a limit to endless and fruitless experiments and data concerning the life span of annual plants, a subject which had preoccupied the scientific mind for many decades in the past and present centuries. It is apparent that an original and effective method used in creating new long-lived plant forms precludes the non-expedient attempts of prolonging life by applying methods of establishing and supporting tendencies towards the achievement of the longevity of any plant tissue. The method of distant hybridization offers the shortest and most effective way to the transformation of short-lived plants into viable perennials of a stable and productive kind.

The effectiveness of the method may be seen in its application to the concrete task of transforming the cultivated wheat plant.

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Hybrids of the First Generation

The crossing of cultivated wheats with various species of wild-grown perennial couch grass produces perennial hybrid plants in the first generation. Weak and insignificant in appearance at the beginning of their development, the hybrids F_1 achieve extraordinary power and milti-spiked ability towards the end of the first year. In the second year, the number of spikes and tillering were still larger. Observations made over a period of many years established that the hybrids F_1 are not affected by pests, common in agricultural plants, and were immune to fungus diseases. They winter well in conditions of the open soil of the Moscow region and in Siberia. Their frost-resistance is of particular value in connection with their perennial growth.

In the fall of 1939, a sowing of 161 hybrid plants of the first generation was made; their wintering and growth over a period of the following three years is illustrated in Table I.

It indicates the percentage, in consecutive order, as related to the previous condition of the plant in the same year. If one considers, however, the relationship to the original number of germinated plants, the results are the following: after the second wintering, 80.1 percent of all plants remained alive; after the third wintering - 62 percent; from the spring growth up to the time of the gathering of the harvest, the loss in plants in the second and third vegetative periods amounted to 4 percent. While in the majority of plants - when in separate combinations in those preserved by the spring of 1942, i.e., the wintering and growth reached 100 percent.

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TABLE I

THE GROWTH AND WINTERING OF THE HYBRIDS F_1 OF THE 1939 SOWING

Periods of calculation	Growth after Wintering		Growth after Harvest	
	absolute	in percentage	absolute	in percentage
1940	150	99.3	150	99.3
1941	121	80.7	115	95.0
1942	94	78.2	87	92.5

The life duration of the hybrids F_1 under field conditions is 5-6 years, throughout which time the hybrid plants successfully stand wintering. The hybrids obtained from the crossing of wheat with the species A. elongatum are particularly resistant to frost. The majority of the hybrids F_1, however, bear a strong resemblance to the original forms of Agropyrum and are difficult to tell apart externally from the latter.

The blooming of the hybrids varies in character, although it is generally of the "open" type, while along with the process of self-pollination, cross pollination takes place. The greater part of hybrids of the first generation prove self-sterile. Only in combinations (T. vulg. x A. elongatum) are there instances of self-fertilizing hybrids. The seed F_2, derived from forms that preserve the perennial character in succeeding generations,

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possesses low sowing qualities, and the plants F_2 in these combinations are late-ripening in the majority.

HYBRIDS of the Second Generation

The natural hybridization of self-fertilizing plants F_1 produces hybrids F_2 in only limited quantities.

The sterility of the F_1 plants presents a serious obstacle to the development of successive generations of hybrids.

One of the methods of combatting the self-sterility of hybrids F_1 is the constant vegetative propagation of perennial sterile forms and their training against different agricultural backgrounds.

Another method consists of a repeated pollination of the self-sterile hybrids by the pollen of one of its parents. It is to be observed, however, that in cases of distant crossings, no one but Tsitsin has so far succeeded in obtaining forms of plants of practical value.

Having solved this problem, Tsitsin worked out and offered a new scheme of hybridization, founded on the principle of inter-hybrid repeated pollination. This scheme presupposed the pollination of self-sterile hybrids and of normally fertile wheats by the pollen of self-fertilized hybrids of the same or a later generation. The utilization of this scheme permitted the deliberate control of the formation process, the increase of the changing traits and characteristics of vegetative organisms on a wide scale, and the obtaining of new fertile forms of hybrids.

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The repeated pollination of self-sterile hybrids by the pollen of wheat is made by the direct application of the pollen onto the stigma of plants or by way of the additional sowing of wheat on allotments in nurseries for the cross pollination of hybrids. This leads in the following older generations to a radical decrease of segregated plants of the perennial type.

Table II presents data on combinations (T. vulgare, b. lutescens 0,62 X A. glaucum) X T. vulgare, to illustrate the degree of loss in longevity among hybrids of 4 generations.

TABLE II

PERENNIAL HYBRIDS OF DIFFERENT GENERATIONS

GENERATION	Number of hybrid plants	Among them perennial hybrids	
		Number	Percentage
F_1	1 483	1 483	100
F_2	190	139	73.2
F_3	156	140	30.7
F_4	391	4	1.0

In other combinations this uniformity is expressed by other indicators. Among the F_3 the number of perennial hybrids, for instance, may reach

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80 percent, as against - 30.7 percent, indicated in the table.

The repeated pollination by the pollen of the second parent form - couch grass -, however, leads to the formation of perennial, immune, and frost-resistant hybrids, very close to the pollen parent in their characteristics.

Repeated pollination of sterile hybrids by the pollen of self-sterile hybrids eliminate the one-sided influence of parent forms over the processes of division, and also contribute to the safe-guarding and accumulation of perennial forms in succeeding generations.

The pollination of wheats by the pollen of hybrids produces in all cases a larger percentage of germination of the hybrid seed than the crossing in the opposite direction. The entire formative process of the hybrid progeny in similar crossings moves towards the predominance of the intermediate and wheat type of plants. This uniformity is particularly striking in the combination with A. glaucum. The older the generation of hybrids, called upon for the pollination of wheat, the greater the number of forms of the wheat type in the progeny.

Whenever the mother form is represented by summer annual wheat, similar combinations produce already in F_1 the quantity of growth forms composing no more than a third of the total quantity of obtained hybrids. Their growth proceeds slowly and may be characterized as weak.

In F_2 and F_3, when combined with summer wheat, there are no growth forms at all. If they are present, however, the number of growth forms is smaller in scales of tens than in F_2 and F_3 crossings of another type.

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In hybridizating for perennial growth, this therefore proves inefficient. The comparison of the latter conclusion with the conclusions of the results of other crossings permitted us to make some methodical generalizations which proved of essential aid in the matter of strengthening and gathering the characteristics of longevity in the hybrid progeny.

It became possible, for instance, not only to raise the wintering - and frost-resistance in the hybrid progeny during the crossing of parent pairs fo winter wheats and winter forms of Agropyrum species, selected according to the above characteristics, but it became also possible to increase the frequency of the segregation of perennial forms endowed with these characteristics in the older generations, thereby widening the possibilities of selection.

It is therefore necessary to select as a maternal seed plant - the winter frost-resistant wheat, provided with tendencies for a rapid regeneration of runners and possessing other high characteristics of economic value, so as to obtain perennial forms of intermittent and wheat type, while one should select as a pollen plant for a repeated pollination, the fertile hybrid with a perennial winter cycle of development, immune, of powerful growth, well developed root system, and high productivity. As the result of a crossing of such parent pair the progeny may produce perennial forms of valuable economic characteristics in a shorter period.

Table II indicates that up to 75 percent of perennial forms are segregated in the hybrid progeny of the second generation. This indicator refers to the combination where the seed plant was a summer wheat combined with

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couch grass. This combination does not aim at producing perennial forms and the number of the latter is therefore radically reduced in the succeeding generations. In the combinations of 28-chromosome summer wheats with couch grass the percentage of perennial forms is slightly higher than in the preceeding types.

In crossings of a similar type the quantity of perennial forms may be reduced to 25 percent, with a predominance among them of plants of a summer cycle of development. The characteristic of longevity in the F_2 hybrids, as well as its productive trait of tillering, are thereby decreased, as compared to the hybrids F_1, in one or the other degree. The segregated hybrids of low frost-resistance perish in the first winter, while the rest of the hybrids proving frost-resistant - vegetate over a period of years. Among this group of hybrids the best-in frost-resistant characteristics - are those originating from the A. elongatum.

There were 1940 hybrids of second generation in the fall sowing of 1939. Their wintering ability and growth following harvesting are given below in Table III.

TABLE III

GROWTH OF HYBRIDS FOLLOWING WINTERING AND HARVESTING OF THE 2nd GENERATION

Periods of Calculation	Growth following Wintering		Growth following Harvesting	
	Amount	Percentage	Amount	Percentage
1940	1877	96.8	1877	96.8
1941	1185	63.1	997	84.1
1942	606	60.8	525	86.6

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The second and third wintering showed a poorer reaction upon the condition of hybrids. Of the number of plants ready to winter, 61-63 percent survived the wintering; after the second and third harvests 84.1 - 86.6 percent of the amount of harvested plants had grown anew. This indicates that the hybrids F_2 are not equal to the hybrids F_1 in frost-resistance and longevity. The hybrids F_2 reestablish fertility and in that respect surpass the hybrids F_1 considerably. However, even in the second generation the number of self-sterile hybrids reaches 30-35 percent in some cases. The majority of F_2 hybrids produce a grain of hard milling quality, which has the typical characteristics of couch grass. In combination and connection with A. glaucum, one finds individual hybrids with a seed that resembles in shape, fullness, and absolute weight that of the wheat. In cases where the absolute weight of seeds reaches 28-30 g., it is possible to select even in F_2, the perennial forms for the future examination of their constancy in economic utilization.

HYBRIDS OF THE THIRD GENERATION

The formative process of the hybrids of the third generation appears considerably wider than in F_2. Here the number of segregated perennial forms decreases much more than in F_2, and besides, a part of the non-frost-resistant forms perishes during the first wintering. Generally speaking, and with regard to their frost-resistancy, immunity, and general development, the hybrids F_3 measure up to the F_2. In habit and shape of spike the hybrids of the third generation contain couch grass, as well as wheat forms. Hybrids produced from the crossing of wheats with A. elongatum retain for the most part the characteristics of couch grass throughout all

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generations. The variation in the shape of the spike reaches therefore only the intermediate type - in combinations with A. elongatum,- while in a crossing of A. glaucum with F_3 one may already find wheat forms. The fertility of F_3 reestablishes itself to a larger degree than in F_2. The hybrid plants have a splendidly developed root system. The fall growth of hybrids F_3, produced from the crossing of summer wheats with couch grass, varies between 50-75 percent, while the quality of the growth may be characterized as poor or medium. The well grown forms represent no more than 10 percent of the total number of hybrids with longevity traits. A high growth is obtained from hybrids derived from crossings of hard summer wheats with couch grass and a somewhat better one yet from inter-hybrid crossings of F_2 plants. The highest growth is observed in hybrids obtained from the crossing of winter wheats with winter couch grass, and from inter-breeding crossings with the participation of these kinds. In the latter instances the growth is observed in 90 percent of available F_3 plants. In the spring from 75 to 100 percent of hybrids grow from among the latter group. With regard to stability, the hybrids produced from the crossing of wheat with A. elongatum are particularly outstanding.

The frost-resistance and capacity for regeneration of the latter hybrids are referred to in Table IV, which contains a summary of observations on the conduct of hybrids F_3, in 1076 items, which "went wintering" in 1939.

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TABLE IV

WINTERING AND REGENERATION IN HYBRIDS OF THE THIRD GENERATION

Periods of calculation	Growth following Wintering		Harvesting	
	Amount	Percentage	Amount	Percentage
1940	905	89.5	963	89.5
1941	385	40.0	326	84.7
1942	185	55.5	149	80.5

The regenerating capacity in the third year of life in hybrids F_3 was preserved, according to this experiment, on a fairly high level and was retained by 80 percent of the plants which survived successfully the latest wintering. In frost-resistancy, however, the hybrids F_3 gave much poorer showing than the plants of the second generation. The vegetative period of the hybrids F_3 lasts from 100-140 days from the beginning of the germination up to the time of ripening.

The seed of perennial forms does not measure up to the seed of the annual forms of the same third generation. Nevertheless, we have in F_3 already a considerably larger group of plants than in F_2, which possess spikes of the intermediate and particularly wheat types, of an absolute weight of 30-32 gr. This produces better opportunities for selection of practically and valuable forms of a perennial kind.

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HYBRIDS OF THE FOURTH GENERATION

In the hybrid material of the fourth generation the formation, with regard to original characteristics is spread even wider than in F_3. The number of forms which inherit perenniality decreases approximately to 50 percent. Simultaneously with this process, the forms possessing perenniality are in the majority of instances self-fertile and frost resistant to a high degree. While they exhibit a lower productive tillering and a somewhat reduced resistance against fungus diseases, as compared to the hybrids of younger generations, F_4 distinguish themselves by a wheat and intermediate form of the spike, as well as a good shape and size of the seed. The root system of the hybrid plants is also somewhat weaker than that of the hybrids of younger generations; though it is superior to the root system of cultivated wheats.

Hybrid forms F_4 of perennial habit serve as the starting material for further hybridization, as well as for the production of perennial economic-prospective forms. In 1935 Tetisin selected the first perennial form No. 34085 from the hybrid mate ial, which at present undergoes experimentation in production. In pedigree - perennial wheat No. 34085 represents a hybrid from the crossing of the soft summer wheat Lutescens C62 with A. glaucum. For repeated poll'nation the winter wheat "Cooperatorka" was used. The hybrid has a white, bearded spike with shortened coarse beards extending sideways. The seed is red, rib-like, with a deep furrow. It conditionally belongs to the variety Eritrospermum; its cycle of development - summer perennial. The medium length of the spike - 9.5 cm; firmness - 1.4; the

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number of spikelets - 15-16; the number of seeds in a spike - 3-5.

In 1936 the second perennial form No. 23086 was segregated possessing the same origin as the first one. This perennial wheat has a white non-bearded spike and a red seed. Belongs conditionally to the var. Lutescens. Medium length of spike - 9.4 cm; medium firmness - 1.52; the shape of the spike is spindle like, somewhat "tail-like". In cross-section the spike has a square Shape with rounded (softened) corners. The number of flowers on the spike - 7; of seeds - 4-5. The rooting system is fibrous, better developed than in the common wheat, does not die in the winter. The vegetative period of perennial wheats varies dependent upon climatic conditions and lasts in the first year of its life 110-120 days if sowed in the spring.

In the second year or if sowed in the fall, the vegetative period is some 10-20 days shorter. The seed of both perennial forms is of the wheat type. The absolute weight of the seeds averages 32 gr. The seed of the No. 34085 is half-glass like, that of the no. 23086 - starchy. In order to illustrate the characteristics of the milling-baking qualities of the seed of the perennial wheat No. 34085, we are giving below the results obtained at the technological laboratory of the Siberian Inst. of Grain Economy, Table V.

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TABLE V

MILLING-BAKING CHARACTERISTICS OF PERENNIAL WHEAT NO. 34085

(and average for 1937 - 1939)

Variety	Glassiness of seed	Output of flour	Color of crumb	Porosity of bread	Volume of bread output	Percentage of Gluten raw	dry
Perennial Wheat No. 34085	81	70.0	65	83	493	53.2	18.8
Hilturum 0321	72	72.3	72	83	501	46.0	14.4
Cesium 0111	93	75.0	73	77	522	47.1	14.9

As a result of wide experimentation done over a period of 3 years on perennial wheat in conditions of production at the collective farms of Kazakh and Kirghiz Republics the possibility and expediency of cultivating perennial wheat was established for the southern parts of the Union.

Whenever accurate agricultural methods were used perennial wheat produced record harvests, 33-37 centners per hectar in a single harvesting. The southern regions (Frunze) yielded in one season two harvests of grain from the same sowing. In addition, the exploitation of a single sowing is possible over a period of 2-3 years with a gathering of 3-5 yields of grain. In an experiment made at the Kirghiz Selective Sta. 4 harvests were gathered in the space of two years from one sowing, yielding a total of 55 centners per hectar.

In 1943 the second harvest was gathered from fields sowed in the spring

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of 1942, which had yielded their first harvest also in 1942. The area sowed in perennial wheat of the second year amounted to 14.2 hectars.

We are of the opinion, however, that the above experiments do not reveal in the majority of tests the potential possibilities that perennial wheat may exhibit. This may be explained in the first place by the lack of attention paid to perennial wheat, poor agricultural methods, the inadequacy of irrigation, persistant diseases, and other unfavorable factors. The urgent need for organizational methods to aid a planned implantive of perennial wheat has been established at the present time. The decision of the Sovnarkom (Council of the People's Commissariat) of Sept. 2, 1943 permitted the Narkomsem (People's Commissariat for Agriculture) to arrange for the storage of seeds of perennial wheat in the Kirghiz and South-Kazakhstan regions on terms established at the regional grain economics for the storing of graded seeds. The stored wheat is distributed among the state and collective farms on a loan basis, without interest, to be repaid from the harvest of 1944. The gossortfond (Govt. Grade Fund) arranged for seed storage in the Kirghiz and Kazakhstan Republics and issued a seed loan to the state and collective farms of those regions where sowings of perennial wheat were planned. In addition, the Sovnarkom, in its decree of Sept. 4, 1944, permitted the Narkomat of provisions (stocks) to release the state and collective farms of the tow regions from the obligation to return the seed to the govt., we well as to keep other agricultural products obtained from the ploughing area devoted to perennial wheat.

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The production of elite and super-elite for Kirghisia was supervised by the Kirghiz Selective Sta. Min 1943. The task of supervising the first seed sowing at Kazakh was placed upon the Krasnovopadski Govt. Selective Station.

In 1944 the Govt. Commission on grade-testing will organize the experimentation of perennial wheat on its own allotments. All these above mentioned actions are intended to lead to the immediate liquidation of an irresponsible attitude with respect to perennial wheat and to a strengthening of the implanting of perennial wheat in production.

The production of one variety of perennial wheat does not solve, however, the problem of this crop in its entirety. We are now faced with the more difficult task of creating perennial wheat for the Central areas of the Union. Hybrid material, stored from previous experiments, as well as newly developed, is being used and studied for this purpose.

The new winter perennial hybrids of older generations, produced in 1942, were taken from the field allotments in the two winter seasons of 1940/41 and 1941/42. It is known that these two winters were exceptionally hard. In spite of this the new forms survived two winters successfully without re-sowing in open ground and produced two excellent harvests of seeds and hay. One of these "forms", No. 27, survived without re-sowing successfully even a third winter that of 1942/43, in most unfavorable conditions of a changing winter, and perished only in the summer of 1943.

No segregation is noted, with regard to morphological characteristics, in the yearly sowed progenies of new forms, which is evidence of the constancy of these forms. Sowed anew in the field nursery in the fall of 1942,

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the new winter forms stood the hard winter of 1942/43 well, produced a plentiful harvest of good quality, showed an excellent growth up to the winter gathering, and in 1943/44 went through another wintering without damage and re-sowing, preserving the greater part of plants for wintering. The higher frost-resistance of these hybrids, as compared with wheat No. 34085, is explained in the first place by their origin from more frost-resisting varieties of cultivated wheat, included in the original and repeated crossings with couch grass. Among the frost-resistant (hardy) hybrids of the older generations that we possess in our laboratory, the core consists of forms obtained from crossings with couch grass of the more hardy winter wheats:

Lutescens 0329	.....55 percent
Militurum 107	.....18 "
Gostianum 0257	.....12 "
Eritrospermum 46/131	..... 5 "
Other winter wheats	.....10 "

The origin of the segregated hybrids is the following:

No. 20 (Eritrospermum 46/131 X A. glaucum) X cross

Nos. 19, 27, 29, 31 [Lutescens 0329 X F_1 (Lutescens 0329 X A. elongatum)]. To describe these numbers we are presenting them in illustration and a brief resume.

(Perennial wheat No. 20 - illus. 1, p. 44.)

No. 20 - a tall, powerful plant with coarse straw. Distinguished by a high resistance to frost. The spike - long, unbearded, open. The "shoulder - of the glume is raised slightly and pointed. The tooth short, wedge-like pointed. The 'keel-' of the flower film begins at the center, and ends in a needle-like pointed tooth that leans outwards. The seed is glassy, large.

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Absolute weight - 32 gr. Does not lodge, crumble, immune to disease; free threshing.

No. 27 - tall, open clumpy plants of non-lodging straw. Clumps violently and abundantly. The spike - tall, open, bearded. The lowest spikelet - unbearded, the second and third with short beards. Scale has pointed-elongated (teeth); flower film oval, smoothly passing into an awn. The awns - small indented, as is the upper part of keel of the flower layer. The seed - of medium size, glassy, full, absolute weight - 31 gr. Its regenerative ability after reaping (storing) is high. Growth early. Some insignificant susceptibility to rust noted. Does not lodge; threshing is easy.

No. 29 - tall growing plant of coarse straw. High frost-resistance. Spike open, non-bearded. Empty spikes at top; spikelets multi-colored with a spreading spike stalk. The seed large with a depression on the "abdomen". Non-lodging and disease-resistant. Does not crumble; absolute weight of seed - 29, 33 gr. Growth following gathering - good; threshing - easy.

No. 31 - tall growing plant; firm straw, non-lodging. Spike gradually narrowing towards top; length of 20 cm, open, non-bearded; non-lodging; two upper spikelets frequently empty. Spike scales and flower films have a pronounced keel. Teeth of flower film pointed, extended outwards. Seed - large, with collapse on "abdomen, of good quality. Absolute weight - 31.20 gr. Growth after gathering - good.

(Fall-grown perennial wheat No. 20 illus. 2, p. 45. Perennial wheat No. 27 - illus. 3, p. 45)

The above described hybrids, along with other numbers of older generations, were propagated in 1943 in a small nursery. The observations and

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practical
value of the selected hybrids.

Tables 6 and 7 present the characteristics of the selection hybrids with regard to tillering and their yield. A cytological analysis established that all these forms contain 56 chromosomes. The excellent durability of the spikes, their structure, seeds, and the good absolute weight of the latter tell of the potential possibilities of new constant perennial hybrids.

In the fall of 1943 new sowings of perennial constant forms were made in order to increase their propagation for purposes of wide and manifold experiments.

TABLE VI

PRODUCTIVE TILLERING OF HYBRIDS

Nos. of hybrids	Number of plants	Number of productive stalks	Medium productivity & tillering	Variations
19	10	160	16	8-30
20	60	1099	18	3-31
27	87	2313	27	7-60
29	60	1021	17	5-45
31	35	586	17	5-35

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TABLE VII

CHARACTERISTICS OF YIELD OF HYBRIDS

Nos. of hybrids	Productive tillering	Med. number of spiklets in spike	Med. number of grains in one spikelet	Med. number of grains in one spike	Abs. weight of grains in gr.	Yield in centn.	Relation of grain to straw
19	16	21.7	1.28	27.9	29.28	-	1:5
20	18	19.9	1.73	34.6	32.11	31.1	1:5
27	27	20.5	1.45	29.8	31.55	35.7	1:5
29	17	19.0	1.49	28.4	29.33	28.3	1:8
31	17	18.6	1.27	23.6	31.20	32.4	1:6

Some other winter hybrids are being propagated and studied simultaneously. These do not yield in quality to the above. Among them is the hybrid No. 10949, of very long spike, good seed, and high productivity.

No. 920 - produces up to 90 seeds on one spike;

No. 1013 - is distinguished by its high frost resistance and non-lodging stable straw.

No. 2643 - form has powerful growth and high frost resistance, segregated (developed from grey-stemed population on green stem. In turn, it produced a new green-seeded form in segregation.

No. 2614 - short-bearded, powerfully grown form, high frost resistance; red, well filled, glassy seed.

No. 263 - non-bearded, red, glassy seed, frost resistant, good growth.

No. 3123 - distinguished by long, coarse, non-bearded spike, large, green seed (grain). Frost resistant, well growing

(Hall-grown perennial wheat No. 27, illus. 4, p. 47. Perennial wheat No. 31, illus. 5, p. 47)

The segregation (division) into cycles of development of perennial hybrids by the method of (testing) led to the segregation of several interesting, perennial forms of summer cycle development. For instance, No. 18 was being sowed as a winter crop for several years. Several plants of this

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number, sowed in the fall of 1940, were preserved and grew in the spring of 1942, i.e., they successfully stood two winterings in field conditions without re-sowing. When sowed in the spring of 1943 in the testing nursery, this number was full of spikes and produced several new forms in segregation. A similar resistance to cold was discovered in other perennial summer long-lived plants obtained from the crossing of winter wheats with couch grass. Outstanding forms of economically valuable characteristics were segregated, for instance, from the Nos. 14 and 22, providing for a high resistance to frost.

The study of testing of the resistance to winter - and cold on the part of new perennial forms and their evaluation from the point of view of economic utilization form the subject of our current work. A constant improvement in the methods of work proceeds simultaneously with the process of creating new perennial forms. The accumulated experience, the wealth of variety in perennial forms, and the presence of outstanding hybrids in terms of economically useful characteristics lead to the strong hope of a swift solution of the complicated and difficult task ahead of us.

(Fall-grown perennial wheat after harvesting illus. 6, p. 48.)

Conclusions:

1. The fundamental rules of the process of creating perennial forms have been established in the work of creating wheat-couch grass hybrids.

2. N. V. Tsitsin has in a short time produced a wealthy variety of perennial forms, and from among their large number the constant perennial summer wheat No. 34085 was introduced in the southern regions of the Union.

3. The continued development of work with perennial wheat led to the

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creation of new winter forms, with prospects for their economic utilization in the central belt of the Union. Among them stand out some constant forms of high frost resistance and other economically useful characteristics.

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(Author - a professor and active member of the Lenin Academy of Agricultural Sciences)

Translated from the Russian by
S. N. Monson

The contemporary Soviet agronomist, an agronomist of the Stalin era, is closely related to the majestic system of agricultural science prevailing in the USSR, and is likely to forget at times the fundamental progress obtained in the field of agricultural science in the first 30 years of the Soviet regime.

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The local agronomist constitutes the main link tying agricultural science to Soviet agricultural production. When 38 years ago, in 1909, I was assigned to agricultural work near Poltava, this entire gubernia numbered at that time no more than 50 agronomists. At that, the Poltava gubernia was considered one of the most advanced agriculturally. The foremost representatives in Russian agricultural science, Sergei Fedorovich Tretiakov and Vassili Nikolaevich Diakov were engaged in work there and were the leaders of the Poltava experimental fields throughout the various stages of the latter's activities. The Poltava agronomic conference of 1910, called for the entire gubernia, was attended by 40 representatives and considered populous, although the large hall in which the conference was held appeared empty. In 1947 there are at work no less than 1000 agronomists in the Poltava region, which in area does not exceed the Poltava gubernia of those days. Current agricultural conferences held in Poltava have difficulty in finding large enough quarters.

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Regional conferences combining agronomists and advanced workers, require an enormous hall. Such conferences turn into public meetings attended by many thousands and serve as a school of advanced experimentation for the masses.

One of the most important basis for the development of agricultural science was and has remained field practice. The predominant part of problems facing plant study is solved by the method of experimenting in the fiedd. The latter is conducted on experimental fields of various types. Timiriasev dreamed of the time when there would be thousands of experimental fields in operation throughout Russia. Prior to the revolution the number of experimental fields in the country could be measured by few units. Among these the following experimental fields earned particular fame and achieved significant successes: the Odessa experimental field under the leadership of Kotmister; the Kherson field led by Yanovisk, and particularly the Poltava field under the above mentioned outstanding workers - Diakov and Tretiakov. The influence of the Poltava experimental field was felt throughout the entire gubernia, and it is no accident that the bright talent of Lysenko received its first training at Poltava, completing its development near Odessa.

The first few complex field-and selection stations (Saratov and Kharkov) were founded in the last years prior to the October Revolution. The Soviet country greets its 30-th anniversary with a well developed network

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of agricultural experiment institutions. Their number may be called - grandiose. Timiriasev's dream about one thousand experimental fields has been exceeded many years ago. At present the number of variety-testing stations throughout the territory of the Soviet Union exceeds 1,200. Each individual variety-lot represents a developed experimental field. The total number of selection stations has increased ten times, reaching above 60. Many of the Union republics possess several selection stations. The larger regions of the RSFSR have also one each, frequently even two selection stations. Particularly noteworthy is the splendidly organized network of experimental-selection stations devoted to sugar beet. A large number of complex experiment stations and stations specializing in separate branches and crops - beet, cotton, flax - are at work in the USSR.

A vast number of all-union and branches of scientific-research institutes has been founded and developed in the Soviet era. The reader of this publication knows that along with the all-union institutes of plant science, fertilization and agro-chemistry, animal husbandry, mechanization, the protection of plants, and the work on selection-genetics, the institutes are active in individual branches, such as the three institutes on cotton growing, two institutes devoted to beet sugar study, one institute on fiber crops, one Institute on forage; another on flax; and one institute for tobacco and machorka (inferior grade of tobacco); one institute of vegetable growing; one each for food feeding; apiculture, and a great

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many more. A full enumeration of these would take several pages of writing. The role of unifying all agricultural science has been placed upon the Lenin Academy of Agricultural Sciences. The main institutes and the Khazakhsky branch are under its care and administration. The staff of the academy was enlarged by an order of the Soviet Ministers of the USSR, dated July 28, 1947.

The higher agricultural schools carry the greatest importance for the development of agricultural science. In Tsarist Russia there were only five: the Moscow Agricultural Institute (formerly the Petrovski, now the Timiriasev Academy), the Novo-Aleksandrovski Agricultural Institute (transferred to Kharkov), the Voronezh Agricultural Institute, and the branches of the Polytechnic Institutes at Kiev and Riga. There were also several veterinary institutes (at Kharkov and Kazan).

At its 30-th anniversary of the October Revolution the country possesses 70 agricultural schools of the higher level. The total number of students in these schools prior to the revolution was 5,000, - at present they number many tens of thousands.

The small number of medium and lower schools produced an enormous amount of technical schools for the peasant youth. The agricultural schools of higher education maintain faculties of special assignment, intented to raise the qualifications of responsible agricultural workers (superintendents of agricultural districts and directors of the

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MTS (Machine-tractor station). The system of agricultural education is supplemented by an enormous quantity of temporary courses for the benefit of the presidents of collective farms, brigade leaders, and section members.

Agro-propaganda is conducted by the All-Union radio-committee, agricultural publications, and special regional publications, republic, district, and regional newspapers, as well as by radio-committees on location. At a time when agricultural conferences are held in the individual republics, regions, and districts, exhibits are usually organized on the results of the preceding year's work.

Russian agricultural science possessed prior to the Oct. Revolution only disconnected data which seldom penetrated to the peasant masses. Prior to the revolution problems of manure fertilization had alone received adequate study, and the conditions of the use of phosphate (Prianishnikov and Kossovich) were closely observed; so was the value of ammonium fertilization (Shulov and Petrov); the superior method of row fertilization for the sugar beet was also proven, but the suitability of nitrogen for black earth was not indicated; the system of fertilizing and cultivating was not connected with grass-field crop rotation, and the formation of selective varieties had only been begun. On the other hand, the system for obtaining high yields of individual crops remained most schematic. Plant growing in Tsarist Russia was merely a descriptive science. In Soviet Russia, the study of plant growth assumed productive significance.

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The strength of Soviet agricultural science consists primarily in its accessibility to the masses. Collective agriculture permitted the participation of tens of thousands of collective farmers, both men and women in the development of science. The work of Timiriazev, which closely linked physiological and agricultural sciences was consumated already in the first years following the October Revolution. Immediately after it, science benefitted from the new and valuable discoveries made by Prianishnikov, the founder of Russian agro-chemistry. The discoveries and research of Williams and Michurin reached their full bloom in the first two decades of the Soviet era. The teaching of Michurin concerning the transformation of plants and that of Williams on the transformation of soils paved the way for the discoveries of Lysenko who set a new direction for agricultural science. The principal basis of this direction may be characterized as the uncovering of the close relationship between ecology in agricultural plants and their forms. Lysenko has pointed out and proven that the system of agronomic reaction is determined by the peculiarities of the biology of each individual crop. He applied this teaching to a series of basic agricultural plants, to wheat and cotton, the potato and the sugar beet; to kok-saghyz and millet. Simultaneously, Lysenko established the connection of the reverse order, demonstrating on a large number of examples that the methods of cultivating and particularly those of training produce deep changes in the development of plants and their formation. The level of fertilization is reflected not alone in the number of seeds in the spikelet, but also in the degree of the branching of

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the spike. The influence of temperature affects not only the heading of typical winter crops at spring sowings but it also offers the opportunity to strengthen these transformations in subsequent generations.

Lysenko achieved stable transformation of summer into winter forms. The fields of the collective farms in the Leningrad region carry transformed wheat (II-160), obtained from summer wheat, which have already produced excellent harvests at fall sowings for several years. Remarkable results on the transformation of varieties have been achieved by the work of Lysenko and his associates with the aid of inter-varietal crossing with regard to self-pollination and by way of the inter-varietal crossing applied to cross-pollination (rye).

The successes of Soviet selection in the field of winter-and summer wheats, rye, millet, sugar beet, cotton, sunflower seed, potatoes, and many other crops are eminent and frequently turn into actual triumphs. It suffices to point here to the new variety of cotton - C 460, (selector Kanash) which stands out as a valuable mixture of a high yielding, high growing fibre, of increased length. In the space of four years, which included the war years, this variety was propagated from small lots of several hectars onto enormous areas of half a million hectars. It is sufficient to point also to the successful distribution of new varieties of wheat, such as the Odessa 3 on the Ukraine and the Novo-Ukrainka at Kuban.

New sunflower seed oil varieties of high content brought about a

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turn in the production of oil at oil manufacturing plants. Soviet selectors (Kazlumov at the Ramon station) succeeded in obtaining the combination of high content of sugar and high root weight in the sugar beet, which was considered unobtainable in capitalistic countries.

Much was accomplished in the field of distant crossings (rye-wheat, wheat-couch grass hybrids, wheat-grain (corn) hybrids). New forms of perennial cereals were produced (Tsitsin, Derzhavin).

The successes of Soviet agriculture have frequently been exposed. I wish to dwell here briefly upon the problems solved by Soviet science in the field of the cultivating of field plants and agro-technique. In the Soviet period the distribution of crops has undergone a radical change. A new wheat base was created in the non-black earth region. With regard to sugar beet, climatic boundaries formerly considered unsurmountable were smashed. Completely new regions were conquered for cotton growing. The Soviet complicated agricultural machinery, combines, tractor ploughs, grain-drying and electrical threshing machines, produced new techniques in agriculture.

With respect to the application of chemical science to agricultural crops, a considerable amount of many-sided study has been devoted to the introduction of fertilization during the period of growth (pod-kormki) in the Soviet period. The Stakhanovtsi of agriculture managed to fulfill Williams' principle of feeding the plant rather than the soil. New forms of "pod-kormi" (supplementary feeding) were also evolved. Even prior to

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the October Revolution Latzkov began the study of supplementary feeding of outside roots by using the spraying method. At present, there are attempts made at the Timiriazev Academy to strengthen the transfer of sugars from the leaves into the root bodies by using the method of spraying the sugar beet prior to the harvest. One may view as a peculiar form of fertilization the spraying with growing substances in minute doses (less than 10 mg per liter). This leads to the speeding up of the ripening of fruits, the protection of plants from the falling off of ties, the rapid rooting of clones. The methods of local applications of fertilizers at sowing and planting periods have been well developed. It has been established that fertilization of winter wheat in-rows offers a valuable method of protecting the plants from winter-spring destruction. Excellent results have been achieved by the introduction of fertilization in-rows in the cultivation of sunflower seeds.

Considerable results were obtained also in the field of cultivating the soil. It is to be observed that even prior to the revolution the significance of deep ploughing was appreciated not alone with regard to the sugar beet but also for wheat and other crops. It should further be remembered that the Poltava station even then showed the danger of deeply-laid cultivation carried on prior to sowing for the wintering of winter cereals. I have had numerous occasions in the past ten years to write and speak on the subject and have stressed that this Poltava method never contradicted, nor does it stand in contradiction to Williams' principle concerning the gradual deepening of the cultivating of the fallow in order

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to clear a field of weeds. The depth of the superficial cultivations of the fallow must be deepened throughout the spring season and early summer, while in July, 3-4 weeks before sowing, the deepening must be reduced. The Poltava station began obtaining high yields of winter crops only from the time it started to apply such gradual reduced deepening of the plough land prior to the sowing, and it is an error to consider this most important rule to be of only current discovery. (see Ryzhikov's article in the newspaper "Socialist Agriculture" for Sept., 1947).

The application of Williams' method of cultivation produced the reorganization of all methods in the cultivation of cotton. In the cotton-lucerne crop-rotations the multiple repeated ploughing disappears. New methods of deep cultivation of soil, without the turning of layers, were transferred from the cotton regions to the central parts of the Soviet Union, the new process consisting in cultivating with the aid of chisels. This method helps considerably in reducing the choking (contamination) of fields, since the seeds of weeds grow in a friable layer but are unable to come to the surface. Soviet science has also worked out new forms of disking, i.e. a fall plowing of wild oat fields, as well as spring pre-plowed disking on areas destined for summer crops (Lysenko), using pairs of horses.

The success achieved in the fight with sand storms is aided by the reduced amount of cultivated ground, especially on fallows. The

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decree of the Plenum of the Central Committee of the VKP (All-Communist Party) established the transfer to the mass use of coulter which ensures the liquidation of small plowing of fallows and "ziaba". With respect to sugar beet and cotton more significance is given the further deepening of the plowing for valuable plants primarily in electrified sections. The cultivation of fields, the wide use of "predplushniki" (coulter) assist considerably in combatting weeds and incidentally altering the methods of presowing cultivation. Fields, plowed up to 20-22 cm by "predplushniki", even in grass layers, do not require repeated operations of equipment in the spring season, limit the use of harrows, and reduce the pulverizing influence upon the soil. Methods were developed permitting to combine into one operation the harvesting by combines and the disking of fields, thereby producing a more efficient disking in a system of plowing cultivation.

With regard to sowing, the transfer to the establishment of norms of sowing according to number of seeds has been worked out. Conditions under which increased norms of sowing can be efficiently used have been determined. The increased norms should be used for the protection of sowings from contamination, since weeds get oppressed only in a thick stand of cereals. The increased norms of sowing have to be used equally in all cases where the appearance of close growth is not sufficiently assured, when the sowing layer is inadequately moist, or when the sowing is done too late. Once close growth is insured, the norms of sowing should be reduced. The Rostov experimental station indicated the expediency of

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of changing the norms of sowing to depend upon the supply of moisture in the spring season. Increased supplies of moisture permit the increase of norms of sowing. If the supply of moisture is limited in the spring, it is advisable to use lowered norms.

Soviet agricultural science has also solved the long-standing problem concerning the character of the relationship between the level of harvests and the norms of sowing. A large number of experiments showed that harvests of medium height are obtained from a variety of norms, while harvests of the highest level demand increased norms. Only new forms of wheat may change this regularity.

Increased significance belongs to nest sowings. The nest sowing method advocated by Lysenko for kok-saghyz produced considerable reductions in the labor force during harvesting, and has now become the principal method of cultivating this plant. Nest sowings produce very valuable results in the cultivation of sunflowers and corn. They may also be used in cotton growing and in addition may be of significance in the cultivation of lucerne. Soviet agricultural science solved the problem concerning the rational methods of sowing together grass and cereals ("podpokrovnie posevi"). Special seeding machines were constructed for the simultaneous sowing of grass crops and 2 components of grass mixtures (bean and grain grass). The "Tukovii"box of combined seeding machines is used successfully for the sowing of grain-grass crops. In the south-east, good results are obtained in sowing lucerne together with sunflower or in wide rows with

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millet. Such method may be referred to as polu-pokrovni (half-covering) sowing. The supply of sun light to the growth of grass is secured by the wide-rowed sowing of cover rye. The grass mixture feels considerably safer under wide-spaced rye than under narrow-spaced sowings.

Soviet agricultural science has also solved the problem of selecting cover crops for the different regions of the USSR. Among summer grain crops, summer wheat proved to be the best "cover" plant over a wide region, while the winter grass crops also feel safer under the cover of wheat than under the cover of rye in narrow sowing. Under-cover sowings have been developed for other crops as well, particularly for the perennial lupine. These under-cover or double-deck systems aid the elimination of a break between the general duration of the period suitable for the growth of the plants (field period) and the vegetative period of certain crops.

Significant changes were obtained with regard to periods of sowing. The method of early potato planting recommended by Lysenko, proved to be best in protecting it from degeneration. Summer sowings of lucerne became the basis of lucerne seed crops over a wide area in the southern districts. The ("reaping") sowing of millet, buckwheat, corn, flax also represent forms of summer sowings and ensure the development of these crops by using the cooler months of the summer season. The wide-rowed sowings acted favorably not only upon millet but also upon buckwheat and peas.

With regard to the preparation of seeds, agricultural science has developed a series of samples. In the majority of regions the "summerizing"

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of the seeding material ensures in the south protection from dry winds, in the north protection from the first frosts. The spring warming of seeds helps the increase in their germination and contributes to early growth strength. A series of experiments show that the best development is achieved by a seed material of increased uniformity. Seeds uniform in size and thickness - produce closer growth and a more uniform development and ripening, thus considerably reducing the double-deck form of crops. One of the basis for ensuring a high yield is uniformity in the placement of plants upon the field's surface. Such uniform distribution for grain is obtained with the aid of narrow-rowed seeding machines, a cross sowing, and more superior sowing equipment. The uniform distribution of plants ensures a better utilization of sunlight. With regard to crops of infrequent stand, there is less loss in the absorption of sunlight if special measures are taken. Among such measures with regard to potatoes one may consider close sowing followed by thinning, while with respect to root crops a break through in two periods. These measures help considerably in taking better advantage of sunlight in the spring and summer months.

The methods of caring for agricultural crops also underwent substantial changes. Prior to the revolution, such care was in the majority of cases limited to reactions upon the soil or the control of weeds, all care frequently lacking with regard to grain crops. The peasant considered it possible not to show up on his field at all between sowing and harvesting time. In socialist agriculture this has been radically changed. Grain crops, along with technical and vegetable crops, are provided with care throughout the vegetation period. On winter fields additional fertili-

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zing and hoeing is done in the fall yet. The process is repeated in the spring when harrowing is added. Harrowing of summer grain following germination proved among one of the more valuable methods in collective farm agriculture.

A radical and noteworthy change with respect to care lies, however, in the fact that many methods of care are now directed upon the plant itself. This includes the above mentioned method of thinning potato plants or the repeated thinning of root crops, sowed clovers, the new form of the "stamping" of the cotton plants, worked out by Lysenko, which at the same time also includes the trimming of the cotton shrub. The stamping does not limit itself to the cutting of the central runner, but takes in the side runner as well. Stamping and pinching are applied by Soviet agricultural science to other crops as well, such as the castor plant, hemp, and the planting of sugar beet. Finally, the artificial propollination of Musiiko belongs to the methods intended to influence the plant itself. The latter method is already widely used in the practice of production and assures many plants - corn, sunflower, lucerne, and rye of a higher yield. The latter article has particular significance with us since rye occupies tens of millions of hectars.

With regard to the harvesting of individual crops, the change in the periods and manner of storing during ceraceous ripeness carries an important value. The methods of controlling losses at harvesting with combines

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are well developed. In harvesting with ordinary machines the expedient way of stacking by hand at close distances has been accepted. This method releases a considerable number of teams for other work where they are indispensible. A large advantage in the manner of harvesting is derived from milling from shocks, which reduces the loss involved in additional transfers of shocks, unavoidable in stacking. It is an error to assume (though frequently so stated) that stacking has to be done immediately following the mowing of grain. In such case the sheaves that are not dried yet are stacked and so subjected to rotting and molding. Much significance is attributed to the use of combines in harvesting seed grasses - clover and lucerne. Harvesting in several stages is practiced in many cases. A considerable change is observed in the mechanization with regard to cotton growing which applies the method of harvesting cotton from open boxes.

To summarize, it is to be noted that agricultural science and stachanovtsi (advanced workers) obtain the highest yields by way of influencing the various factors in the development of plants. At present such influence is exerted not only on nutritious substances and water, but also heat, light and air. In the 30-year period of Soviet rule the theory and practice of irrigation have undergone a radical change. Watering by drowning has been replaced by watering by furrow (trenches) and pipes which prevents the soil from silting. Stachanovites apply frequent

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watering (irrigation); the sprinkling method is more and more used, considerably reducing the watering norms. A greater economy in watering is achieved by irrigation below the surface, accomplished with the aid of plant foods. Here every drop of water is put to use, even a small norm of watering, such as 20 cu.m., which corresponds to 2 mm of precipitation. The supply of heat and additional supply of carbonic acid is provided by peat mulch. Additional feeding with carbonic acid may be given in sprinkling.

A manifold and even many-sided influence upon the development of plants is obtained by the crop rotation with the use of the grass-method in agriculture which does not limit itself to field grass crop rotation. The crop-rotation with the use (travo-polnaia) of grass system is comprised of two crop rotations closely connected with each other: the field and fodder, the tree-sheltering belt, the system of fertilization with a definite system of cultivating soil. All these methods join in a single complex and their application changes substantially the level of fertility and the conditions of the development of each crop.

The academician Williams labored until the last days of his life at the task of improving the system he had proposed. Several days before he died he said that while the first half of the work of obtaining 7 billions of poods of grain a year has been solved, it is now important to attempt to reach the goal of 8 billion poods. In the current year (1947), only two years after the end of the war, the country was already

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able to approach this goal in the production of grain. The large number of candidates for the high distinction of "Heroes of Socialist Labor" is evidence of the deep changes that have been accomplished by Soviet agriculture in 1947, as a result of the historical decrees of the February Plenum of the Central Committee of the All-Union Communist Party issued to commemorate the 30-th anniversary of the Great October Socialist Revolution.

End of Article

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Translated from the Russian by
S. M. Monson

INTRODUCTION

The February plenum of the Central Committee of the All-Union Communist Party (1947) in its decree on "Methods of Raising Agriculture in the Post-War Period" - recognized the necessity of completing the transfer to fully regionalized (adopted) winter and summer plantings of higher yield grain crops in all sections, areas, and republics no later than by 1949.

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In the recent past Soviet selectionists have produced a number of varieties of grain, leguminous - and oil crops, as well as grasses. Among these are varieties of:

Winter Wheat:	Novo-Ukrainka 05	(Krasnodar Selection Station)
	Ulianovka	(Novouzenskaia Selection Station)
	Lutescens 17	(Verchniatchesk Selection Station)
	Eritrosperrum 16	(" " ")
	Odesskaya 3	(All-Union Selection Genetic Institute)
	Lutescens 110	(Falenski Selection Station)
Summer Wheat:	Tulun 70B/8	(Leningrad Selection Station)
	Artemovka	(Stalin Selection Station)
	Moskovka (Mosgibrid 40)	(Institute of Grain Agriculture of Non-Black Earth Belt)
Oats:	Sovietski	(Verchniatchesk Selection Station, etc.)

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In order to select the best grain, local agricultural organizations certify the varieties of crops every year. This certification is intended not only to ensure an accurate accounting of the distribution of varieties, but it also provides a strict appraisal of the qualities of the sowed material.

In view of the varied climatic conditions, soils, and demands of agriculture, prevailing in the Soviet Union, the collective and state farms cultivate a considerable number of varieties of all grain crops (winter and summer wheat, winter and summer rye, winter and summer barley, oats). Different varieties of the same crop are planted within the borders of the same region and districts, depending upon the different natural zones. Frequently, the same collective and state farms will plant two varieties of one crop.

In Siberia and the Trans-Ural region, the collective and state farms plant both early and late crops. The task of the agronomists on location is to examine the varieties of crops and to give them the proper appraisal. They are obliged to possess an adequate knowledge of the morphological and biological traits of the varieties under consideration and to judge the degree of changes in them under actual environmental conditions.

The purpose of this handbook is to provide a practical guide on the conduct of grade approval of the sowings of grain crops, and to assist agronomists, selectionists and farmers in learning the varieties

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of the most important field crops produced in the USSR. The work will also prove of help to students of agricultural colleges.

Included are: a brief description of crops, their value and significance, regions of distribution, brief botanical and agricultural characteristics of the varieties, along with data on the diverse morphological characteristics and biological traits of particular importance to examiners.

An illustration of every important economic plant is reproduced; the principal diseases and pests are indicated for every crop, as well as of the special varieties of weeds.

The first handbook - on the Approval of Grain Crops - was issued by the All-Union Institute of Plants in 1928. Beginning 1935, the Institute published a handbook on the individual economic crops; the first volume, devoted to cereal crops appeared in its fourth edition. The last, pre-war edition was published in 1938. It was used in 1940 as a basis for a brief manual on the procedure to be followed in "approvals" issued in various districts and regions.

Of winter wheat - 112 varieties are described; of summer wheat - 182; of rye - 46; barley - 90; oats - 54. The majority were described for the first time. The volume further supplements our knowledge with respect to the characteristics of previously described varieties. All newly adopted varieties, as well as potential varieties and also those widely distributed in the Western Ukraine, White Russia, Moldavia, and the Baltic Provinces, are included.

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This work is a product of collective labor; participants were - specialists of the Government Commission on variety-testing of grain crops, the All-Union Institute of Plants, and the scientific workers of the selection-testing network of the USSR. The varieties are listed in alphabetical order (with in the limits of given species and crops) and in tables - in the order of varieties. Within the latter, the strains are distributed according to an ecological-geographical principle.

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By:
E. Ruwell
Extracts

Rye

Distribution and importance of that crop.

Cultivation of rye is known to almost all the countries in the world. But thanks to its biological characteristics (marked resistance to cold, ability to germinate at a temperature not much above zero, little demands of and great adaptability to growth conditions etc.), rye has nevertheless received its largest expansion in countries with a temperate or cold climate (U.S.S.R. - Germany, sweden, Poland etc.).

For the area cropped to it in U.S.S.R. rye ranks second to wheat. Being a cosmopolitan crop it was able to spread all over the U.S.S.R. from the northern limits of agriculture to the southern steppes inclusive. It is very widespread in the central oblasts of the European part of the U.S.S.R. In the north, rye crops extend up to Arhongelsk and in the south down to Rostov. In the Asiatic part of U.S.S.R. - rye crops are less widespread.

In connection with the February (1947) decree of the Tsk VKP(b) [Bolshevik Party] plenary meeting "On the measures to raise agriculture in the post-war period", together with an expansion of winter rye crops, the main problem in the near future, is to increase rye's yield, and to increase its production in the raions of the non-chernogem oblasts, the northern oblasts of the Ukraine the right-bank raion's of Povolshia [along the Volga] and of other raions.

Winter varieties are cultivated mostly; as for spring gye it does not have any real importance. Its sowing is concentrated principally in East Siberia, the eastern raions of Zabaikal'ia [Region beyond lake Baikal].

Rye is of extreme importance for our public agriculture and its wide distribution over the U.S.S.R. expresses that fact.

Rye is one of the main food products. It is widely used in livestock raising, in alcohol, paper and technical industries.

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Biology of flowering of rye.

Rye is a cross-pollinated plant. Pollen is transferred from one plant to another by the wind.

When self pollination occurs (within the flower, the ear, or the plant) there generally is no fertilization and the grain does not germinate; only a few strains can stand this forced self-pollination. Progeny of self-pollinated plants develop more weakly than the crops pollinated ones and often show reduced vitality as Ch. Darwin had already proved irrefutably. A considerable percentage of freak plants, single-stemmed, dwarfish, chlorophyl-less etc. appear among them. A large percentage of grain, from inbred plants does not germinate.

Acad. T. D. Lysenko's works in the field of agriculture biology, has established that rye varieties not only do not lose their valuable properties and characteristics when cross pollinated with other varieties but on the contrary, benefit when different varieties are grown together. This principle is being widely used now, for the production of new rye varieties.

Production of new varieties.

The biological particularities of rye; reproduction, also condition selection methods for that crop.

To produce rye varieties, general or individual (family) selection is generally used. As rye plants are complex heterozygotes the selection methods (general and familial) always consist of multiple processes.

Local populations and selected varieties are used as material from which selection proceed. Most of the old Soviet varieties are being produced by selection from local rye, generally not isolated from other rye plantings and because of that, it would be a mistake to relate the origin of such varieites to a single fully determined variety without studying the possible influence of other rye varieties over them.

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At the present time when the economic advantage of cross pollinated varieties has become evident, the method of free cross pollination with very carefully chosen pollination varieties is being widely used for rye selection and established on scientific bases. The selector almost always chooses rye plants not from a determined local or selected variety, but from a biological blend obtained as a result of free cross pollination of a local variety by one or many varieties.

The following methods were used to produce the rye varieties described below:

1). Many times repeated general and family selection, continuous family selection.

2). Preliminary free pollination of two varieties followed by repeated family selection.

3). Preliminary free pollination of the variety by three or more varieties, followed by repeated family selection (method of complex populations).

We are introducing a table presenting the methods used for selection and the initial material.

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Methods and initial material used to produce selected varieties•

•According to the data of their authors and to data from literature

Methods of production of the varieties	Initial Material	Botanical Variety	No. of Varieties produced	Name of the selected varieties
Many times repeated general and family selection and continuous family selection	Local Varieties population	(Vulgare)	9	Viatka, Lisitsyna, Tulunskaia zelenserhaia, Taranashchanskaia, Polesskaia, Garinskaia, Nikulevskaia, Belia Psonskaia, Dotnuvskaia VII.
id.	Selected varieties	(Vulgare)	8	Saratovskaia I. Petkusskaia vegelopodolianskaia, Petkusskaia kharkovskaia 194, Viatkamoscovskaia, Pularskiarannaia, Zeelandskaia, Vershbinskaia, Ragalinskaia.
Preliminary free-pollination (of 2 varieties) followed by many times repeated family selection	Product of cross pollination of local varieties (previously selected)	(Vulgare)	14	Besenchukskaia Gheltozernaia, Voronezhskaia S. Kh. I. Avangard, Manychskaia, Tarashchanskaia M-4 Mup, Onokhoiskaia iarovaia, Kazanskaia 5 + 6, Sangasti, Petkusskaia Lokhova, Iygeval, Dotnyvskaia Aukshtein, Dotnyoskaia VIII
Preliminary free-pollination (of 3 varieties and more) followed by many times repeated family selection (method of complex populations)	Product of selected & local varieties inter-pollination (previously selected)	(Vulgare)	4	Omka, Volzhanka, Udinskaia, Vloshanovskaia

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We can see from this Table, that, such rye varieties as Petkusskaia Lokhova (Germany) which served as initial material for producing the high-yielding varieties of Belorussia and Ukraine, southern oblast (Vloshanovskaia for instance) as cold-resistant variety "Omka" adapted to the germinating conditions in Siberia Steppe raions, with a thin show blanket as "Onokhoiskaia iarovaia" superior for its grain size, to all Siberian varieties of spring rye, and as the still quite new variety "Voshanka" superior in yield to "Saratovskaia 1" have been produced by the method of preliminary free pollination.

In many selection stations, and in specialised institutes (Karan'dinskaia, Onokhoiskaia, South-eastern grain farming institute, et.) the method of free inter-varietal pollination is one of the basic methods, in the production of new varieties.

Increase of Varieties.

Before the Revolution the work on improvement, production and increase of rye varieties was carried on, on a very small scale and took place/mostly in the following stations of Viatka (no Faleno) of Kharkhov, Shatilov, Voronezh, Tulun, and in the Bogaroditsk experimental field.

Only in the Soviet era when an exceptional importance is given to increas-in yield, production and multiplication of varieties, did selection and seed farm develop rapidly.

At the present time, practical work on rye is being carried in numerous raions of our Union. More than 40 varieties have been produced which have been recognized in practice. New ones, more productive and better resistant to cold are being readied to take their places.

Selection stations, at the same time as they produce new varieties must also increase (grow an elite) the selected rye varieties already produced and in

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quantities such, that seed plots of all raion seed-growing farms be seeded with elite seeds of officially adopted varieties. Elite seeds must be of first quality. This depends on the extent to which selective, seed growing methods have been mastered and on the know-how of practical workers in using them in their work. At the present time, the method proposed by Acad. T. D. Lysenko is being used in seed growing work (growing plants on land prepared with high standard of cultivation strict evaluation of qualities and properties of the plants and uninterupted selection of the best plants and families). This method provides that the selectionor, in the course of his seed production work, will continuously improve the variety he produces and increase its economical indexes.

With respect to isolation T. D. Lysenko, notes that spatial isolation of varietal fields of rye -- a crop of which the economical and biological benefits concur -- is useless. In 1938, he indicated the necessity of Alkin's isolation of rye.

Practice has shown that the discard in N. K. Z. U.S.S.R. of the indicated isolation of varietal crops in 1939, and its change to a 200 metres separation, did not have an influence on biological impurity and did not decrease the resistance and productivity of selected varieties.

Variety Identification.

According to their morphological characters, all rye varieties are to some extent heterozygotic. This makes it more difficult to determine variety, and because of that identification just as determination of varietal value is made in a different way from that used for self pollinators. It is based mainly on the presence in the farm of documents that indicate the generation of the crop and confirm that the crop has been seeded with one or another selected or local time honored variety and determination of the variety's purity is excluded.

Besides establishing through documents that a crop of rye belongs to

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one variety or another, it is indispensable on the basis of the knowledge of variety characteristics, to check in the field, whether the crops correspond to the variety designated in the documents.

Until 1935, the category of rye crops was established mainly according to the percentage of typical features, taking as a basis the typicalness of the ear. As the division of ears into typical and non-typical ones very often depended on the approbator's subjectivity, on the degree of his acquaintance with the variety, the determination of rye's varietal value according to the percentage of typical features, often resulted in wrong conclusions, in mistakes. It is a fact that with such a means of evaluating a variety the approbator ran into great difficulties resulting from the following:

1). All the existing rye strains belong to only a single botanical variety, var. vulgare (vulgare means common rise) and there are no sharp morphological differences between them.

2). In any variety, no matter by what method it is produced, and what are its growth conditions, some strains can be found that differ from one another in a number of quantitative and qualitative characteristics.

3). The complexes of varietal characteristics, a large number of which are quantitative, do not show the outward differences between varieties; these characteristics depend on their homozygosity (genetic uncomformity) can have a different degree of stability. More genetically uniform varieties (Li'sitsyna, Tarashihaanskaia 2, and others) keep their varietal characteristics better than less externally similar varieties (Viatka Eliseevka, Vershbinskaia, Beniakonskaia, Stendskaia and others);

4). A number of varieties have been used as initial material for producing many varieties. Among the varieties produced, very often well-defined morphological differences did not appear, but at the same time they differed

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through a number of biological properties, For instance, through straight selection and also preliminary crossing out of 42 varieties in the table, eight were obtained from Petkysskaia Lokhova (Novozybkovskaia M-4, Tarashchanskaia 2, Tarashchanskaia 4, Petkusskaia veselopodolianskaia, Petkusskaia Kharkovskaia 194, Vloshavskaia, Vershbinskaia, Iygeva 1). Three were obtained from Probshteiskaia (Petkusskaia (Lokhova), Shlanshtedskaia, Sangasti), two from Eliseevskaia (Saratovskaia 1, Bezenchukskaia zheltozernaia) and others.

At the present time though the purity of rye crops is not established at the time of approval the approbator still must be familiar with the features and characteristics of varieties, principally so as accurately to compare (check) the variety with the document and the crop in its natural form.

Ecological groups of winter and spring rye varieties, cultivated in U.S.S.R.

All the diversity in biological and morphological characteristics of the rye varieties cultivated in U.S.S.R. can be divided in accordance with the conditions of the initial point of origin into a certain number of ecological groups, distinguished by a complex of external features peculiar to a number of varieties.

U.S.S.R. rye varieties are related to the following ecological groups:

1). The North-Russian group encompases the northern zones of the European part of U.S.S.R. including the western as well as the eastern raions. It is characterised by its long stem, good foliage, high tillering, either half or slightly spread apart bush. The coleoptile and first leaf are of medium thickness, colored with different shades of violet. The ear is of average size, the grain is exposed, shatters, has yellowish-green color.

The varieties are mostly winter ones, average maturing, not exacting in their temperature requirements at maturing time. They are characterised by their high resistance to cold, a relative resistance to grass mildew, to brown and stem rusts. They are not resistant enough to lodging.

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Viatka, Viatka Moscovskaia, Avangard Kazanskaia 5 and 6, are related to this group.

2). West European lowlands rye in U.S.S.R. is widespread in western raions of Ukrainian S. S. R. and B. S. S. R. in the Baltic republics, and also embraces the low raions of Germany, Denmark and Poland. It is characterized by its, average or short stem, thick, strong, straw that does not lodge, average tillering, wide foliage, thick half spreading apart, seldom straight bush. The coleoptile and the first leaf is sturdy, thick intensely colored. The ear is sturdy, wide, often clearly tetrahedral, average sized. The grain, large green, exposed or half-exposed, does not shatter much.

It is represented mostly by winter varieties, average maturing. Its resistance to cold is average. In the U.S.S.R. climate conditions, it is not sufficiently resistant to cold. Its resistance to drought is average. It is susceptible to brown and stem rust. Its productivity is high under optimum growing conditions. The following varieties belong to this group: Tarashchanskaia 2 (II type), Tarashchanskaia 4 (IV type). Petkusskaia vesepodolianskaia, Petkusskaia kharkovskaia 194, Petkusskaia (Lokhova), Ragalinskaia, Vloshanovskaia, Verzhbinskaia, Iygova 1 Sangastè, Pulavskaia rannia [early], Beniakonskaia, Zeelandskaia, Mikulevskaia Stendskaia, Priekil'skaia, Dotnuvskaia VII, Dotnuvskaia VIII, Dotnuvskaia Aukshtein.

3). The steppe group encompasses the steppe and steppe-forest raions of European and Asiatic part of U.S.S.R. It is characterized by an average, more rarely a short, stem, average foliage, a relatively sturdy straw, average tillering, a half or completely spread apart bush. The coleoptile and first leaf are small, thin, narrow, more often of a medium or light shade of violet. Sometimes, some individual plants have a colorless coleoptile and a green leaf (of the same type as wheat seedlings). The ear is of medium size or short, the grain half-exposed or half covered of medium or small size, of greenish-yellow coloring, more

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resistant to shattering than the northern group varieties.

Winter varieties, medium-maturing and medium early maturing are mostly widespread.

All that group of varieties is resistant to soil and atmospheric drought. It is characterized by its resistance to cold, requires a lot of warmth at the time when it matures, and can withstand heat. It is medium susceptible to grass mildew, stem and brown rust.

Here belong the following varieties: Lisitsyna, Eliseevkaia, Bezenchukskaia zheltozernaia, Saratovskaia 1, Volzhanka, Mup, Voronzhskaia S.Kh.I, Garinskaia, Onka, Dolinskaia.

REMARK - Varieties Novozybkovskaia M-4, Poleskaia, Pul'mann Zheltozernaia are intermediate between the northern and steppe groups.

6). The East Siberian group encompasses the Krasnoiarsk krai, the Buriat-Mongolian and Iakutk A.S.S.R. It is characterized by medium stem length, medium thick straw, little or average tillering, thin foliage, a thin, very much, spread apart bush. The seedlings at the coleoptile and first leaf phase are most often small. The ear is narrow of average or under average size, the grain small, needle shaped, grayish green, exposed, and does not shatter.

This group is represented by spring, less often by winter varieties, with a medium or medium early vegetative period. It is resustabt to drought. The winter strains are highly resistant to cold, their susceptibility to brown and stem rust is low.

To this group belong the following varieties: Tulunskaiazelenozernaia, Udinskaia, Zhitkinskaia.

RYE VARIETIES.

Winter Rye

Variety's history - "Avangard"

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Produced in the Kasan State selection station through the family selection from a degenerate of Alpine rye. State tested from 1927 - 1928. Officially adopted in 1929.

Botanical characterization - Variety Vulgare

Related to the North Russian ecological group. The ear has a prismatic shape, with square or rectangular transverse section area; it is of average length and compactness, less often loose.

The awns are soft half open, of average length.

Glumes -

Around glumes are lanceolate or of a shape close to rhombord. The lemma is tough, the small on their outer surface are of average length and not coarse.

The grain is fully or half exposed, adheres weakly to the lemma, shatters considerably, has a green color, (number of yellow and brown grains is comparatively low) is elongated, and of average size. The weight of 1000 grains is average. The consistency is half mealy. It takes a dark tint under the action of phenol.

Stem Leaves

The straw is of average height, not sturdy enough, has a tendency to lodging. It produces many leaves and tillers.

Vegetation period

The variety is a medium early one. Matures two days before Bezenchukskaia zheltozernaia.

Resistance to cold and drought

The resistance to cold is above average and high.

The resistance to drought is medium.

Susceptibility to diseases

Susceptibility to diseases below average for brown rust, slight for stem rust and medium for ergot.

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Yield

The variety yields high crops in the forest steppe right bank zone of the Ul'ianov oblast, and good ones in the other zones for which officially adopted. Officially adopted for the Ul'ianov, Kuibyshev, Gorki oblasts, in Chuvak and Tatar A.S.S.R.

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"Bezenchukskaia zheltozernaia"

Susceptibility to diseases

Below average for brown rust and ergot.

Officially adopted in the Chkalov, Pavlodar, Kuibychev, Kustana, and East Kazakhistan oblasts.

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"Beniakonskaia"

Is found in the fields of western Belorussia, where it is the most widespread variety, especially in the Baranovichi and Vileika oblasts.

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"Verzhbinskaia"

Susceptability to diseases

Medium for leaf and stem rust and snow mold. Is found in the fields of western B.S.S.R. and Ukrain S.S.R. oblasts.

~~~~~~~~~~~~~~~~~~~~~~

"Vloshanovskaia"

Is found in the fields of the Lvov and Stanislav oblasts of Ukrain S.S.R. and southern oblasts of B.S.S.R.

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"Volshanka"

It is recommended economical evaluation in the Saratov oblast production.

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"Voroneshskaia S.Kh.I."

Susceptibility to diseases

Medium for brown rust and ergot, below average for grass mildew.

Officially adopted for Voronezh and Riazan oblasts.

"Viatka"

Susceptability to diseases

Under average for brown rust(medium in central, Chernozem oblasts. Slight and below medium in Eastern Siberia), slight and below medium for stem-rust, about medium in the northeast, and below medium or slight in other zones for snow mold. In the northeast of European Soviet Union susceptible to sclerotina. Officially adopted in the northern, northwestern, and central non-chernozem oblasts, in the northeast of European U.S.S.R. in West and East Siberia, in the East Kazakhstan and Semipalatin oblasts. It is a widespread variety.

"Viatka moskovskaia"

Susceptability to diseases

Average.

Officially adopted in the Moscow and Kaluga oblasts.

"Garinskaia"

Susceptibility to diseases

Below average for brown rust.

Officially adopted in the Sverdlovsk oblast.

"Dolinskaia"

Susceptibility to diseases

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Below average, for brown and stemm rust. Has a tendency to become severely infected with fusanosis and stinking smut.

Officially adopted in Karagandin, Ak. Molinsk, North-Kazakhstan and Kokchetav oblasts.

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"Dotnuvskaia Aukshtein"

Is found in fields of Lithuanian S.S.R.

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"Dotnuvskaia VII"

Is found in fields of Lithuanian S.S.R.

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"Dotnuvskaia VIII"

Is found in fields of Lithuanian S.S.R.

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"Eliseevskaia"

Susceptibility to diseases.

Below average for brown rust, slight for stem rust, average for ergot.

Officially adopted to Saratov, Stalingrad, Astrakhan, West-Kazakhstan oblasts, Bashkir A.S.S.R. Is being superseded by more productive variety Saratovskaia 1.

"Zhitkinskaia"

Susceptibility to diseases

Below average for brown and stem rusts. Gets infected with ergot more than the other varieties.

Officially adopted in Chitin oblast, Khabarov krai and Iakutsk A.S.S.R.

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"Zeelandskaia"

Is found in fields of L'vov, Stanislav and other southern oblasts of Ukrain S.S.R. and B.S.S.R.

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"Lygova 1"

Is found in fields of Esthonian S.S.R. where it is less widespread than variety Sangasté.

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"Kazanskaia 5 and 6"

Susceptibility to diseases

Below average for brown rust, slight for stem rust, average for ergot, gets infected by snow mold more than other varieties.

Officially adopted in Mordovian, Tartar and Chuvash A.S.S.R., in Gorki and Vladimir oblasts.

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"Lisitsyna"

Susceptibility to diseases

Below average in Uli'anov oblast, generally medium for brown rust, slight for stem rust, above average for ergot.

Officially adopted in Mordovian A.S.S.R., in Briansk, Orlov, Tula, Riazan, Kur Kursk, Voronezh, Tambov, Penza, Ul'ianov oblasts, and in some raions of the Moscow and Kaluga oblasts.

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"Kanychskaia"

Susceptibility to diseases

Below average for brown rust.

Officially adopted in Rostov andAstrakhan oblasts.

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"Mikulevskaia"

Is found in fields of western oblasts of Ukrain S.S.R. and B.S.S.R.

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"Mup" (local, improved Persian)

Susceptibility to diseases

Average for brown rust and ergot, slight for stem rust.

Officially adopted for steppe raions of Voronesh oblast.

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"Novosybkovskaia M-4"

Susceptibility to diseases

Below average and medium for brown rust, below medium for stem rust, average for ergot.

Officially adopted for B.S.S.R., Smolensk, Orlov, Kaluga, Chernigov, and Aumsk oblasts.

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"Omka"

Susceptibility to diseases

Below average for brown and stem rusts.

Officially adopted in Western Siberia in Krasnoiarsk and Primorskii kreis, in the Rustanai, North Kazakhstan and Kokchetav oblasts of Kazakhstan.

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"Petkusskaia"(Lokhova)

Is found in fields of southern B.S.S.R. and Ukrain S.S.R. oblasts where it is the most widespread variety.

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"Petkusskaia veselopodolianskaia"

Susceptibility to diseases

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Average for brown rust, below medium for stem rust.

Officially adopted in Saporozh, Nikolaev, Kherson, Kiev, Poltava, Odessa, oblasts and Moldavian S.S.R.

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"Petkyvskaia Kharkovskaia 194"

Susceptibility to diseases

Modern and below medium for brown rust, slight and below medium for stem rust.

Officially adopted in eastern and southeastern oblasts of Ukraine S.S.R. to replace Nemyshliankaia rye in the foothill raions of the Krasnodar krai.

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"Polesskaia"

Susceptibility to diseases

Above medium for brown rust and ergot.

Officially adopted in Zhitomir, Cheringov and Kiev raions (in Forest zone).

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"Priekul'skaia"

Is found in fields of all Latvian S.S.R. raions, especially in Vidzeme and Latgalia.

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"Pulavskaia ranniaia"

Is found in fields of western oblasts of Ukraine S.S.R. and B.S.S.R.

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"Pul'mana Zheltozernaia"

Susceptibility to diseases

[illegible] for brown rust and ergot.
Medium

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"Rogalinskaia"

Is found in fields of Baranovichi and Brest oblasts (western raions of B.S.S.R.) and in lvôv oblast (western raions of Ukraine S.S.R.

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"Sangastè" *

*- This variety is also known as Zagmitskaia

Is found in fields of Esthonian and Latvian S. S.R. Most widespread variety in Esthonian S.S.R.

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"Saratovskaia 1"

Susceptibility to diseases

Below average for brown rust (medium in Penza oblast) slight for stem rust.

Officially adopted in Saratov, Stalingrad, Astrakhan, Kuibyshev, Chkalov, Cheliabinsk, West Kazakhstan oblasts and Bashkir A.S.S.R.

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"Sitinkovskaia"

Officially adopted for Iakut A. S. S. R.

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"Stendskaia"

Is found in fields Latvian S.S.R. especially in Kurzem and Zemgalia.

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"Tarashchanskaia 2 (Type II)"

Susceptibility to diseases

Below average for brown rust.

Officially adopted in the right bank part of Ukraia S.S.R. - Moldavian S.S.R. in Groznen oblast, Stavropol' krai.

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"Tarashchanskaia 4 (Type IV)"

Susceptibility to diseases

Below average for brown and stem rust, medium for snow mold.

Recommended economical valuation, in Kamenets-Podolsk, Zhitomir, Kiev, Poltava, Kharkov and Vinnitsa oblasts of U]S]S]R.

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"Tulunskaia Zelenozernaia"[T. green grained]

Susceptibility to diseases

Slight and below average for brown and stem rust.

Officially adopted for Irkutsk oblast

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"Udinskaia"

Officially adopted in Buriat-Mongolian A.S.S.R.

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Spring Rye

"Onokhoiskaia"

Officially adopted in Chitin oblast, Buriat-Mongolian and Iakutsh A.S.S.R.

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Summary

Particularities of approval of varieties

Use of description and morphological tables but authenticity established by document.

Since 1947, in commercial fields approval by sight of standing crops.

In elite farms: study of a number of sheaves for degree of infection by diseases, weed infestation.

The percentage of typicality not established by appearance but documents

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if mechanical admixture with other varieties are absent and spacing in planting observed.

Presence of a certain percentage of some weed is disqualifying.

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Varieties of Barley

Spring Barleys

"Amurskii mestnyi" [A local]

Susceptibility to diseases

High for fusiarosis, medium for loose smut, below average for helminthosporium and dwart leaf rust of barley.

Officially adopted in Khabarav krai for southern Amur, Birobidzhan and Khabarovsk

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"Armavirskii 593"

Susceptibility to diseases

Above medium for loose smut, below average for dwart leaf, rust, slight for stinking smut, helminththosporium and stem rust.

Officially adopted for the eastern zone of the Krasnodar krai

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"Auksiniai II"

Is found in fields of Lithuanian S.S.R.

"Akhabtesli"

Susceptibility to diseases

Medium for loose smut and dwaft leaf rust, slight for yellow rust; very highly susceptible to stinking smut.

Officially adopted for Georgian S.S.R.

"Boets"

Susceptibility to diseases and destructive insects

Medium for helminthosporium, below average for loose smut and swarf leaf rust; very susceptible topupation, medium susceptible to stinking smut;

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infection by stem rust is below average but higher than for Europeum 553/188 -- is mostly harmed by frit fly [Diptera Chloropidae, Oscinosoma frit L]

Officially adopted in the steppe zone of the Altai krai.

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"Vairoga"

Is found in fields of Latvian S.S.R.

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"Verkhniachskii 6"

Susceptibility to diseases, insects and pests

Above average for helminthosporium, Below average for loose smut and dwarf leaf smut, slight for stem rust; very highly susceptible to stinking smut. Its resistance to frit fly is medium.

Officially adopted in Poltava oblast, and in forest Steppe zone of Bashkir A.S.S.R.

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"Verkhniachskii 8"

Susceptibility to diseases and insects and pests

Medium in Ukrain S.S.R. and below average in central chernozem oblasts and in northwest, slight in the southeast for loose smut; below average for helminthosporium and dwarf leaf rust; very highly susceptible to stinking smut. Medium damage by hessian and frit flies.

Officially adopted in Voronesh oblast and recommended for economical valuation in Kuibyshev, Ul'ianov and Kiev oblasts, and in individual raions of Gorki and Kirovograd oblasts.

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"Verkhniachskin 2038"

Susceptibility to diseases, insects and pests

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Extracts

Below average for loose smut and dwarf leaf rust; susceptibility to stinking smut below average; medium damage by hessian and frit flies.

Officially adopted for Riazan oblast.

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"Viner"

Susceptibility to diseases, insects and pests

Below average for loose smut (in Vologda) (Arkhangelsk oblast and Khabarov krai high), below average for helminthosporium (slight in Western Siberia, medium in northeastern and eastern Siberia and above average in the northwest), slight and below average for dwarf leaf stem rusts. Receptivity to stinking smut is medium (above average in the northeast but slight in B.S.S.R. Has not enough resistance to frit fly damage.

Officially adopted in oblasts of the northern non-chernoziom zone of European S.S.R. in the north of the central Chernozem oblasts, in B.S.S.R, in the Volga-Kama forest-steppe, in Western and Eastern Siberia and in the Far East. One of the most widespread varieties.

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"Viatskii 6040"

Susceptibility to diseases, insects and pests

Medium for loose smut, below average for helminthosporium and dwarf leaf rust; average receptive to stinking smut.

Officially adopted for the north of the Molotov oblast.

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"Ganna Loosdorfskaia"

Susceptibility to diseases, insects and pests

Below average for loose smut, slight and below average for helminthosporium, slight for dwarf leaf and stem rust, receptivebelow average to stinking smut. Med-

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ium damage from insects and pests, in some particular cases above average.

Officially adopted in Kamenets-Podolsk, Zhitomir, Vinnitsa, Kiev, Chernigov, Sumsk, Poltaiva oblasts, in the forest steppe raions of Odessa, Kirovograd, Kharkov oblasts and Moldavian S.S.R.

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Susceptibility to diseases, insects and pests

Above average for loose smut, below average for helminthosporium and dwarf leaf rust, medium receptivity to stinking smut. Damage from insects (frit fly) medium, in individual cases high, (stem sawflies [hymenoptera, Cephidae, Cephuspygmaeus L and Trachelus tabitdus F.].

Officially adopted in Voroshilovgrad, Stalin Dvepropetrovsk, Zaporozh, Kirovograd, Kherson Nikolaev oblasts.

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"Danubiia Akermana"

Is found in fields of western oblasts of B.S.S.R. and Ukrain S.S.R.

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"Darwin (D.C.-657/1)"

Susceptibility to disease

Below average for loose smut.

Officially adopted for Krasnonador krai.

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"Dzhau-Bapust"

Susceptibility to diseases

Slight for loose smut and dwarf leaf rust, medium receptivity to stinking smut.

Officially adopted in Garm and Leninabad oblasts of Tadzhik S.S.R.

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"Dzintars"

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Is found in fields of Latvian S.S.R. According to the Stenda station's data, suitable for sowing in all raions of Latvian S.S.R.

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"Donetskii 591"

Susceptibility to disease, insects and pests

Slight for dwarf leaf rust, average for loose smut. Medium damage from nocive insects.

Officially adopted for the Stalin oblast.

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"Europeum 353/133"

Susceptibility to diseases, insects and pests

To loose smut: above average and high, in Western Siberia and Volga-Kama forest-steppe, medium in remaining zones where officially adopted. To helminthosporium: high and very high in Ukrainian S.S.R., above average in southeast and in Kazakh S.S.R, average and above average in central chernozem oblasts and Western Siberia, and below average in northern Caucasus; to dwarf leaf and stem rust from slight to below average;receptivity to stinking smut varies from slight (south) to above average (southeast). Damage from frit fly is above average and higher in the central chernozem oblasts.

Officially adopted in Orlov, Riazan, Kursh, Voronezh, Tamlov, Penza oblasts, Bashkir A.S.S.R., Kuibyshev, Ul'ianov oblasts, Dagestan A.S.S.R., Kurgan, Cheliabin, Omsk, Novosibirsk oblasts, Altai krai, Kustavai, North-Kazakhstan, Kokchetav and Akmolinsk oblasts.

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"Zalarinets (Tulunskii 315/11)"

Susceptibility to diseases, insects and pests.

Slight (Irkutsk) and above average (Krasnaiarsk for loose smut, medium

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for helminthosporium, below average for dwarf leaf rust; receptivity to pupation above average.

Officially adopted in subtiaga and forest steppe zone of Irkutsk oblast.

"Zolotoi"

Susceptibility to diseases, insects and pests

Slight and medium for loose smut, medium to helminthosporium; slight to dwarf leaf and stem rust; receptivity to stinking smut below average, fairly extensively damaged by frit fly.

Officially adopted for Leningrad, Pskov Novgorod, Velikoe Luki, Kalinin oblast and Bieborussian S.S.R.

"Isariia"

Is found in fields of the south of Moldavian S.S.R.

"Iygova II"

Is found in fields of Esthonian S.S.R.

"Iygova 463"

Susceptibility to diseases

Medium and below average to loose smut, slight to helminthosporium, dwarf leaf and stem rusts; very receptive to stinking smut.

Officially adopted for Tatar A.S.S.R. for podsolised soils and in Riazan oblast (for gray forest steppe soils).

"Kleb Mariot"

Susceptibility to diseases

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Slight.

Officially adopted in Chirchik-Angren zone of Uzbek S.S.R. in spring and fall sown fields.

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"Kolkhikum 10/30"

Susceptibility to diseases, insects and pests

From slight (Armenia) to above average (Krasnodar krai) to loose smut. Slight to below average to helminthosporium, below average to dwarf leaf, stem, and yellow rusts; receptivity to stinking smut from medium to high. Damage from pests from medium to slight.

Officially adopted in humid part of Stavropol', Krasnodar krais and Kabardin A.S.S.R.

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"Krasnoiarskii 74"

Susceptibility to diseases, insects and pests

Slight and medium to loose smut, medium to helminthosporium. Damage by frit fly above average.

Recommended for economical valuation in most raions of the Chitin oblast.

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"Kruglik 188/49"

Susceptibility to diseases, insects and pests

Above average for loose smut; average and below average for dwarf leaf rust, below average for helminthosporium and mildew grass, slight for stem rust, medium receptivity to stinking smut. Average damage from frit fly and grass fly (chlorops pumilionis - Bjerk).

Officially adopted in Krasnodar and Stavrapol krais.

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"Crimean 17"

Susceptibility to diseases, insects and pests

Below average for loose smut, below average and medium (crimea) for dwarf leaf rust, slight for helminthosporium. Receptivity to stinking smut, below average. Medium damage from frit fly.

Officially adopted for Crimea oblast

"Crimean 301"

Susceptibility to diseases, insects and pests

Above average to dwarf leaf rust, below average to helminthosporium, slight to loose smut; receptivity to stinking smut below average. Medium damage from insects.

Recommended for economical valuation in Crimean oblast.

"Klubanets"

Susceptibility to diseases

To loose smut below average in Northern Caucasus, slight in central chernozem oblasts and in Ukrain, below average to helminthosporium and stem rust; above average in Northern Caucasus and below average in Ukrain and in central chernozem oblasts for dwarf leaf rust. Receptivity to stinking smut slight and below average.

Officially adopted in dry and half dry zone of Rostov oblast and recommended for economical valuation in Kharkov oblast.

"Kugeevskii"

Susceptibility to disease

Medium and below average for loose smut, but higher than that of "Viner",

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below average for dwarf leaf rust; receptifity to stinking smut above average.

Officially adopted in northern part of Chuvash A.S.S.R.

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"Leninakanskii G 151"

Susceptibitlity to diseases

Medium for loose smut and dwarf leaf rust, high in some particular years. Below average for stem and yellow rust; receptivity to stinking smut slight.

Officially adopted in Armenian S.S.R. For single raions.

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"Maiia"

Is found in fields of Latvian S.S.R.

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"Mashin"

Susceptibility to diseases

Also medium for helminthosporium, below average for loose smut and dwarf leaf rust.

Officially adopted in the central part of Komi A.S.S.R.

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"Medikum 46"

Susceptibility to diseases, insects and pests

High for loose smut and helminthosporium, slight for dwarf leaf rust, receptivity to stinking smut below average. Medium damage from insects (frit fly and others).

Officially adopted in Voroshilov grad and Stalin oblasts of Ukraine S.S.R. and in Moldavian S.S.R.

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"Medikum 513"

Susceptibility to diseases

Below average to loose smut and slight to stinking smut.

Officially adopted for the partially self-sufficient "bogara" [dry lands] of South Kazakhstan oblast.

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"Medikum 8955"

Susceptibility to diseases

Medium for brown rust, slight for helminthosporium, relatively resistant to loose smut.

Officially adopted for the foot hill raions of Almo-Atui oblast.

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"Narymskii 1/4"

Susceptivility to diseases

Medium for loose smut and helminthosporium.

Recommended for economical valuation in taiga raions of Tomsk oblast.

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"Nakhchivandany (Pallidum 310/1)"

Susceptibility to diseases, insects and pests

Medium for stem rust, below average for loose smut, dwarf leaf and yellow rust. Medium receptivity to stinking smut. Damage from insects and pests above average.

Officially adopted for fall and spring sowing in foot hill-forest steppe raions of Azerbaidzhan, Georgian, and Armenian S. S. R.

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"Nudum maloagiatskii (13272)"

Susceptibility to diseases

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Medium to dwarf leaf rust, medium and below average to loose smut, slight to helminthosporium and stem rust; receptivity to stinking smut from medium to high.

Officially adopted in the Rostov oblast for use in cream of barley industry.

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"Nutans 8/71"

Susceptibility to diseases , insects and pests

Medium and above average for helminthosporium, slight for dwarf leaf and stem rusts; receptivity to stinking smut high. Damage by insects (frit fly) average but higher than for other similar varieties.

Officially adopted in Kharkov, Poltava and Nicolaev oblasts of Ukrain S.S.R.

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"Nutans 27"

Susceptibility to diseases

Below average for helminthosporium and dwarf leaf rust; below average and slight for loose smut; medium receptivity to stinking smut.

Officially adopted in Uzbek S.S.R.

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"Nutans 32-28"

Susceptibility to diseases, insects and pests

Medium and below average for loose smut; slight for dwarf leaf, yellow and stem rusts; receptivity to stinking smut, below average. Medium damage from insects.

Officially adopted for Georgian S.S.R.

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"Nutans 147"

Susceptibility to diseases, insects and pests

Slight and below average for loose smut, stem and dwarf leaf rust. Severely damaged by frit fly.

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Recommended for economical valuation in humid raions of Stavropol krai and Dagestan A.S.S.R.

"Nutans 187"

Susceptibility to diseases, insects and pests

Below average for loose smut, helminthosporium, dwarf leaf and stem rust, slight receptivity to stinking smut.

Officially adopted in Kursh, Voronej, Tambov, Penza, Kuibichev, Ul'ianov, and Saratov oblasts, Mordovian A.S.S.R. and Kirgiz S.S.R.

"Nutans kazakhstanski"

Susceptibility to diseases

Slight for loose smut.

Recommended for economical valuation in foot hill raions of Taldy-Furgan oblast of Kazakh S.S.R.

"Odesskii 9"

Susceptibility to diseases, insects, and pests

Slight in Southern Ukrain and below average in Northeast to loose smut, To helminthosporium slight in Southern Ukrain, medium in northeast, high in Ural in humid years; below average for dwarf leaf rust, slight for stem rust, receptivity to loose smut below average. Damage from insects below average.

"Odesskii 14"

Susceptibility to diseases, insects and pests

Slight for dwarf leaf rust, loose smut, helminthosporium, receptivity to stinking smut slight. Damage from insects slight.

"Omskii 10664"

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Susceptibility to diseases, insects and pests

High for loose smut, medium for helminthosporium, dwarf leaf rust; one of the varieties that suffers most pupation; highly receptive to stinking smut. Damage from frit fly medium.

Officially adopted in the forest steppe. Ob raions of the Altai krai.

"Omsk 11464"

Susceptibility to diseases

Medium for loose smut, below average for helminthosporium, slight for dwarf leaf rust. Medium receptivity to stinking smut.

Recommended for economical valuation in watered and high mountainous raions of East Kazakhstan oblast.

"Omskii 13709"

Susceptibility to diseases weak for loose smut and helminthosporium.

Recommended for economical valuation.

"Omskhoiskii B-566"

Susceptibility to diseases

Below average to loose smut; highly receptive to pupation and stinking smut.

Recommended for economical valuation in Chitin oblast.

"Pollidum K-2114"

Recommended for economical valuation in sub-polar and northern raions of Arkhangelsk oblast and Komi A.S.S.R.

"Pollidum 52"

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Susceptibility to diseases, insects and pests

From medium to high for loose smut, medium for helminthosporium, below average for dwarf leaf rust; highly receptive to stinking smut. medium damage from frit fly.

Officially adopted in Zaporozh, Kherson oblasts and in southern steppes of Odessa and Nikolaev oblasts of Ukrain S.S.R.

"Pollidum 43"

Susceptibility to diseases and insects and pests

High in Northern Caucasus and below average in Southeast for loose smut; below average for helminthosporium and dwarf leaf rust, slight for stem rust; high receptivity to stinking smut in southeast, medium in Northern Caucasus. Damage for frit fly and hessian fly severe in southeast, medium in northern Caucasus.

Officially adopted in Stalingrad oblast and in right bank part of Saratovo oblast and also in dry parts of Rostov oblast and Stavropol krai.

"Pollidum 46"

Susceptibility to diseases and insects and pests

Medium for loose smut, below average and medium for helminthosporium, below average for stem rust; below average and slight for dwarf leaf rust, medium receptivity to stinking smut. Both slight and severe damage from frit fly.

Officially adopted in Kuibishev, Ul'ianov, Chkalov, Saratov oblasts and in Mordovian A.S.S.R.

"Persikum 64"

Susceptibility to diseases, insects and pests

Above average (in southeast), medium in Kasakh S.S.R) and slight (in Kirgiz S.S.R.) for loose smut, below average for yellow rust; slight for helminthos-

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porium; receptivity to stinking smut slight. Damage from stem flea beetle (L. Coleopters, Chrysomelidae Chaetocnema, Ch-hortenses Geofr.) in Kirgiz S.S.R. above average.

Officially adopted in the following oblasts West Kazakhstan, Aktinbin, Karagandin, Akmolinsk (in mountainous and volcanic raions), Chkalov (for dark chestnut soils), Stalingrad (fort light chestnut soils), and the valley drylands ("Bogara") of Kirgiz S.S.R.

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"Pioner"

Susceptibility to diseases

High for loose smut and fusiarosis, medium for helminthosporium. Not resistant to pupation.

Officially adopted in Iakutsk A.S.S.R. and in the most northern part of Irkutsk oblast.

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"Precocious 143"

Susceptibility to diseases, insects and pests

To loose smut in central Asia Republics slight, and in rare cases high, in southeast medium, in Kasakh S.S.R. below average, to dwarf rust medium in southeast and Kazakh S.S.R, below average in central Asiatic Republics, to helminthosporium in southeast and in central Asiatic Republic slight, in Kazakh S.S.R. medium, to stem and yellow rusts below average; highly receptive to stinking smut in Central Asia and Kazakh S.S.R. slightly receptive in southeast. Medium and above average damage from frit fly, and hessian fly and flea beetle.

Officially adopted in Chkalov, Saratov, West-Kazakhstan, Aktiubin, Kustanai, Pavlodar, Akinolinsk, Kokchetav, East-Kazakhstan, Semipalatin, Talli-Kurgan, Alma-Atin, Dzhambul and south Kazakhstan oblasts.

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"Severodoinskii" (S.D. 97/103)

Susceptibility to diseases

Medium for loose smut, high in some particular years.

Officially adopted in the south of Komi A.S.S.R.

"Sumbmedikum 199"

Susceptibility to diseases, insects and pests

Below average to dwarf rust and stinking smut, slight to loose smut and helminthosporium. Medium damage from frit fly.

Officially adopted for left bank of Saratov oblast.

"Trebi"

Susceptibility to diseases, insects and pests

Slight and below average to loose smut, below average to helminthosporium, stem rust and grass mildew, medium for dwarf rust and in Ukrain below average. Highly receptive to stinking smut. Medium damage from insects (for saw-fly and cereal beetles (Coleoptera Scarabeidae-Anisoplia) above average and high).

Officially adopted in the Rostov and Stalin raions located near the Azov sea and not humid enough, in the northern and central part of Krasnodar kri, and also in Georgian S.S.R. (in Spring and fall sown fields).

"Tulunskii 263"

Susceptibility to diseases

Slight to loose smut and helminthosporium.

Officially adopted for Akut A.S.S.R.

"Umanskii"

Susceptibility to diseases, insects and pests

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Medium, above average and not seldom high for loose smut. Below average for helminthosporium and dwarf rust. Receptivity to stinking smut above average. Slight and medium damage from frit fly and hessian fly.

Officially adopted in Ztutomir oblast and in part of Poltava oblast. Promising for Kamenets-Podolsk, Vinnitsa, Kiev and Sumsk oblasts.

"Khordsham 122"

Susceptibility to diseases

Below average for yellow rust, slight for dearf rust, below average receptivity to stinking smut.

Officially adopted in Kurgan-Ianbinsk and Kuliabsk oblasts of Tadshik S.S.R.

Recommended for economical valuation in fall sowing for Leninabad oblast.

"Chervonets"

Susceptibility to diseases, insects and pests

Medium for loose smut and fusiarosis, above average (in Eastern Siberia) and medium (in western Siberia to helminthosporium, below average for dwarf rust, slight and below average for stem rust; receptivity to stinking smut medium, to pupation above average. Damage from insects medium, and in single cases above average.

Officially adopted in Tomsk, Irkutsk, Chitin oblasts, in Krasnoiarsk and Khabarav krais, in foot hills and mountainous raions of Altai krai and Burial-Mongol A.S.S.R.

"Chetyrekhgrannyi mestnyi (ch. local)"

Susceptibility to diseases, insects and pests

Medium and high for loose smut; below average for dwarf rust and grass

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mildew, slight for helminthosporium, receptiv to stinking smut.

Officially adopted in Rostov oblasts, and also in northern, central and eastern raions of Krasnodar krai.

"Chishminskii 16"

Susceptibility to diseases

Slight to dwarf rust and helminthosporium, slight and medium for loose smut.

Recommended for economical valuation in Bashkir A.S.S.R.

"Iubileinyi (Nutans 138612)"

Susceptibility to diseases

Below average to loose smut, helminthosporium, stem and dwarf rusts, medium receptivity to stinking smut.

Recommended for economical valuation in Poltava and Kharkov oblasts.

Winter Barleys (including spring and autumn barleys sowing).

"Gibernakulium 2664 [Hibernaculum]."

Susceptibility to diseases

Slight for loose smut, below average for dwarf rust, receptivity to stinking smut slight.

Officially adopted in Dagestan A.S.S.R.

"Gibernakulium 9006" [Hibernaculum].

Susceptibility to diseases

Slight for loose smut, above average for dwarf rust, below average for helminthosporium and stinking smut.

Officially adopted in Northern foothills of Dagestan A.S.S.R.

Recommended for economical valuation in Issyk-Kul'sk basin (Kirgiz S.S.R.).

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"Dagestanskii (Samurikum 289)"

Susceptibility to diseases

Below average for dwarf rust and helminthosporium, slight for loose smut; receptivity to stinking smut high.

Officially adopted in the southern flat zone located by Caspian Sea, of Dagestan A.S.S.R., in Kabadin and Northern Ossetin A.S.S.R. and Groznen oblast.

"Dzveltesli mestnyi mnogoriadnyi"(D. local, multiple rowed)

Susceptibility to diseases

Below average to dwarf and yellow rusts, medium to loose smut and helminthosporium. Receptivity to stinking smut above average.

Officially adopted in Georgia S.S.R. where it occupies the main areas.

"Krasnodarskii N-1918"

Susceptibility to diseases

Below average to dwarf rust, helminthosporium and loose smut.

Recommended for economical valuation in eastern, southern, and foot hill zones of Krasnodar krai.

"Krasnodarskii 2929"

Susceptibility to diseases

Medium to dwarf rust, below average to helminthosporium, slight to loose smut, receptivity to stinking smut high in Kazakh S.S.R. and medium in Krasnodov krai.

Officially adopted in Krasnodar krai, Crimea and Dshambul oblasts.

Recommended for economical valuation in Stavropol krai

"Krasnyi Dar (Pallidum 2494)"

Susceptibility to diseases

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Slight in Stavropol krai to dwarf rust and above average in Krasnodar krai, below average to helminthosporium, slight to loose smut; receptivity to stinking smut in Northern Caucasus medium and in Kazakh S.S.R. high.

Officially adopted in Krasnodar and Stavropol krais, Kabardin and Dagestan A.S.S.R., Groznen, Taldy-Kurgan, Alma-Atin oblasts, and Kirgiz S.S.R.

"Kruglik 21"

Susceptibility to diseases

Below average for dwarf rust and loose smut, medium to helminthosporium, receptivity to stinking smut, below average.

Officially adopted in Krasnodar and Stavropol krais and Taldy-Kurgan oblast of Kazakh S.S.R.

Recommended for economical valuation in Grognen oblast and Moldavian S.S.R.

"Krymskii N-30"

Susceptibility to diseases

High for helminthosporium, medium for dwarf rust, slight for loose smut.

Recommended for economical valuation in Crimea oblast.

"Maikopskii 13096"

Officially adopted in Kirgiz S.S.R.

"Mozdovskii"

Susceptibility to diseases

Medium to dwarf rust, loose smut and helminthosporium, receptivity to stinking smut medium.

Officially adopted in Stavropol krai, Groznen oblast, Kabardin and North Ossetin A.S.S.R.

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"Pallidum 16"

Susceptibility to diseases

Medium to helminthosporium, slight to dwarf rust and loose smut, receptivity to stinking smut medium.

Officially adopted in Crimea oblast and Turkmen S.S.R.

"Pallidum 330/2"

Susceptibility to diseases

Below average to dwarf rust, medium to loose smut, high to helminthosporium.

Officially adopted in the dry land and Nukha-Zakatol'sones of azerbaidshan S.S.R.

"Pallidum 475"

Susceptibility to diseases

Slight to loose smut, below average to dwarf rust. Receptivity to stinking smut medium.

Officially adopted in the valley irrigated zone of Kirgiz S.S.R.

"Pallidum mestnyi (local)"

Susceptibility to diseases

Medium to helminthosporium, below average to dwarf rust, slight to loose smut; receptivity to stinking smut medium.

Officially adopted in commercial fields of Crimea oblast where it occupies to main area of croping.

"Pallidum precox local"

Susceptibility to diseases

Medium to loose smut, helminthosporium and dwarf rust; receptivity to stinking smut medium.

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Officially adopted in zones of highly chernozem and the foot hill carbonate chernozen steppe of Crimea oblast.

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"Samurikum 3265"

Susceptibility to diseases

Below average to loose smut and dwaft rust, slight to helminthosporium, medium receptivity to stinking smut.

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"Khordzhan 16"

Susceptibility to diseases

Below average to dwarf rust, medium to yellow rust, slight to loose smut, below average to helminthosporium , receptivity to stinking smut below average.

Officially adopted in Tadzhik S.S.R. and in Kaska-Daria hilly plain zone of Uzbek S.S.R.

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"Xordzhan local"

Susceptibility to diseases

Receptive to loose smut and yellow rust, above all others.

Officially adopted in Tadzhik S.S.R.

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"Chenad 395 (Tsenader 395)"

Susceptibility to diseases

Medium to helminthosporium, high to loose smut.

Recommended for economical valuation in southern raions of Krasnodar krai.

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"Shirvandany (Pallidum 629/9)"

Susceptibility to diseases

Above average for stinking smut and helminthosporium, below average to

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to dwarf rust and loose smut.

Officially adopted in irrigated valley drylands and Nukha-Zakatal' zones of Azerbaidzhan S.S.R.

"Mutans 17"

Susceptibility to diseases

Below average to dwarf rust, above average for helminthosporium.

Recommended for economical valuation in Zeravshan plain zone of Uzbek S.S.R.

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Oats Varieties

Spring Oats

"Antoninskii white"

Susceptibility to diseases slight to crown rust, above average to stinking smut.

Is found in fields of western oblasts of U.S.S.R. and B.S.S.R.

"Antoninskii yellow"

Susceptibility to diseases medium to crown rust; infected by loose smut more severely than Mokhovskii.

Is found in fields of western Ukrain S.S.R. and B.S.S.R. oblasts.

"Baikal (Tulunskii 28-N-12)"

Susceptibility to diseases above average to pupation; highly receptive to smut.

Officially adopted in Subtaiga foot hills and northern forest steppe of Irkutsk oblast.

"White Masur"

Susceptibility to diseases receptive to loose smut.

Is often found in fields of western B.S.S.R. and Ukrain S.S.R. oblasts.

"Beta 10-N-4 (Sibiriak)"

Susceptibility to diseases below average to crown rust; highly receptive to bacterial canker, and above average to smut and pupation.

Recommended for commerical valuation in Chitin oblast.

"Verkhniachskii 63"

Susceptibility to diseases slight and below average to crown and stem and to bacterial canker. Receptivity to smut slight and below average.

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Officially adopted in Kamanets Podolsk, Zhitomir, Vinnitsa and Kiev oblasts.

"Vydvishenets P-194"

Susceptibility to diseases below average to crown rust, above average to pupation, fusiarosis and smut.

Officially adopted in Krasnoiarsk krai.

"Viatskii 6622"

Recommended for economical valuation in central and northeastern zones of Mari A.S.S.R.

"Girunes"

Susceptibility to diseases above average to crown and stem rust.

Is found in fields of Lithunian S.S.R.

"Dippe"

Susceptibility to diseases below average to crown rust, slight and below average to stem rust; highly receptive to smut.

Officially adopted in Moscow, Kaluga, Gorki, East Kazakhstan and Semi-Palatin oblasts and in Chuvash A.S.S.R.

"Golden rain"

Susceptibility to diseases slight in northern and northwestern oblasts and below average in all the remaining zones to crown rust; from slight to below average to stem rust and bacterial canker; receptivity to smut high (in western oblasts receptivity above average).

Officially adopted in European north zones, northwestern, northeastern, Volga-Kama forest steppe, southeastern, west Siberian, East Siberian B.S.S.R. and

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Kazakh S.S.R. zones.

"Iygeva Agu (Zaria)"

Susceptibility to diseases medium to crown rust.

Is found in fields of Esthonian S.S.R.

"Iygeva Koit Koidu (Rassvet)"

Susceptibility to diseases medium to crown and stem rusts.

Is found in Esthonian S.S.R.

"Iygevskii Roostekindlam (Rust Resistant)"

Susceptibility to diseases rather slight to crown and stem rusts.

Is found in Esthonian S.S.R.

"Kökhra Varane (Early Kherson)"

Susceptibility to diseases and insect pests medium to crown and stem rust. Damage from frit fly slight.

Is found in Esthonian S.S.R. Basic variety for northern Esthonia.

"Krasnoiarsk F-272"

Susceptibility to disease below average to crown rust, smut and pupation.

Recommended for economical valuation in Chitin oblast.

"Crimean 53"

Susceptibility to diseases medium to crown rust, stem rust, smut and bacterial canker.

Recommended for economical valuation in Crimea oblast.

"Krymskii 75"

Susceptibility to diseases medium to crown rust, below average to stem

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rust and smut.

Recommended for economical valuation in Zaporozh oblast.

"Krymskii 90"

Susceptibility to diseases above average to crown rust, receptive to smut.

Officially adopted to Rostov oblast.

"Kinto"

Susceptibility to diseases from slight to below average for crown and stem rust, and slightly receptive to smut.

Officially adopted to Arkhanyelsk oblast, Komi A.S.S.R. Karelo-Finnish S.S.R., in Leningrad, Molotov and Tomsk oblasts, in Krasnodar krai and Ialsut A.S.S.R.

"Leitevitskii"

Susceptibility to diseases below average for crown rust(in Northern Caucasus medium and above average), receptivity to smut below average in central Chernozem oblasts and in southeast high in northern caucasus and very high in southern Ukrain.

Officially adopted in Voronezh, Astrakhan S.S.R., Rostov, Groznen, Crimea, Stalin and Zaporozh oblasts, and also in Stavropol and Primorski krais.

"Lokhovskii"

Susceptibility to diseases to crown rusts slight in northwest, below average in central Chernozem oblasts in northeast and in Siberia, medium in Kazakh S.S.R. and up to above average in northern Caucasus and Ukrain S.S.R.p to stem rust from slight (East Siberia) to medium (Central Chernozem oblasts); to bacterial canker up to below average. Receptivity to smut below average in northwest in central Chernozem oblasts, in Krasnodar krai and Kazakh S.S.R., medium

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in Northeast, above average in West Siberia and high in Ukrain S.S.R., Crimea and Rostov oblasts.

Officially adopted in non-Chernozem and north eastern zones for North Caucasus in Ukrain S.S.R., Western and eastern Siberia, Kazakhstan.

"Maganskii 44"

Officially adopted in Olekminsk and Iakutsk raions of Iakut A.S.S.R.

"Magistral"

Susceptibility to diseases below average to crown rust, slight to stem rust and smut.

Officially adopted in southern zones of Kirov oblast.

"Markton"

Susceptibility to diseases medium and below average for crown rust; remarkable for its exceptional resistance to smut.

Officially adopted in Saratov and Stalingrad oblasts, in northeastern and southwestern Kazakhstan oblasts, in Tadzhik S.S.R. (in autumn sowing) in Kirgiz S.S.R.

"Mirage" (1059)

Susceptibility to diseases below average and medium to crown rust and bacterial canker. Receptive to smut.

Officially adopted in Kirov oblast, in Mari and Udmur A.S.S.R.

"Moskovskii A-315"

Susceptibility to diseases slight and below average to crown and stem rust; medium to bacterial canker. Receptivity to smut above average.

Officially adopted in eleven oblasts of the northwestern zone in 5 oblasts

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of the central Chernozem zones, in Gorki oblast.

"Pidar" (Population)

Susceptibility to diseases high to crown rust (higher than in other varieties). Slight to stem rust; very much receptive to smut.

Recommended for economical valuation in northern zones of Karelo-Finnish S.S.R. where it ripens every year because of its very early maturing properties. Its yield is lesser than that of the more productive variety Kinto which in certain years does not attain maturity. It produces a high straw yield and because of that can be recommended for growing as fodder.

"Adnogrivyi (local)

Officially adopted for southern zone of Udmyr A.S.S.R.

"Omskii 6922"

Susceptibility to diseases below average for crown rust, above average to pupation. Medium receptivity to smut.

Officially adopted in Altai and Krasnoiarsk krais.

"Onokhoiskii S-215"

Recommended for economical valuation in steppe zone of Buriat-Mongol A.S.S.R.

"Onokhoiskii A-547"

Susceptibility to diseases below average to crown rust; receptivity to smut and pupation high.

Officially adopted to Buriat-Mongol A.S.S.R.

"Eagle"

Susceptibility to diseases below average to crown rust, slight to smut.

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Recommended for economical valuation in western zone of Vologda oblast.

"Osmo"

Susceptibility to diseases slight to crown rust.

Officially adopted to Karelo-finnish S.S.R.

"Pel'so"

Susceptibility to diseases slight to crown rust (in Komi A.S.S.R. medium) below average for bacterial canker; receptive to smut.

Officially adopted in Komi A.S.S.R.

"Victory"

Susceptibility to diseases below average for crown rust (a little higher in northern Caucasus and in Volga-Kama forest steppe, slighter in north and north-west); from slight to below average for stem rust and bacterial canker; highly receptive to smut.

Officially adopted very extensively in northwestern and northeastern zones, in central Chernozem zone, in southeast and in Volga Kama forest steppe, in Northern Caucasus, in West Siberia, Kazakhstan and Kirghizia. Altogether in 35 oblasts, krais and republics of European and Asiatic parts of the U.S.S.R.

"Priekul'skii White"

Susceptibility to diseases, medium for crown and stem rusts.

Is found in all raions of Latvian S.S.R., especially in Vidzeme and Latgalia.

"Record"

Susceptibility to diseases slight to crown rust, average to bacterial canker; highly receptive to smut.

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Officially adopted for Kirov, Sverdlovsk and Molotov oblasts.

"Rykhlik Kozarovskii"

Susceptibility to diseases above average to crown rust.

Is found in West oblasts of Ukrain S.S.R. and B.S.S.R.

"Sobeshinskii"

Susceptibility to diseases medium for crown rust, high for smut.

Is found in west oblasts of U.S.S.R. and B.S.S.R.

"Sovietic"

Susceptibility to diseases slight to crosn rust in all zones where officially adopted except for Azerbaidzhan S.S.R. and along the Volga; slight for stem rust (somewhat higher in Azirbaidzhan S.S.R.). Receptivity to smut slight and below average (in forest steppe zone of Uk. S.S.R. high, in steppe medium).

Officially adopted in central Chernozem zone, Volga-Kama forest steppe, in southeast, northern caucasus, in Uk. S.S.R. and B.S.S.R., in the transcaucasian republics, in Kazakhstan and Kirgizia.

"Stendskii small early"

Susceptibility to diseases slight to stem rust.

Is found in Latvian S.S.R.

"Stepniak 648"

Susceptibility to diseases and insect pests, slight to crown and stem rust, higher than other varieties to fusiarosis, receptivity to pupation high, to smut slight. Damage from frit fly high.

Officially adopted in northern and southern forest steppe of Krasnoyarsk krai foot hills and in Kemerov oblast.

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"Stiprouoles"

Susceptibility to diseases high to crown and stem rusts.

Is found in Lithuanian S.S.R.

"Teodosiia"

Susceptibility to diseases from slight to high for crown rust, medium for loose smut.

Is found in western oblasts of Uk. S.S.R. and B.S.S.R.

"Tulunskii 8616"

Susceptibility to diseases below average for crown rust; receptivity to smut high.

Officially adopted in Irkutsk and Chitin oblasts and also in Buriat-Mongolian A.S.S.R.

"Udarnik" (1-885)

Susceptibility to diseases medium and below average, medium for fusiarosis, above average for pupation; receptivity to smut below average.

Officially adopted in Taiga, Sub-taiga and forest steppe zones of Krasnoiarsk krai.

"Kharkovskii 596"

Susceptibility to diseases below average and medium to crown rust (Transcaucasia both slight and high); slight and below average for stem rust (in Transcaucasia high in some cases); receptivity to smut below average (in Uk. SSR very high.)

Officially adopted in Kurks oblast, on left bank of Uk. S.S.R., in Alma Atin oblast in Georgian S.S.R.

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"Chakinskii 1812"

Susceptibility to diseases below average for crown rust, receptivity to smut high.

Officially adopted for the northern zone of Tamlov oblast.

"Chenad 88"

Is found in Moldavian S.S.R.

"Shatilovskii 56"

Susceptibility to diseases below average to crown and stem rusts; receptivity to smut high.

Officially adopted in Vladimir oblast.

"Shatilovskii 30-M-15"

Susceptibility to diseases below average to crown rust and smut.

Recommended for economical valuation in Chuvash A.S.S.R.

Oats sown in fall

"Byzantine 11"

Susceptibility to diseases slight (during the testing period in different points of Uzbekistan no infection by rust or smut was noted).

Officially adopted for fall sowing in Kashka, Daria mountainous zone and Zerebshan foot hill zone of Uzbek S.S.R.

"Byzantine 602"

Susceptibility to diseases slight to smut and crown rust (according to data from literature).

Officially adopted for winter crops of irrigated low land zone and

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and Nukha Zakatal zone of Azerbaidzhan S.S.R.

"Byzantine 950"

Susceptibility to diseases slight for smut and crown rust (according to data of literature).

Officially adopted in winter crops of low land irrigated zone, foot hill forest steppe zone, dryland zone and Nakhichevan zone of Azerbaidzan S.S.R.

"Aristata 7"

Recommended for economical valuation in mountainous zone of Alma Atin oblast.

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Rukovodstvo po aprobatsii sel'skokhoziaistvennykh kul'tur [Handbook on the approval of agricultural crops] v.1, Zernovye kul'tury (pshenitsa, rozh', iachmen', oves) [Grain crops (wheat, rye, barley, oats)]. Ed. 5, rev. and enl., 639 p. Moskva, Sel'khozgiz, 1947. 64 R85

Translated from the Russian by
S. N. Monson

METHODS OF LABORATORY RESEARCH ON THE AUTHENTICITY AND SORTING OF SEEDS FOR PURITY (pp. 593-599)

The laboratory sorting analysis of seeds is performed according to the characteristics of seeds and seedlings and may be carried on at any time of the year. Compared to field methods (approval and ground control), it has the additional advantage of establishing of the purity of the sowing material prior to planting, already approved in field conditions, but which may have become contaminated during gathering, threshing, storing, or transportation. Seeds not meeting all standards may consequently be removed in time.

The laboratory control of the varieties is conducted following the analysis for contamination of the sample under test. As a rule, samples are taken from a fraction of seeds of the original crop.

DETERMINATION OF WINTER AND SUMMER VARIETIES OF WHEAT, BARLEY, AND RYE

The "Regulations Concerning the Analysis of Seeds", published by the Narkomsem of the USSR in 1943 (People's Commissariat

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Handbook on the Approval of Agricultural Crops, (pp. 593-599).

of Agriculture) provided for three methods for the recognition of winter and summer varieties.

1. Depending upon the differentiation of the cone of growth (method offered by T. A. Krasnoselskaia-Maksimova).

2. According to the stem node which accompanies the cone of growth (method proposed by S. M. Lapinsky).

3. According to the hairiness of the blade, (method proposed by N. N. Kuleshov).

The preparation of seeds for analysis, according to the first two methods, is done in the same manner. Two test groups of 100 germinated seeds each are counted from a weight of 50 grams. The counted seeds are soaked in water for 2 hours prior to planting to ensure a faster degree of the necessary stage of development, or they are germinated on a moist filter paper in a thermostat.

The seedlings obtained are planted into earthen dishes filled with soil and placed in a luminous chamber lit by an electric light of 500 candles. The source of light should always remain at a 40 cm. distance from the plants. The lighting area of one lamp has to equal one square meter. The lamps are equipped with reflectors and the chamber has to be provided with ventilating equipment. The temperature in the chamber to be maintained between 20-25°.

The lamps should stand on blocks. Maintenance of the proper distance from the light carries much significance since the

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lengthening of the distance leads to the growing of the plants, while its shortening produces over-heating. In the absence of a special light camera the latter may be replaced by a veneer cage lined with asbestos. One may obtain seedlings of 2-3 leaves under natural light but this will require a longer period. The plants in such case are less powerful and long. It is also difficult to make an analysis of such plants.

The analysis according to the CONE OF GROWTH, if performed within the light-chamber, is done in the following periods depending upon the respective crops: for hard wheat - in 20 days; soft wheat - 15-18 days; barley - 8-10 days; rye - 13-15 days. (Illustration No. 299, p. 594 - the determination of summer and winter crops depending upon the placement of the node: at right, winter barley; at left, summer barley).

In periods designated for analysis, the plants along with the remnants of the seed are pulled out of the soil and cleaned of leaves. The cone of growth is freed of its leaf coverage with the aid of a sterilized, ("preparovalni"), needle and inspected through a magnifying glass or binoculars.

The cone of growth in summer crops is very marked; it has side protrusions in the place of future stalklets; in winter crops the cone of growth has the appearance of a sitting lump of small size.

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Handbook on the Approval of Agricultural Crops, (pp. 595-599).

The method of distinguishing winter and summer forms according to THE PLACEMENT OF THE STEM NODE, which accompanies the cone of growth, is the most likely because of its extreme simplicity and accuracy. Plants are pulled out of the soil for analysis together with the remnants of the grain. The stem node is easily recognized when two leaves are removed. The summer forms have a clearly outlined node on the stem, directly under the cone of growth, not less than 6-12 mm. from the base of the plant. In winter forms of the same crops it remains along with the cone of growth at the base of the seedling and does not move upwards along the stem.

The method of determining winter and summer forms of wheat according to THE DEGREE OF THE HAIRY SURFACE OF THE LEAF BLADE is one of the older methods. It is based upon the fact that the majority of varieties of summer wheat have a pronounced hairy leaf sheath and blade, while winter wheat is slightly hairy or not at all.

It is true that in both winter and summer varieties of wheat there are exceptions to this rule. The blade and leaf sheath of varieties of the summer wheat: "Eritrospermum 341" and "341", "Grekum 283" and "289", "Strube", "Marquis", "Kitchener", etc. - are all slightly hairy or not at all.

Taking this into consideration, the "Regulations for the Analysis of Seeds", published in 1943, have reduced the possibilities

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for using this method. In those regions where summer varieties of wheat with non-hairy blades pre-dominate or varieties of winter wheat with hairy blades prevail, it is not possible to apply this method.

The above method is also unusable in the determination of winter and summer forms of barley, since winter and summer barleys have a slightly hairy first leaf.

The determination of the degree of hairiness of the first leaf and the leaf sheath (case) is performed on young plants grown in soil in nurseries or in a light thermostat at a temperature of 20°. Two test groups are grown of 100 seeds each. As soon as the blades of plants are well developed, at about the seventh to ninth day after germination, they are cut and examined under binoculars, a strong magnifying glass under a moderate enlargement. The degree of hairiness of the leaf sheath is determined on plants at the stage of two developed leaves.

Following the analysis of the young plants by any of the above three methods, the percentage content of summer and winter forms is established in the test sample as an arithmetic median of two determinants.

DETERMINATION OF HARD, SOFT, AND RED-GRAIN AND WHITE-GRAIN WHEATS

In order to establish the content of hard and soft wheat in the sample of seeds two test groups of 1000 seeds each are set apart.

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Upon dividing these into seeds of hard and soft wheat, according to the morphological designations of seeds, their percentage content is established as a median between two determinants.

Following the division of the test group of seeds (1000) into seeds of hard and soft wheat, the percentage content of red-grained and white-grained wheats is established based on the predominating kind (hard or soft). The result is accepted as an arithmetic median for the two test groups.

Seeds are analyzed without any preliminary preparation, and red and white grains are separated according to the natural coloring of the seeds. In actual practice the coloring of the seeds is frequently so slight that it is difficult to refer seeds to either the red or white varieties. In such cases the seeds under test are treated with a five per cent solution of alkali (KOH or NaOH) for 15-20 minutes or they are subjected to boiling for the same length of time. As a result of the boiling the seeds of white grained wheats remain white, while the red-grained ones become brown. As a result of the treatment with alkali the seeds of white-grained varieties of wheat obtain a light-cream coloring, and the red-grained varieties an intense red-brown color.

DETERMINATION OF THE PURITY OF WHEAT

The analysis for purity is conducted according to the complex of characteristics. The following characteristics are taken as a

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basis for the determination of purity: the coloring of seeds and stalk with phenol, the coloring of the coleoptile with anthocyanin, the hairiness of the first leaf, and the degree of the development of the second leaf.

DETERMINATION OF VARIETIES OF WHEAT ACCORDING TO THE COLORING OF SEEDS WITH PHENOL (Carbolic Acid)

The seeds of various wheats color into dark and light tones upon being treated with phenol. The nature of the coloring represents a hereditary characteristic. This method became widely spread in the USSR and abroad. In order to determine the purity of the group of wheat seeds, two test groups of 100 seeds each were selected of the median test sample. The seeds under test were covered with a solution of phenol at room temperature.

The concentration of the solution was applied in uneven proportions for the different types and varieties of wheat. Seeds of hard wheat varieties are the most difficult to color and a stronger concentration of the solution (1 per cent) is therefore applied in their case.

Seeds of winter crops and white-grain summer wheats require a solution of 0.5 per cent. Red-grained summer wheats are sensitive to phenol and the weakest solution of 0.1 per cent is therefore applied.

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The solution is poured off 15 minutes later and the seeds laid in Petri vessels or saucers on filter paper which is also moistened with the same solution up to its fullest moisture capacity. The seeds must be covered from above in order to provide for a moist atmosphere.

The reaction of the coloring may be speeded up by increasing the temperature up to 30-40° C. or by adding ammonia to the phenol solution. Ammonia is added in the following proportions: 100 drops of ammonia for 100 cub. cm. of a one per cent of the solution; for weaker solutions - (from 0.5 to 0.1 per cent) - only 50 drops of ammonia to 100 cub. cm. of the phenol solution. The coloring is studied, if action is speeded up, in two hours in the case of hard wheat, and within one hour on winter and white-grain summer crops, in 30 minutes in the case of red-grain summer wheats. For the purpose of control the analyzed dry seeds are examined after 24 hours.

Five degrees of coloring of grains are established: those that do not take color, light-brown, dark-brown, and black. In practice one usually comes across two, more seldom three gradations of coloring in determining the purity of seeds.

The reaction of the seeds of various types of wheat to the treatment with phenol is referred to in the description of varieties in the chapter of WHEATS of this handbook.

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DETERMINATION OF VARIETIES OF WHEATS ACCORDING TO THE COLORING OF THE STALK WITH PHENOL

In some instances it is expedient to apply the coloring with phenol to the stalk. The stalks are submerged for this purpose into a solution of 0.5 per cent of phenol. They are removed from the solution in two hours and spread upon filter paper moistened with a solution of phenol and ammonia. The stalks are then placed under glass. The coloring of the stalks is established 4 hours later and verified on dried stalks.

THE DETERMINATION OF VARIETIES OF WHEAT ACCORDING TO THE COLORING OF THE COLEOPTILE

One of the most characteristic symptoms of seedlings of wheat varieties is the coloring of the coleoptile with antho-cyanin. On the basis of this characteristic regionalized varieties may be studied more fully.

For this determination the seeds under test (in two groups of 100 pieces each) are sowed in dishes on filter paper placed over moist sand. The seeds are grown in natural light and under room temperature. To speed germination, the vessels with the seeded material are placed into a thermostat for 24 hours.

The coloring of the coleoptile by antho-cyanin is established on the fifth day following germination, the moment the coleoptile

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is pierced by the first leaf. The analysis should be made at that very moment - by separating the seedlings of a different colored coleoptile from the variety under test. The varieties are divided into two groups according to the coloring of the coleoptile: varieties with the coleoptile colored by antho-cyanin, and the uncolored coleoptile varieties. The intensity of the coloring of the coleoptile in the varieties of the first group is not alike. The most striking result in antho-cyanin coloring is obtained in winter wheat in the variety "Ukrainka", and in summer wheat - in the varieties "Lucerne 62" and "Cesium 111". The weakest coleoptile coloring appears on winter wheat in the variety "Novo-Krimka 204" and "Zemka", and in the summer wheat variety "Kitchener".

The intensity of the coloring depends upon the strength of light and temperature. The stronger the light, the more intense the coloring of the antho-cyanin (Bolsunov, 1927). At a reduced temperature (2-10°) the antho-cyanin coloring appears more striking, and at a higher temperature (15-20°) is weaker and disappears more rapidly.

DETERMINATION OF VARIETIES OF WHEAT ACCORDING TO THE PROGRESS OF THE DEVELOPMENT OF THE SECOND LEAF
(Method proposed by A. P. Timofeeva)

Some varieties of wheat are characterized by a normal progress of development of the second leaf, others by a more reduced one.

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In varieties having a normal development of the second leaf, the length of the second leaf - at the moment of analysis - equals the length of the first leaf. In varieties with a reduced tempo of development the length of the second leaf - at the moment of analysis - equals 1/4 of the length of the first leaf.

For the purpose of analysis one uses plants that were utilized for the determination of varieties in the coloring of coleoptile by antho-cyanin. The analysis is made on about the twelfth day, at the exact moment of the appearance of the second leaf. This method permits the separation, without effort, of the summer wheat varieties "Eritrospermum 341" and the "Balaganka 81/4".

The method for determining the varieties according to the degree of hairiness of the first leaf and the leaf sheath was indicated above. It is necessary to add that all regionalized varieties of summer wheat may - according to this characteristic - be separated into three groups: 1. a lightly haired first leaf, when the number of hairs varies between 0.2 to 2.5 - (multiplied 300 times in the field of vision of the microscope); 2. medium haired - from 3 to 55; 3. strongly haired - from 7 and upwards.

DETERMINATION OF TYPES OF OATS

Methods for the determination of varieties of oats in laboratory conditions have as yet not been fully worked out. The laboratory variety analysis is at present limited to the determination

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of the type of grain established on the basis of form, coloring, and the length of the stalk on the lowest (bottom) grain in the spikelet.

The type of oats is determined only on the basis of the normally developed bottom grains in the spikelet and of separate grains. The second, third, double and bare grains are excluded from the analysis. The second and third grains are characterized by a smaller size, a sharp top and pointed, sideways bent ("kruishko") basis. To double-grains belong those where the flower scales of the first grain cover the second grain.

In order to determine the type of oats from 150 grams of weight of seeds, two test groups of 1000 first grains are counted. The grain of each test group is separated into types and the percentage of the mixture in relation to the basic type is then established.

In determining the types of oats according to the coloring of flower scales one frequently meets with difficulties. The natural coloring of flower scales depends to a great extent upon the conditions prevailing during harvesting, threshing, and storing. It is therefore not always distinctly expressed. In such cases the seeds under test are treated with a 10 per cent solution of hydrochloric acid for a period of ten minutes or they

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are treated with ultra-violet rays. Seeds treated with the solution of hydrochloric acid are examined after they are dry. Seeds of yellow-grain varieties get intensely yellow following 5 hours of treatment; seeds of white-grain varieties take on a light-brown color following 18 hours of treatment.

The ultra-violet rays method is the speediest and most accurate. One may treat seeds with ultra-violet rays or with the aid of a quartz mercury vapor lamp, or yet within a special dark chamber under natural light penetrating through a suitable light filter.

Under those conditions the seeds of white-grain varieties of oats produce a light luminescence; light grey, bluish-grey, and intense blue; the seeds of yellow-grain varieties of oats produce a dark luminescence: dark brown, grey-brown, and violet-brown.

DETERMINATION OF VARIETIES OF OATS ACCORDING TO THE COLORING WITH PHENOL OF THE FLOWER AND STALK-SCALES

The coloring of seeds and stalk scales of oats with phenol has not been experimented with in the USSR. On the basis of some work done abroad one may, nevertheless, assume that the application of this factor in varietal control may gain as much recognition as did the coloring of wheat grains with phenol. The method of treating grains and stalk scales of oats with phenol is indicated below, as practiced in the seed-control laboratory of the VIR - (All-Union Scientific-Research Institute of Plant Growth).

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Following the selection of the test seeds of oats, according to type of grain, one attends to the determination of purity of seeds of the predominating type on the basis of the phenol reaction. Two test groups of 500 grains each are counted for this purpose. The seeds are covered with a solution of phenol of 0.5 per cent concentration. After 30 minutes the solution is poured off and the seeds are placed in saucers on filter paper moistened with the same solution and covered with glass. The coloring of seeds is examined 4 hours later. The seeds are left in open saucers until the following day for control revision. This method permits to distinguish the different varieties from among those belonging to the same type; for instance, the seeds of the variety "Dippe"- color into brown, while the seeds of the variety "Pobeda" do not take this coloring under the same conditions. Similarly, the grains of the varieties "Golden Rain" and "Kuito", "Tulunski 86/5", "Stepniak", etc., also differ in color if treated with phenol.

The stalk scales of oats are colored in the following manner: stalk scales of stalks of the middle section of the panicle are dipped into a 1 per cent solution of phenol; 4 hours later the scales are taken out, placed in saucers on filter paper moistened with the same solution, and covered with glass. The coloring is examined 24 hours later.

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Among other traits used in determining varieties of oats, one should refer to the presence of a strong hairiness at the base of the variety "Moskovski A-315". The variety "Tulunski 86/5" may be set apart because of the strong hairiness of the leaf sheath at the two or three leaf stage on germinating plants.

DETERMINATION OF THE AUTHENTICITY OF BARLEY

The "Regulations on the Analysis of Seeds" prescribe the determination of the authenticity of seeds of barley on the basis of the following characteristics: the coloring of flower scales (black-scaled and yellowish-scaled); the manner of the attachment of the flower scales (bare-grained and scaly); the peculiarities of the build of the basic corymb (cyme) of the grain (felted, hairy or intermediate); the distinction between summer and winter forms and the double-row from the six-row barleys (depending upon the presence of symmetrical and non-symmetrical grains).

Aside from these methods of distinguishing among varieties of barleys, it is considered expedient to apply the methods of determining green-grain and yellow-grain seeds of barley, as well as the method of coloring grain with phenol.

METHOD OF LABORATORY ANALYSIS OF BARLEY

Two test groups of 1000 grains each are set apart from the seeds of the basic crop. The seeds under test are divided:

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1. according to the coloring of the flower scales into black-scaled, (which include the forms nigrum and persicum), and the yellow-scaled (the rest of all varieties of barley produced in our country); 2. according to the attachment of flower scales - into bare-grained (of which the flower scales are not attached to the seed vessel); 3. according to the form of the (basic) corymb of the grain into varieties of felted, hairy or intermediate corymbs.

Following the separation of the test groups into groups, according to the above indicated characteristics, the percentage content is figured out based on the results of the analysis of the two test groups (according to the arithmetical median).

DETERMINATION OF THE ADMIXTURE OF SIX-ROW BARLEY WITHIN TWO-ROW BARLEY

If a variety of two-row barley comes up for analysis, the percentage of the admixture of six-row barley is established depending upon the relation of symmetrical grains to non-symmetrical ones. Two-row barley consists only of symmetrical grain; in non-selected seeds of six-row barley the number of symmetrical grains is related to the number of non-symmetrical ones in the proportion of 1:2. In passing seeds through grain cleaner machinery this ratio changes: seeds that pass through the winnowing

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machine "Clayton No. 5" - 1:1.76; in seeds next passed through the winnowing machine "Clayton No. 5" and "Triumph No. 2", the ratio is - 1:1.5; in seeds passed through "Clayton No. 5", "Triumph No. 2", or through the complicated machines (VIM-2 and others), it is - 1:1.25.

In passing seeds through grain cleaning machinery the correlation of symmetrical and non-symmetrical grains varies depending upon the fullness ("vypolnennost'") of the grain. This method of establishing the percentage of purity of seeds is therefore tentative.

DISTINCTION OF GREEN-GRAIN FROM YELLOW-GRAIN VARIETIES OF BARLEY

In analyzing barley seed varieties that belong to the variant "pallidum", yellow-grain and green-grain varieties are distinguished. The green coloring of seeds is the result of the presence of green pigment in the fruit scale of the grain showing through the flower scale. The following summer barleys belong to the varieties with a green colored grain: "Pallidum 43" and "46", "Darwin", "Pallidum K-2/14", "Grushevski", and "Trebi". From among winter barleys - "Pallidum 761/3".

In order to distinguish green-grain varieties from yellow-grain ones in cases when the coloring of the grain is not very clear, the seeds are treated with a 50 per cent solution of

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sulfuric acid for a period of 4 hours. The films are then washed in water and the color of the seeds examined. The seeds of yellow-grain varieties of barley remain yellow, light-cream and white; the seeds of green-grain varieties get bluish-grey or greenish-blue.

LABORATORY ANALYSIS OF SEEDS OF RYE

A definite correlation of plants having one set of characteristics with plants having another set of characteristics is typical for every variety of rye. With regard to the color of seeds, for instance: yellow-grained (predominating) and green-grained (predominating); according to the size of the grain (whether large or small grains predominate), with regard to the proportion of length to the thickness of the grain; with respect to the coloring of the coleoptile by antho-cyanin; with regard to the hairiness of the sheath of the first leaf; and finally with regard to the coloring of the grain by phenol.

Samples of seeds of rye are prepared for tests in a manner similar to that which is used in analyzing seeds of wheat. Following the selection of the test samples the percentage content of seeds with any characteristics is established as a result of the analysis of the two test groups.

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METHOD OF COLORING SEEDS OF RYE WITH PHENOL

As a result of a comparative testing of various methods of coloring grains with phenol, conducted in the seed-control laboratories of VIR, it was established that the method may be reduced to the following: the seeds (two test groups of 1000 grains each) are dipped in a 0.2 per cent solution of phenol; two hours later they are taken out, spread on saucers onto filter paper moistened with the same solution, and placed under glass. The examination for color is made four hours later. The varieties are recognized by the correlation of colored and non-colored grains. It is necessary to point out that this method of distinguishing varieties is not anymore secure than the rest since the samples of seeds of the same variety, if received from different regions of production vary, while some varieties retain constancy (stability) to some degree or other, such as do the varieties "Lutescens" and "Tarashchanskaia 2", for instance.

In determining the purity of seeds of all enumerated crops the difference between the results of two analyses should not exceed the established standards of the "Regulations of the Analysis of Seeds". Otherwise an analysis should be repeated.

ADMISSABLE DEVIATIONS (LATITUDES) IN ESTABLISHING THE PURITY OF SEEDS

Following the completion of the analysis and the establishment of the percentage content of basic species of grains and admixtures,

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the results obtained from several tests are compared.

The laboratory estimate of the purity of seeds is considered final and completed if the factors of the individual tests differ from the arithmetical median, in either direction, not above the following percentage:

AT AN ARITHMETICAL MEDIAN PERCENTAGE OF SEEDS OF BASIC SPECIES	ADMISSABLE DEVIATIONS FROM THE ARITHMETICAL MEDIAN (in percentage)
From 100 to 99.0	1.0
From 98.99 to 97.0	2.0
From 96.99 to 95.0	3.0
From 94.99 to 90.0	4.0
From 89.99 to 85.0	5.0
From 84.99 to 70.0	6.0
Below 70.0	8.0

End of Chapter

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Rukovodstvo po aprobatsii sel'skokhoziaistvennykh kul'tur [Handbook on the approval of agricultural crops] v.1, Zernovye kul'tury (pshenitsa, rozh', iachmen', ovas) [Grain crops (wheat, rye, barley, oats)]. Ed. 5, rev. and enl., 639 p. Moskva, Sel'khozgiz, 1947. 64 R85

1 2

Translated from the Russian by
S. N. Monson

MILLING AND BAKING QUALITIES (pp. 612-614)

The nutritional value of the grain of wheat depends upon its chemical composition. Of greatest value are starch and albumen. The cellulose possesses a minor nutritional value because it is poorly digested by man. The starch of the grain of wheat serves only as a substance of energy for the human organism, while the albumen substances are used in the human body for the building and restitution of cells. The amount of albumen and its physical properties are of great significance in the estimate of the bread-baking qualities of flour, as well as of those producing macaroni.

Of greatest technological significance among the albumens of wheat grain - in using flour for the production of bread and macaroni - are gliadin (vegetable protein) and glutenin of which gluten basically consists. The gas-retaining capacity of the dough, prepared from yeast, depends upon the content and quality of gluten, the gas-retaining capacity serving as the basic indicator of the bread-baking qualities of the flour. A large gas-retaining capacity of the dough is observed in those cases where the flour contains a large amount of gluten of good quality (resilient gluten.)

The gas-forming capacity of the dough depends upon the quality and quantity of yeast and the diastatic activity of the flour, i.e., of the

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degree of hydrolysis ("raspad"- dissolution, decomposition) of the starch into maltose which serves as nutrition for the yeast cells.

The capacity of the starch of flour to hydrolyse prior to the formation of maltose has much practical significance in industrial bread-baking where bread is baked without sugar or other substances containing sugar.

So long as the content of gluten, its physical properties and the diastatic activity of flour vary, strongly depending upon the variety, the climatic soil, and agro-technical conditions, as well as upon the different fertilizers used, this will produce a strong variation also in the bread-baking qualities of flour. In using flour for the production of macaroni, however, the capacity of starch to hydrolyze , prior to the formation of maltose, does not possess any significance.

In obtaining flour from small outputs a marked reduction in the content of vitamin B_1 is noted. One may remove this deficiency by catching the cyme (corymb) of the plumule containing most of this vitamin in the process of milling. The plumule of the wheat grain also contains much vitamin E. The value of grain is determined by the content of endosperm in it. The latter also establishes the theoretically possible output of flour. A normally riponed, developed, full, and undamaged wheat grain containson an average about 86-88 percent of the kernel (endosperm) and about 12-14 percent of seed-coat.

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The largest amount of cellulose and ashes is contained in the seed coat of the grain. The endosperm, on the other hand, contains the smallest amount of these chemical substances. The ash content of the endosperm varies between 0.35 to 0.48 percent, depending upon the variety and the conditions of the region of production; the ash content of seed coat varies between 7 and 10.0 percent. Since the greatest quantity of ash content elements is contained in the seed coat, one may, by determing the amount of ashes in the flour, establish the content of cellulose in it.

At an equal output one will rate best the flour which contains fewer ash elements. The output of flour and its quality may also be established by the content of cellulose in the flour or seed coat, and by its color (Pekar method).

The output of flour from grain depends in a large measure also upon the physical properties of its individual anatomical parts and the mechanical properties of the endosperm and seed coat which determine the technological characteristics of the grain and its conduct in the milling process. The latter greatly influence the output of flour; the establishment of the milling qualities of grain is better achieved by a method of laboratory milling which is also applied in practice in laboratory research in the Soviet Union.

From among the physical properties of grain the absolute, natural, and specific gravity weights serve as indirect indicators of the output of flour.

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They establish to a certain degree the relation between the content of the endosperm and the seed coat within the grain. They are also significant for the establishment of a regime of milling grain and the appraisal of its technological properties.

The glassiness of grain determines the method and the plan of milling, the output of grits and their quality, the ease with which the siftings (bran) are detached from the flour, the ease in degree with which flour sifts through the cells of a sifter, the amount of energy to be used in crushing the grains, the milling, the reaction of the grain to moisture, and partly - the entire production of the mill itself. A high glassiness of the grain is usually accompanied by a high content of albumen.

The bread-baking qualities of flour are determined by the following basic indicators: the volume of bread obtained from 100 g. of flour, the porosity of bread (rated 1-5), the elasticity of bread (in ratings), the color of bread (in ratings), the spreading of bread when baking in a hearth, (the relationship of the height of the hearth-baked bread to its diameter); and the taste of bread (in ratings). Wheat bread should possess a large volume output, a good porous, small-grained and thin-walled porosity. It should be non-lumpy, not coarse, well baked, not too dry but also not too moist, of white or cream color, and should TASTE well.

The varieties of wheat which do not meet these requirements, should not receive a satisfactory appraisal with regard to bread-baking quality.

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The indicators of the physical properties of grain, of the output of flour and its quality, the chemical composition of the grain and flour, the bread-baking qualities of flour, characterizing the individual groups of wheats (excellent, good, average, below average, and poor wheats) are listed in the Table on p. 614.

> Illustration no. 315, p. 613. Kandikaus 76/10, a variety of summer "besostoi" hard wheat of good flour-milling and bread-baking qualities. Stalks 1/1; scales and grain 3/1.

One must admit that the method of referring individual varieties of wheat to one or the other qualitative group will represent some practical difficulty, since the same variety may, according to some indicators of the quality of the grain, flour, and bread, be referred to different qualitative groups. However, these difficulties may be overcome to a large extent if one will judge the quality of the variety not on the basis of individual indicators of technological appraisal, but in their entirety. Only the entirety of all technological features (characteristics) and the chemical content of the grain and flour may furnish a relatively accurate understanding of the variety.

Table on page 6.

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INDICATORS OF THE QUALITY OF GRAIN AND FLOUR	GROUPS OF WHEAT				
	I	II	III	IV	V
General Glassiness of Grain ( )...	75 and more		from 74 to 41	40 and less	
Yield of flour ( )(acc. to Pekar method)...	76 and more	from 75.9 to 73.0	from 72.9 to 70.0	from 69.9 to 67.0	66.9 and less
Ash Content in Grain ( )...	less 1.65	from 1.66 to 1.85	from 1.86 to 2.05	from 2.06 to 2.25	2.26 and more
Ash Content in Flour of a 70 yield ( )...	less 0.55	from 0.56 to 0.65	from 0.66 to 0.75	from 0.76 to 0.85	0.86 and more
Protein Content in Grain ( )...	18.0 and more	from 17.9 to 16.0	from 15.9 to 14.0	from 13.9 to 12.0	11.9 and less
Raw Gluten Content in Grain ( )...	36.0 and more	from 35.9 to 31.0	from 30.9 to 26.0	from 25.9 to 21.0	20.9 and less
Raw Gluten Content in Flour of 70 yield ( )...	42.0 and more	from 41.9 to 37.0	from 36.9 to 32.0	from 31.9 to 27.0	26.9 and less
Stretchability of Raw Gluten (cm)..	from 20 to 30		from 31 to 40	from 41 to 50	51 and more (strongly stretchable), 19 and less (short, tearing)
Diastatic activity of Flour (mg) (acc. to Ramsey)...	from 250 to 300		from 249 to 200	from 199 to 150	149 and less
Gas-forming strength of Dough (c.c.) (acc. to Yago-Yorgensen)...	1400 and more	from 1399 to 1200	from 1199 to 1000	from 999 to 800	799 and less
Gas-preservating capacity of Dough (c.c.)...	475 and more	from 474 to 425	from 424 to 375	from 374 to 325	324 and less
Volume of Bread from 100 g. of flour (cc.)(baked with sugar)...	525 and more	from 524 to 475	from 474 to 425	from 424 to 375	374 and less
Porosity of Bread in ratings (100-standard scale)(baked with sugar)...	85 and more	80	75	70-65	60 and less
Spreading of hearthen-baked bread; (relation of height of bread to its diameter)...	0.50 and more	from 0.49 to 0.40	from 0.39 to 0.30	from 0.29 to 0.20	0.19 and less
Elasticity of pulp of bread (rated)...	5	4	3	2	1
Color of pulp of Bread (rated - 100 standard scale)...	85 and more	80	75	70-65	60 and less
Taste of Bread (rated)...	5	4	3	2	1

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Rukovodstvo po aprobatsii sel'skokhozialstvennykh kul'tur [Handbook on the approval of agricultural crops] v.1, Zernovye kul'tury (pshenitsa, rozh', iachmen', oves) [Grain crops (wheat, rye, barley, oats)]. Ed. 5, rev. and enl. 639 p. Moskva, Sel'khozgiz, 1947. 64 R85

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Translated from the Russian by
S. N. Monson

BIOLOGICAL AND ECONOMIC CHARACTERISTICS OF VARIETIES (pp. 599-614)

The duration of the vegetative period carries much significance for the characteristic of speedy ripening or, on the contrary, the late-ripening variety. In addition, it also testifies to the possibility of producing a variety within certain geographical conditions, characterized by a definite period of vegetation.

Under the term vegetative period one understands the time (in days) during which the entire cycle of development takes place, and the growth of the plant from the time of sowing to ripening.

The full vegetative period for varieties of grain crops is customarily defined by the number of days from the date of sowing or germination up to full ripening. The complete vegetative period for grain crops is divided into phases: sowing - germination; germination - tillering; tillering - boot stage; boot-stage - heading; heading - blooming; blooming - milky ripeness; milky ripeness - dough stage; dough stage - full ripening.

Different varieties of crops are characterized by different lengths of periods of development.

The vegetative period in crops varies within considerable limits; it also varies with respect to the different varieties of the same crop. The change of environment (temperature, precipitation, the length of the

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day, the soil, the methods of crop cultivation, etc) all react upon the length of the vegetative period. Within the borders of European USSR, for instance, the summer wheat Lutescens 62 completes vegetation in dry years in 66-70 days, in wet years in 80-86 days. Fertilizers also bear an influence upon the duration of the vegetative period: phosphorus shortens the latter, while nitrogen lengthens it.

The duration of the vegetative period depends upon the tempo at which the plant passes through the different stages.

At present two stages are known, i.e.: the first stage - which is that of vernalization and the second - the light stage. Each variety is characterized by a definite length of these 2 stages (vernalization and light): long, medium and short. Definite conditions are required for the passing of the above stages.

According to the vegetative period, all varieties of grain crops may be tentatively separated into 5 groups; for summer wheat, for instance:

1. Varieties of early ripening, germinating 5 or more days in advance of Lutescens 62; such as, for instance, Sibirka 1818, Garnet, and Severianka, etc.
2. Varieties of an average period of ripening, germinating 3-4 days ahead of Lutescens 62; such as, for instance, Odesskaia 13, Fetcher, Albidum 24, etc.
3. Varieties of an average stage of ripening; such as Lutescens 62, (having a vegetative period of 66-86 days in the European USSR);

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4. Varieties of the average-late ripening 3-5 days later than Lutescens 62; such as Gordeiform 189, Artemovka, Kitchener, Moskovka (Mosgibrid 48), etc.

5. Varieties of late ripening, germinating 6-8 days later than Lutescens 62; such as, for instance, Milturum 321, Milturum 553, etc.

Varieties of other crops similarly grouped according to their vegetative periods.

Illustration no. 501 (p. 600) "Novo-Krimka 204", a variety of speedy ripening of winter wheat. Stalks 1/1; grain 3/1 (original illustration by L. Chernishova).

The February I lenum of the Central Committee of the All-Union Communist Party (b) "finds it necessary to arrange for sowings of early and late ripening varieties on collective and state farms of the Trans-Ural and Siberian regions - in order to lessen the strain in the more demanding periods of work, i.e. the periods of sowing and collecting of harvests, with the view of ensuring an increased gathering of grain".

Frost-resistance of varieties of winter crops carries in many regions much significance. Our agricultural economy suffers yearly losses in harvests as a result of a partial destruction of winter crops.

Winter-resistance of plants is a complicated physiological characteristic. The latest data indicates that crops and varieties resistant to frost, are those that possess the ability to harden themselves and to preserve this hardening capacity throughout the entire winter. I. I. Tumanov established

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that the process of hardening consists of two consecutively running stages. The first stage of the hardening of winter crops takes place in daylight at an average daily temperature of 0 to 6°, when the plants accumulate especially in the tillering nodes, a large amount of sugars. The first stage of hardening passes successfully also through periods of varying temperatures: 10-15° during the day, about 0° at night. The second stage of hardening takes place in frozen plants during daylight, as well as in the dark, in temperatures below the point of freezing (from minus 2 to minus 5°). Under these conditions the dehydration of cells takes place because of the change of part of the water into ice. The resistance of winter plants is particularly increased following their passing through the second stage of hardening. They acquire the capacity for wintering under unfavorable conditions upon having passed, as a result of complicated inter-cellular changes, from a condition of vigorous growth into a so-called hardened condition.

It is known from the works of the academician T. D. Lysenko that the passing through the stage of vernalization lowers the wintering resistance of plants of winter crops. Sowings with vernalized seeds result in a weak state of hardening.

Wintering does not represent therefore an unchangeable characteristic always inherent to a given plant; it may be increased within the limits of nature of the variety or may be reduced, depending upon external conditions and different stages of the development of plants.

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The destruction of plants of winter crops may be caused by: severe frosts (freezing), a deep snow cover of long duration (sweating-out), an over-abundance of the supply of water on the surface of the soil (soaking), the formation of ice close to plants (ice crust and the shoving-out of plants), and winter drought. The principle and most common cause for the loss of winter crops is - freezing. According to physiological data, the injury to plants from low temperatures is caused by the formation of ice within the cells which destroys their structure.

> Illustration no. 302 Erinatseum 716, p. 601. A late-ripening variety of summer dwarf wheat. Stalks 1/1; scales and grain 3/1 (original illustration by L. Chernishova).

Low temperatures react particularly upon plants in the absence of snow cover. In the Ukraine and the Northern Caucasus much harm is caused to winter crops by thawings which frequently are so considerable that the winter crops begin to vegetate, lose their hardening capacity and become very susceptible to frost which follows the thawing. An ice crust is frequently formed after thawing which, in addition to exerting pressure of the ice within the plant, also exerts pressure around the plant. The harmful action of the ice crust is heightened by the fact that it acts as a better conductor of low temperature than does snow and forms after thawing when the resistance of plants is greatly reduced. In the East and South-East an ice crust is a rather infrequent occurence. On over-moistured, heavy soils, especially during improper

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cultivation, one frequently observes a pushing-out of the plants caused in the spring by the ice crust that formed on the surface of the soil or by an icy layer in the upper part of the soil. At such time the tillering nodes of root collars are sort of pushed-out onto the surface of the soil and the roots torn away. During radical variations in temperature in the early spring periods when at night-during freezing-the upper layers of the soil are raised along with the plants, tearing the roots, and when during the day the soil is again lowered because of thawing, the plants appear to have been pulled out of the ground and are occasionally found lying along with the roots on the surface of the soil, perishing from dryness or freezing. Such pushing-out is particularly dangerous in the southern regions where the soil in the spring dries rapidly and therefore does not offer favorable conditions for a renewed rooting of the plants. In steppe-and forest-steppe regions of Siberia and Kazakhstan winter crops frequently perish as a result of winter-drying-out or blowing-out. In the absence of snow, strong winds during the winter-spring period dry the plants in such measure that they perish altogether. The drying-out of plants is also observed when the soil remains frozen while the upper layers begin to thaw; the roots in such case are unable to provide moisture to the plants and perish.

Illustration no. 303 Akuotuotici. p. 602. The most winter-resistant variety of winter wheat in conditions of the Lithuanian SSR. Stalks 1/1 (original illustration of L. Chernishova)

In northern and western regions where winter crops remain under snow cover for a very long time - sweating-out is observed. Plants of Winter

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crops, lying under snow in temperatures close to 0°, manage by spring to use up all their accumulated stores of carbohydrates and develop a sensitivity to low spring temperatures and susceptibility to the snow mold and sclerotinia which frequently appear in such sowings and lead to the destruction of winter crops.

The stagnation of water in the soil reacts poorly upon the wintering of winter crops. During fall stagnation the winter crop sowings harden poorly and are therefore susceptible to frost. To plants, that have suffered throughout the winter, stagnant water in the spring is particularly harmful because then the plantings perish for lack of oxygen. The summer-fall drought in the south-east frequently causes the absence of fall germination of the winter crops or their poor development.

Illustration no. 304 Kuusiku. p. 603. The most winter-resistant variety of winter wheat in conditions of the Esthonian SSR. Stalks 1/1; scales and grain - 3/1. Original illustration of L. Chernishova.

Illustration no. 305, p. 603. Albidum 43. Drought-resistant variety of summer wheat; stalk 1/1; scales and grain - 3/1.

The individual variety and the agricultural methods carry great significance in the matter of solving the problem of increasing the stability of winter crops under unfavorable winter conditions. Considering that in the Soviet Union conditions of wintering differ, the demands placed upon the varieties with regard to their wintering resistance, according to zones, differ equally.

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One may not speak of the winter-resistance of an individual variety without taking into account actual winter conditions in the zone of its production. The most accurate appraisal of varieties with respect to their resistance to frost may be obtained in checking them under field conditions. Aided by the field method, one may establish the cause and the time of destruction of winter crops under actual conditions. The field method provides an opportunity to observe the influence of low temperatures and other unfavorable factors upon the plant that may appear in a variety of combinations.

In searching for a speedier method to establish winter-resistance, several laboratory, - so-called indirect methods - were worked out. It was proposed to establish the stability of varieties according to the content of sugars in the plant's tissues, this determination to be done by a refractometer, testing the content of the dry substance in its juice; and determining the amount of non-frozen water in plants, etc. But all these methods proved inadequate since they were based on the estimate of different characteristics of plants, none of which could explain the complexity of the phenomenon of the stability of plants. Lately a laboratory method directly influencing plants under different low temperatures has been used and has received wide application in selection work, since it provides an opportunity of quickly testing varieties for frost-resistance. Special freezers have been set up for this purpose at many experimental institutions (All-Union Genetic-Selection Institute, the

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Institute of Grain Economy of the Non-Black-Earth Belt, the Institute of Grain Economy of the South-East, the Kharkov government Selection Station).

In the process of producing varieties at selection stations in government variety-testing, and in selecting the best varieties for production, the appraisal of the varieties' stability to unfavorable winter conditions is made in the field, based on many years' observations of their wintering on experimental plots. The appraisal of the winter-resistance of varieties by the field method is calculated on the basis of the percentage of plants that survive a winter.

The percentage of plants preserved by spring is determined on specially segregated "metrovkakh"; the count is done in the spring when they show a sufficient growth (15-20 days following the beginning of vegetation). In addition, an eye-measuring estimate is done in the spring of the condition of winter crops after wintering which is expressed by a 5-rating scale: 5- excellent condition; 4 - good condition; 3 - average condition; 2 - below average condition; 1 - poor condition.

A monthly determination during the winter period of the percentage of destroyed plants, according to tests on germination, gives the opportunity to establish the time and the cause of the destruction of winter crops.

On the basis of many years' experience, concerning the study of winter-resistance on variety-plots, all varieties of winter crops were

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assigned to one of the following groups, with regard to their stability to unfavorable winter conditions in the regions recommended for their distribution:

1. VARIETIES MOST RESISTANT TO FROST (in conditions of winters in steppes without snow). Assigned here were, for instance, of RYE - the varieties Bolinskaia, Orka, Saratovskaia 1; of WHEAT - Lutescens 329, Lutescens 1060/10, Ulianovka.

2. VARIETIES RATED ABOVE AVERAGE IN FROST RESISTANCE. Such appraisal was given to the following varieties: of RYE - Lisitsina, Avanguard, Kazanskaia 5 plus 6, Petkusskaia Kharkovskaia 194; of WHEAT - Gostianum 237, Ferrugineum 1239, Rye-WHEAT hybrid 46/131.

3. VARIETIES OF AVERAGE WINTER RESISTANCE. The majority of varieties fell into this group: of RYE - Viatka, Petkusskaia Veselopodolianskaia; of WHEAT - Ukrainka, Durable, Moskovskaia 2453; among winter Barley - Krasnii Bar, Givernakulium 9006.

   Illustration no. 307, p. 603; Moskovka (Moshybrid 48). Resistant to lodging, variety of summer wheat. Stalks 1/1. Grain 3/1.

4. VARIETIES OF LOWER THAN AVERAGE FROST RESISTANCE. Of RYE - Tarashchanskaia 2, Kanitschskaia, KDS; of WHEAT - Stavropolka 326, Chervonets, Krasnodarka, Kooperatorka, Moskovskaia 2411; of BARLEY - samurikum 3263.

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5. VARIETIES OF POOR RESISTANCE TO FROST. Of WHEAT - Sari-Bugda, Ak-Bugda, Pseudo-Meridionale 122-A; of BARLEY - Shirvandani, Khordjau, etc.

DROUGHT - RESISTANCE: Is called the ability of the plant to resist a deficit of moisture in the air and soil. Appears in a variety of ways depending upon the peculiarities of varieties and the conditions of their germination. The capacity of withstanding a prolonged shrinking without perishing - is one of the characteristics of drought-resistant varieties of agricultural crops. The deep-bio-chemical changes that take place within the plants for lack of moisture permit the drought-resistant varieties to withstand a prolonged drought of the soil, to interfere with the evaporation of water during a dry atmosphere of the air, and to protect the plants from the damaging effect of a high temperature.

Drought-resistance of plants is also apparent in their external characteristics. Among the morphological peculiarities of varieties, resistant to drought, are: the small-leaved varieties, those of thick tissue cover, and those with furry surface organs.

Among anatomical characteristics are: the small cells, thick veining leaves. The varieties of grain crops differ in the matter of their resistance to drought throughout the entire vegetative period or its part. For instance, the summer wheat Eritrospermum 841 is resistant throughout its vegetative period, while Milturum 321 - is resistant only in the

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early stage of its life.

Plants do not grow during a prolonged drought; they form a dry substance, shed their leaves, and their life is only apparent in the expenditure of the accumulated organic substances during breathing.

In a period of prolonged high temperatures, in times of drought, even drought-resistant plants show signs of suffering.

Considerable importance in controlling drought is attributed to the application of agro-technical methods, directed towards the accumulation and preservation of the supply of water in the soil for as long as possible. The most important steps in this direction are: plowing, black, early-and "Kulisni" fallows, cultivating the soil's surface, the control of weeds, mulching of soil, tree-shelter belts, the preservation of snow... However, the most powerful method in fighting drought, as well as the most dependable one for the production of high and stable yields of crops - is irrigation.

One should also mention the "zakhvat" of cereals or the "zapal", under which one understands the untimely dying of cereal crops under the influence of a high temperature and dry air in the period of the ripening of the grain. This factor is observed in dry regions and is caused by dry, hot winds - "suchoveii" chinook winds . During the latter the leaves evaporate water so strongly that the roots and conducting tissues no longer manage to supply it to the leaves. While there may

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yet be a sufficient supply of water in the soil, the plants dry up a few hours after the blowing of "suchoveii". In time of ripening the "suchoveii" produce a shrunken grain. The fast ripening varieties of all crops usually escape the "suchoveii".

With regard to resistance to drought, the varieties of grain crops may be tentatively segregated into several groups; wheat, for instance into:

1. VARIETIES OF HIGH OR EXTREMELY HIGH RESISTANCE TO DROUGHT - the summer wheat Eritrospermum 841, Grekum 283, Grekum 289, Akmolinka 1; the winter wheats Kooperatorka, Voroshilovskaia, Meridionale 77, etc.
2. VARIETIES OF AVERAGE RESISTANCE TO DROUGHT - the summer wheat Pionerka, the winter wheat Stavropolka 528, etc.
3. VARIETIES OF LOW RESISTANCE TO DROUGHT - the summer wheats Tetcher, Tulun 70 B/8; the winter wheats Durable, Eritrospermum 917, etc.

Each of these groups may again be separated into sub-groups.

RESISTANCE TO LODGING. The lodging of grain crops, particularly in moist regions, causes much loss in agriculture. Aside from the loss of a harvest, the quality of the grain is also considerably lowered in lodging. The mechanized method of gathering is most intricate, and frequently impossible. As a result the demands placed upon varieties of grain crops are raised with respect to their resistance to lodging.

The greater part of research done on the lodging of cultivated crops

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is of a one-sided nature. Chemists, for instance, in their study of the causes of lodging, have tried to explain this factor by either the presence or absence of some chemical substance; anatomists - by the peculiarities of the anatomy of the mechanical tissue of the stem; field agronomists - by the different conditions of the external environment, etc.

The problem of lodging has therefore not been sufficiently studied in all its complexity yet, although a vast experimental supply of data has been assembled concerning the conditions causing lodging, and a study made of varieties with respect to their stability against lodging.

Numerous experiments have proved that increased manure fertilization, a one-sided nitrogen fertilization, thick sowings, an over-abundance of moisture - all contribute to lodging. On the other side, phosphorus-acid and alkali fertilizations reduce lodging.

> Illustration no. 308, p. 606. Wheat-couch grass hybrid 22850. Resistant to lodging variety of summer wheat. Stalks 1/1; scales and grain 3/1.
>
> Illustration no. 308, p. 607. Eritrospermum 14. Resistant to shattering variety of summer wheat. Stalks 1/1; scales and grain 3/1.

The varietal range of grain crops with regard to lodging is very considerable. Among varietal characteristics, indicating the degree of lodging, the thickness of the walls of stems, the firmness of the straw, the anatomical structure (of the mechanical tissue of the inter-node, second from the soil), the brittleness of the walls of straw, the filling of the

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stem, etc., all carry much significance. Many varieties of grain crops, widely distributed in the USSR (rye in particular), have a tendency to lodge.

In the past years a series of new prospective varieties, resistant to lodging, have been produced at government variety-testing points. To these belong: among summer wheat - Tulun 70 B/8, Moskovka, Diamond, Pionerka; among winter wheat - Novo-Ukrainka 83, Krasnodarka, Lutescens 17, Moss 4, the wheat-couch grass hybrid 599.

Illustration no. 310, p. 608. Variety of winter wheat - resistant to shattering Irodi 1006. Stalks 1/1; scales and grain 3/1.

The estimate of the stability of varieties to lodging made at government variety testing points, as well as at selection stations, is conducted on the basis of observations of the "behavior" of the varieties throughout the vegetative period, beginning with the first days of the appearance of lodging. The estimate of the resistance against lodging was made by using the 5-rating system:

Non-lodging varieties were rated - 5;

varieties lodging only slightly and in certain places were rated - 4;

varieties of an average tendency towards lodging and prolonged lodging were rated - 3;

varieties of strong and prolonged lodging, which resulted in a considerable reduction of the harvest and interfered with the work of machinery, were rated - 2;

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varieties heavily inclined to lodging and lodging long ahead of gathering (the latter done only by hand in such cases) were rated - 1.

RESISTANCE TO SHATTERING. Non-shattering varieties are of much importance in controlling harvest losses.

The latter occur at various stages of gathering: - beginning with the falling of seeds, (in cases of prolonged standing of crops on the root prior to gathering;); in the process of the gathering itself with the aid of different machinery and at threshing, as well as during the transportation of the sheaths from the field (wherever the gathering is not done by combines). In all indicated instances the presence of varieties exhibiting resistance to shattering in an economy, serves as an effective means of controlling harvest losses.

The range of varietal differences in grain crops is very large with regard to the stability to shattering.

Among wheat, for instance, along with the south-asiatic forms of soft wheats of a firmly held grain causing difficulty in threshing, there are many varieties among our European and Siberian soft wheats that are easily shattering. The shattering of wheat is determined by the structure of the scales and the manner of its attachment to the stalk. The larger the width of the base of the scale at the point of attachment, the better it holds. A sharply "expressed" keel and a strong "nervation" of the scale -

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contribute to the greater stability of the attachment of scales.

Two types of non-shattering varieties have been established in wheat. The type of rigid wheat has a friable stalk, a coarse stalk scale of small size. The grain is held firmly on the spikelet, not at the expense of a close fitting of the films (layers), but because it tears away late from the cuticle or not at all.

Hard wheats do not shatter for another reason - their scales always cover firmly the entire grain. The second type of non-shattering wheats is more desirable, since the wheats of the rigid type are difficult to thresh, wherein lies their disadvantage. In the latter case one may face a loss of grain as a result of under-threshing or a strong separation of the grain.

Illustration no. 511, p. 609. Artemovka; a large-grained variety summer wheat. Stalk 1/1; scales and grain 3/1.

There is no doubt but that the non-shattering of grain is related to the degree of firmness of the attachment of the stalk scale to the stalk stem, and a strong development of the mechanic tissue of the bases of the stalk scales. Chemical research has shown that the stalk scales of rigid wheats contain only a small amount of lignin.

Losses of grain from shattering reach in some cases large proportions. In cases where the variety remains ungathered for 10 or more days, following the period of full ripening, the losses of individual varieties may reach

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50-60 percent, particularly if during that time strong winds and sharp changes from hot weather to rains and vice versa prevail with comparative low humidity. Among the varieties of winter wheat, the high-yielding American variety Govell, for instance, possesses very valuable economic and biological characteristics. Nevertheless, its disadvantage lies in a poor resistance to shattering.

A number of methods were proposed for the estimate of the resistance of varieties to shattering and special equipment was constructed for the purpose. Some authors based their methods upon the study of the degree of resistance to the tearing of the stalk scale from the stalk stem, (Dazhenov, Khizhniak). Others did not estimate the shattering of the grain but considered the degree of the ease of the removal of the grain from the stalk scale by shaking the stalk and the entire plant. Here the varieties were appraised for resistance to shattering during the threshing process, (the Priima method). Other authors yet studied shattering by counting the harvests of varieties in different periods (plots) or on the basis of a definite test number of stalks, brushes.

On purposely set aside variety-testing plots special observations were conducted relative to the shattering of grain crops during prolonged standing on the root", i.e. some 10-20 days following the ripening of each variety. In addition, observations on the shattering of varieties were conducted at all variety-testing points during gathering, drying, trans-

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portation, and threshing, and these were appraised by eye-sight on a 5-rating scale (5 - indicating a high stability, 1 - a low one). The latter method is a subjective one and is not sufficiently accurate, but the mass observations made at variety testing stations provide adequate data for a relative appraisal of the varieties with respect to shattering.

With regard to shattering the regionalized and prospective varieties are separated into five groups:

1. RESISTANT VARIETIES. Among the summer wheats the following varieties belong to this group, Grekum 289, Grekum 285, Fritrospermum 841, Tetcher, Pionerka, and all varieties of hard wheats; among the winter wheats - Lolis-Puri 35-4, Pseudo-Meridionale 122-A, Altii-Aetch, Surkhaki, and all varieties of hard wheats.
2. VARIETIES OF ABOVE AVERAGE RESISTANCE. (shatter seldom, only if gathered late). Among winter wheats the following varieties within this group have to be noted: Krasnodarka, Moskovskaia 241, Durable, Ferrugineum 1239,; among oats: Sovietski, Pobeda, Golden Rain; among summer wheats: Moskovka, Pionerka.
3. VARIETIES OF AVERAGE RESISTANCE. Among the winter wheats: Ukrainka, Gostianum 237, Yessostepka 75; among summer wheats: Lutescens 62; among rye: Petkusskaia Kharkovskaia 194, Tarashchanskaia 2, Lisitsina.
4. VARIETIES OF WEAK RESISTANCE. Among rye: Viatka, Omka, Polinskaia; among winter wheats: Stavropolka 328, Sandomirka, Akhmilovka, Khulugo

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(Khotora), Novo-KrimkaVIII/5.

5. NON-RESISTANT VARIETIES: (strongly shattering). Among winter wheats - Covell.

WINTER BARLEY - large losses in harvest are caused by the breaking of stalks and not the shattering of grain, and all varieties of barley are therefore characterized according to this feature which carries considerable economic significance. No varieties of high-resistance to breaking of stalks were found among the regionalized varieties. Among the groups of varieties of weak resistance one may mention - Pallidium 43, Pallidium 45, and Boets.

THE ABSOLUTE WEIGHT, or the weight of 1000 grains, of a median test (in grams) is one of the leading economic features characterizing the quality of the grain among different varieties of grain crops. The large size of a grain is a feature that belongs to every variety. One therefore distinguishes varieties - large-grained, small-grained, of average size grain, etc. The absolute weight varies within the same variety, depending upon geographical regions of production, meteorological conditions, as well as upon methods of agricultural practices, the fertility of the soil, etc., all points that may be applied to all grain crops.

Usually the larger grain is obtained in the regions of the northern non-black belt, the north-east, the vast forest-steppe regions of Siberia.

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In moving southward and in a south-eastern direction, into the regions of the Volga, the steppe regions of the Caucasus and the Ukraine, and Siberia, the grain is usually found to be smaller. In the central region belt the grain is of average size. With regard to the individual crops, the changeability of the absolute weight within the geographic cross-cut - proceeds singularly, with some deviations peculiar to the respective crop.

In order to characterize the varieties according to the absolute weight for all crops, a special scale, usually of ratings in 5, was accepted, differing between the groups from 3-4g., with consideration given certain peculiarities in every crop. A tentative scale of a weight of 1000 grains for the different varieties of crops is given below.

WINTER AND SUMMER WHEAT

Weight	1000 grains	very high	-35 g. and over
"	1000 "	high	-30-34.9 g
"	1000 "	average	-27-29.9 g.
"	1000 "	below average	-25-26.9 g.
"	1000 "	Low	-below 25 g.

WINTER RYE

Weight	1000 grains	high	-28 g and over
"	1000 "	above average	-24-27.9 g.

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Weight	1000 grains	average	- 20-23.9 g.
"	1000 "	below average	- 16-19.9 g.
"	1000 "	low	- 15.9 g. and lower

WINTER AND SUMMER BARLEY

Weight	1000 grains	very high	- 42 g and over
"	1000 "	high	- 39-41.9 g.
"	1000 "	average	- 35-38.9 g.
"	1000 "	low	- 30-34.9 g.
"	1000 "	very low	- below 30 g.

OATS

Weight	1000 grains	very high	- 32 g. and over
"	1000 "	high	- 29-31.9 g.
"	1000 "	average	- 26-28.9 g.
"	1000 "	below average	- 23-25.9 g.
"	1000 "	low	- 20-22.9 g.

The lamination of the grain within the varieties of barley and oats - is one of the important economic features. Under lamination of the grain in oats and barley one understands the content of the flowering films, expressed in weight percentage with respect to the initial weight of the

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non-fallen grains.

The determination of the lamination of oats and barley was made on the basis of the "Regulations on the Analysis of Seeds" issued by the Narkomsem of the USSR in 1943.

The methods of Chemnits and Nossatovsky were taken as the basis for the determination of the lamination of barley.

The lamination of the grain varies rather considerably within varieties. All varieties may tentatively be separated into several groups with respect to the lamination of grain.

> Illustration no. 312, p. 611, Lutescens 17, a large-grained variety of winter wheat; stalks 1/1; scales and grain 3/1.

Five groups were established for the varieties of OATS:

1. HIGH LAMINATION - above 33 percent.
2. ABOVE AVERAGE LAMINATION - from 30 to 32.9 percent.
3. AVERAGE LAMINATION - from 27 to 29.9 percent.
4. BELOW AVERAGE LAMINATION - from 24 to 26.9 percent.
5. LOW LAMINATION - below 24 percent

With regard to BARLEY three groups were established with the proviso that its lamination is lower compared to that of oats.

1. HIGH LAMINATION - above 12 percent
2. AVERAGE LAMINATION - from 10 to 11.9 percent
3. LOW LAMINATION - below 10 percent

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Depending upon meteorological conditions of growth, the lamination of grain varies strongly within varieties. The lowest lamination, such as is observed in varieties of oats and barley, is noted in regions of high moisture and low temperatures (the north, north-east, and Siberia). In moving southward the lamination of the grain is increased.

The varieties of the south-eastern regions produce the highest lamination of grain, such as was observed in the course of several years in the Rostov district, the Krasnodar region and Trans-Caucasian republics. In the forest-steppe parts of the Ukraine the lamination of the grain is somewhat lower than in the steppe region.

The lamination within the same variety may also vary with the years. In more humid years the ripening of the grain occurs under more favorable conditions and lamination is therefore lower; in dry years, the grain is on the contrary shrunken and has a high lamination.

End of Chapter

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Rukovodstvo po aprobatsii sel'skokhozyaistvennykh Kul'tur [Handbook on the Approval of Agricultural Crops]. v.1, Zernovye kul'tury (pshenitsa, rozh', yachmen', oves) [Grain crops (wheat, rye, barley, oats)]. Ed. 3, rev. and enl., 639 p. Moskva, Sel'khozgiz, 1947. 64 R85

Translated from the Russian by
S. H. Monson

PRINCIPAL DISEASES OF CEREAL CROPS (pp. 615-623)

The selector, in producing new varieties and in improving the existing ones, as well as the approver - in establishing the quality of the harvest, particularly the varieties of sowings, should always remember that diseases of grain-, oil and many other crops react negatively upon the height and quality of the harvest.

The lowering of the quality of the harvest, as a result of disease, points this year to a further reduction of the yield if the production from infected fields will be used for sowing purposes. Many inducers of diseases are passed on along with the seeds, remaining on their surface (smut, ergot) or from within the seeds (loose smut of wheat or barley, fusarium, helminthosporiose, etc.) The major task at "approving" is, therefore the elimination of those sowings of which the yield may not be used for seeding.

Seeds that are infected by some diseases should be discarded, applying standards of a permissable degree of infection, or they should be stored separately.

On the basis of the data provided by the approval method portions of seeds should be separated concerning which additional work is necessary in winnowing, sorting or treating them with a salt solution for the removal of

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all ergots, bags and lumps of smut.

While some diseases are not transmitted by seeds, such as for instance, some species of rust and mildew, these also react upon the sowing qualities of the yield, if strongly developed, and lead to a shriveling of the grain and, correspondingly, to a reduced viability and low resistance of the plants to unfavorable environmental conditions, among others to a lower stability against disease.

Finally, it is important to bear in mind that aside from the direct damage done by disease, estimated in the percentage of stalks infected with smut and loose smut, etc., there also are so-called "hidden" losses.

"Hidden" losses are expressed in the lowering of such valuable features in plant varieties as frost- drought-resistance and non-lodging. Winter crops, for instance, if infected with rust to a considerable degree, become less resistant to frost. In connection with a considerable number of spores of smut on the surface of the seeds almost all germinated plants may be infected by smut, which will considerably reduce their resistance to wintering and lead to an additional loss of several tenths of percent of plants during the winter.

One should take into account during approval not alone the diseases transmitted along with the seeds but also the diseases, subject to estimates, that lower the quality of seeds.

In characterizing the varieties with regard to diseases in the vast

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spaces of the Soviet Union attention is paid not to the degree of the stability of the particular variety as such as to the degree to which it is subject to disease. This because varieties susceptible to a definite disease in practice may not be infected by it in many zones, simply because the latter are outside the main areas of the development of the particular disease. The appraisal of a variety with regard to its stability to a disease would, under the circumstances, be narrow and inadequate.

In areas where disease is spread in a variety of degrees and where their significance with respect to economy therefore differs, varieties are infected in diverse degrees and suffer an unequal amount of damage.

In selecting varieties for the best quality from an economic point of view it is therefore imperative to know the degree to which a variety may be susceptible to infection -(whether very strong, strong, average, etc.), in order to estimate the amount of loss suffered in a given zone and correspondingly establish the specific weight of the disease for the given variety, as compared to other varieties, as well as to compare it with respect to its frost - and drought resistance and other qualities of the particular variety. Should it be established, for instance, that the variety "Ukrainka" in the Ukraine is susceptible to brown rust to a severe and above average degree, this would mean that in a lowering of the yield by 2-3 percent, as a result of every 10 percent of rust, the loss in the "Ukrainka" from this disease would amount to 15-20 percent of the harvest in a zone of severe infection

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and to 10-15 percent of the harvest in zones of above average infection. In this manner the estimate of the degree of infection gives a fuller comprehension concerning the variety.

Finally the stability of a variety and its corresponding degree of susceptibility change within the geographic cross-section which demands a differentiated appraisal of varieties for the different zones of the Union. The varieties of winter wheat "Kooperatorka", and "Voroshilovka" for instance, are strongly susceptible to yellow rust in the Northern Caucasus and Trans-Caucasia, while in the Uzbekh SSR they prominently stand out for their low degree of infection (in tenths of percent), as compared with many middle-asiatic varieties where infection by rust reaches up to 100 percent; the principal reason for this is the fact that the Uzbekh republic possesses other physiological races of the rust fungus.

It is further necessary to point out that predisposition to infection may also change in time, and that plants may pass from a weak category into an average category with respect to susceptibility to infection, etc. This depends upon the change in the composition of the physiological races of the fungus and the environment affecting the change of the variety.

The susceptibility of plants to diseases is determined by two factors:

1. The spread of the disease should be established, i.e. the percentage of diseased plants or stalks, if the disease causes the loss of the entire production of the plant (in cases of wet and loose smut), or

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if the infection of the stalk is connected with a radical lowering of the quality of the seeding material (for instance, in cases of the rose fusarium of stalks).

2. One should proceed from the estimate of the intensity of the infection, i.e. the degree of coverage of the leafy surface or other organs of the plant by a given disease if the surface is covered with spores and suffers from a radical loss of chlorophill and drying out.

The degree of coverage is expressed in ratings or by the words: "small", "average", "large".

The establishment of the intensity of the infection is less accurate because, as a rule, field approval is conducted immediately prior to gathering when the vegetative parts of the plant have dried out or are almost dried out and, in some cases, they have become twisted, which interferes with the count. Only in the case of stem rust may the estimate be correctly made since the black spots which do not disappear from washing (pustules) are clearly evident on the stems, which do not change their shape in ripening.

A description of the most important diseases of grain crops is given below.

DISEASES OF WHEAT

WET SMUT (Tilletia tritici Wint.) and (Tilletia levis Kuhn.). The diseased stalks stand upright, looking more spread since the diseased grains

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are wider than the healthy ones and extend the stalk scales more. The olive-green grains remain green longer, their content turning into a black mass (accumulation of spores) and exhaling a smell of pickled herring solution.

The disease is transmitted by the spores of a fungus which during threshing spill from the smut bags and cling to the surface of seeds. They germinate along with the germinating seeds and cause the infection of young seedlings of wheat.

Control: treatment of seeds with dry mordant (powder-like poisons - AF protars, granosan) or by a wet method (formaline).

LOOSE SMUT[Ustilago tritici (Pers.) Jens] All parts of the spikelets are destroyed, turn into a black-brown mass - spores leaving only a bare stem after the spores are dispersed. The external manifestation of the disease in wheat resembles that of the infection of barley by loose smut.

The infection occurs during blooming and shortly afterwards. The spores settle on the stigma of the ovary of flowers of wheat and cause the infection of the nucleus of the seed. The mycelium nestles within the germinating grain which differs from the healthy grain by appearing dull and of a peculiar wrinkling.

The smut infected grain produces a diseased plant which in place of the grains forms accumulations of spores spread by wind.

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Illustrations no. 314, p. 616. A- at left- healthy, at right - diseased stalk of bearded wheat, infected by wet smut. B - unbearded wheat: C - rye; D - barley (both healthy and diseased plants).

Illustration no. 315, p. 617. Loose and hard (stony) smut of barley: A - healthy stalk; B - diseased, smut infected stalk; V - infected loose smut prior to the spilling of spores; G - after the spilling of spores.

Control: Heating the seeds in hot water which simultaneously kills the spores of other species of smut.

Illustration no. 316, p. 618 - STEM SMUT (Urocystis tritici Koern.). On the stems at the base of the usually undeveloped stalk, and partly on the leaves and leaf sheath form lengthy greyish stripes which later burst and release a black powder - the spores of the smut. The diseased leaves and leaf cases twist in screw-fashion and split, as do the stems. The plants appear depressed, delayed in their growth and usually do not produce any grain.

The spread of the disease occurs during threshing when the spores cling to the seeds, and also through contamination from the soil.

Control: treatment of the grain by wet and dry method.

STEM (LINEAR) RUST (Puccinia graminis Pers. f. tritici). On leaf sheaths and particularly stems, on stalks, and more seldom on the leaves - form lengthy (up to several millimeters) brick-brown, powder-like pustules, surrounded by a sharply torn epidermis. These pustules darken with time and finally get black because the rusty summer spores gradually are replaced by dark-brown winter spores which are not spread by the wind, though not protected by an epidermis.

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The winter spores germinate in the spring and cause the infection of common barberry and some other plants (the so-called intermediate hosts of rust) which subsequently transmit the disease to the cereals.

During the entire vegetative period the disease is spread with the aid of summer spores distributed by the wind.

Illustration no. 317, p. 618 - STEM LEAF RUST: A - summer pustules; B - winter pustules (the medium stage of infection).

BROWN LEAF RUST (Puccinia triticina Erikss.). On leaves, much more seldom on leaf sheaths, form summer pustules spread in disorderly fashion, of brick-yellow color, rounded, smearing, of 1-1.5 mm in length and 0.5-1 mm in width. Later and chiefly on the lower surface of leaves, and during a severe form of the disease also on leaf sheaths, form winter pustules, dark-brown, covered by the skin of the leaves.

The principal manner of spring renewal is from the wintering of the mycelium of rust in the tissues of winter crops, and to a lesser extent is spread with the aid of an intermediate host - the Thalictrum L. ("Vassilistnik"). In the summer the disease is spread by wind; it is not transmitted by seeds.

YELLOW (or STRIPED) RUST (Puccinia glumarum Er. et Henn.). On leaves and on the inner surface of flower and stalk scales; form very small (part of a millimeter) lemon-yellow, smearing pustules which placed one after the other in straight rows look like stitched seams. Later winter pustules of dark-brown color are formed, covered by a skin and distributed in less regular rows. During a particularly severe infection of the stalks large

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accumulations of summer spores of rust form under the layers.

In the summer the disease returns because of the wintering of the mycelium of rust in the tissues of winter crops. Infrequently the disease is transmitted by seeds.

Illustration no. 318, p. 619 - Brown Rust. Summer pustules on the leaves of wheat (1.5/1): A - weak, B - average, V - severe infection.

Illustration no. 319, p. 619 - YELLOW RUST. Stripes stitched of summer pustules on leaves of wheat (1.5/1): A - weak, B - average, V - severe infection.

WHITE STEM OF WHEAT and ROSE MOLD (Fusarium sp.). Appear on the stems as a result of the "life-activity" of fusarious fungi. In planting seeds infected by fucarium a portion of the diseased grains does not germinate, another portion produces germinated plants that perish, and another yet of plants that lose the chlorophyll and dry out, leaving an empty stem (white-stem).

The rose mold on stems develops in moist regions and during moist years especially, when rains fall at gathering periods or immediately prior to them. The development of the disease coincides not infrequently with the germination of the grain on the root. The rose mold is occasionally accompanied (for instance in the Far East) by another factor, that so-called "drunken bread".

Diseased seeds and vegetative remainders form the sources of infection.

Control: - timely gathering in closely adjoining days; drying of seeds

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up to the "conditioned" degree of moisture prior to storage; the removal of the light-weight fusarium infected grains by grain-cleaning machinery.

BLACK CHAFF (Bacterium translucens var. undulosum E.F. Sm.). This bacterium is found on wheat, infecting usually only individual, the most susceptible varieties, especially in Siberia and the Ukraine. It is less frequently observed on barley or rye.

The disease manifests itself in a blackening of the stem scales and sometimes beards. The blackening occurs more frequently in the upper part and on the outside of the scales. In such cases it has the appearance of dark-brown, almost black, lacquered-like strips of various lengths which often unite. The grains darken and shrivel at their base.

BROWN OVAL BACTERIUM (Bacterium atrofaciens McCulloch). Manifests itself in the lower part of scales; the blackening is well seen on the interior of the scales and frequently is also observed on the outer side. The basis of the grain darkens during a severe infection.

Bacterium are easily observed on white-stemmed forms, especially if they appear on the upper part of the scales. On dark colored stems the disease may be confused with the natural color of scales. In order to avoid this it is necessary to compare the suspicious looking stems with typical stems of the variety under test.

The source of infection and distribution of bacterium are seeds and vegetative remainders.

The methods of controlling the disease are not sufficiently studied

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as yet.

Illustration no. 320, p. 620. Black Chaff on wheat; A - the upper parts of scales are diseased; B - the healthy spikelets of the stem.

MILDEW (Erysiphe graminis D.C. f. tritici). Infects wheat, barley, less frequently rye; develops on leaves, sheaths, and stems. Transfers more seldom onto the stem scales and beards.

The diseased organs acquire superficial layers consisting of the aerial parts of mycelium and the fruiting of the parasite. At first the layers are thin, whitish or dirty looking, web-like and starchy from the dispersion of colorless spores with the aid of which the parasite spreads from one plant to another in the course of the summer. Later the layers thicken and take on the appearance of greyish and brownish, rather large, superficial pustules which may easily be removed with a finger nail. On these pustules one may at close inspection note at first yellowish, later black tiny grains. These are the fruiting bodies (ascocarp) of the fungi (Perithecium ?)

DISEASES OF BARLEY

HARD or STONY SMUT (Ustilago hordei Kell. - Ustilago Jensenii Rostr.) Instead of grains dark accumulations of glued spores manifest themselves, covered with a whitish, transparent, frequently destroyed film. The disease is transmitted in the same manner as in the case of the hard smut of wheat,

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i.e. chiefly by seeds. Control: treatment of seeds by semi-dry method.

LOOSE SMUT (Ustilago nuda Kel. et Sw. - Ustilago hordei Pers.) Externally manifests itself in the same manner as does the loose smut of wheat.

STEM RUST (Puccinia graminis Pers. f. hordei) Manifests itself in the same way as stem rust of wheat.

DWARF RUST OF BARLEY (Puccinia simplex Erikss.). Shows on leaves in small (parts of millimeters), brick-red, powder-like pustules, dispersed in disorder. In its outward appearance the disease reminds one of brown rust but the summer pustules are smaller. Later dark-brown pustules appear, especially on leafy cases, covered with an epidermis.

During the summer the disease, aside from the wintering of the mycelium in the tissues of winter barley, returns with the aid of an intermediate host of this rust - the Ornithogalum L. ("Ptitsemlechnik") and of spores carried in from the outside.

HELMINTHOSPORIUM of BARLEY. Manifests itself in: 1. striped spottiness, when elongated spots uniting into strips of grey-brown and grey-leaden color appear on the leaves, frequently accompanied by the elongated, splitting of the leaf. (Helminthosporium gramineum Rabh.); 2. brown spottiness, in the shape of small oval s ots of brownish color with spores of a weakly appearing film (Helminthosporium teres Sacc.)

The disease is transmitted by seeds and in part by reaping remainders left in the soil; in the summer it is spread by spores carried by winds.

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Control: treatment of seeds with granosan (NIUIF - 2).

MILDEW (Erysiphe graminis D.C. f. hordei). Same appearance as mildew on wheat.

DISEASES OF RYE

WET SMUT (Tilletia secalis Kuhn.). The diseased stems are upright, appear more widespread; blown grains are of olive-green color and filled with a black accumulation of spores that smell of a salt herring solution. The disease is transmitted by spores that have clung to the seeds.

STEM SMUT (Urocystis occulta Pabh.) Analogous in appearance to stem smut of wheat, widely spread and not considered a quarantine object.

The stalks on diseased stems occasionally do not come out from the leaf sheath or produce extremely shrivelled seeds unsuited to planting. There is usually no twisting of diseased organs.

The disease is spread by seeds and in part by the soil.

Control: by dry and wet treatment.

LOOSE SMUT (Ustilago tritici Jens. and Ustilago Vavilovi Jacz.) Analogous in appearance to loose smut of wheat, except for the fact that the stem is infected usually only in parts.

STEM RUST (Puccinia graminis Pers. f. secalis). Analogous in appearance to stem rust of wheat.

BROWN RUST (Puccinia dispersa Erikss.) Analogous in appearance to brown rust of wheat.

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Handbook on the approval of agricultural crops. v.1, Ed. 5, 1947.
Principal diseases of cereal crops. (pp. 615-623)

ERGOT (Claviceps purpurea Tul.) In place of normal grains of rye, hard, furrowed "feelers" ("rozhki") (sclerotia) of dark-violet color and up to 3 cm in length, form within the stalk. The "rozhki" (sclerotia) of ergot, getting into the soil along with the seeds, lead in the following year, when the rye is in bloom, to the infection of the young ovaries which in turn produces accumulations of mycelium in the form of feelers ("rozhki") (sclerotia) in place of grains. Diseased stems are usually observed in border parts of a field.

Control: Cleaning of seeds from the feelers of the ergot with the aid of grain-cleaning machinery and the removal of the feelers that float up in a strong solution of sodium chloride.

DISEASES OF OATS

LOOSE SMUT (Ustilago avenae Jens.) All parts of flowers turn into a dark mass of spores that disperse in the air. Stems may be affected only in parts and at the beginning of the infection loose smut can be distinguished from covered smut only with difficulty.

Illustration no. 321, p. 621. Ergot on rye; A - 4 fillers ("rozhki"), (sclerotia) of ergot.

Illustration no. 322, p. 621, Crown rust of rye. Summer and winter pustules ("podushechki") on leaves (1.5/1): A - weak; B - average; V - strong infection.

Illustration no. 323, p. 622; Smut of oats: A - healthy brush, B - disease infected covered smut, V - infected by loose smut up to the stage of dispersing of spores, G - following the dispersion of spores.

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The spores get under the flower layers, germinate gradually and form a mycelium on the inner surface of the layers of oats and on the surface of the grain.

In the spring, when the grain germinates in the soil, the mycelium awakens and infects the seedlings of oats.

COVERED SMUT (Ustilago levis Magn.). As in the case of the hard smut of barley, the spores do not disperse, but remain as if glued and covered by layers which are in part destroyed.

During threshing, the spores scatter and contaminate grain; if the stored grain possesses a considerable amount of moisture, the spores germinate and infect the grain from the surface.

Control: partly dry, less often wet treatment.

LINEAR (BLACK) RUST (Puccinia graminis Pers. f. avenae). Analogous in appearance to the linear rust of other cereals.

CROWN RUST (Puccinia coronifera Kleb.). Red-orange pulverized (powder-like), elongated pustules form on the leaves during the summer stage, of several millimeters in length. Later dark-brown, shiny pustules, covered with a film (winter pustules) form on the leaves and leaf sheaths; they frequently are arranged in semi-circle on the leaves around the summer pustules, giving the impression of small "eyes".

Transmitted to oats by the intermediate host of this rust - the Rhamnaceae cathartica L., "krushina slabitelnaya".

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Handbook on the approval of agricultural crops. v.1, Ed. 5, 1947.
Principal diseases of cereal crops. (pp. 615-623)

COCKLE (?) STAGE - a disease of a virus nature and infecting primarily oats, to a lesser degree wheat, barley and other crops. A diseased plant - of short growth but thick clump, does not "throw out" brushes during a severe infection. Prevalent primarily in Siberia.

Source of infection - a virus, transmitted to the plant by the pricks of the dark cicada. The disease is not transmitted by seeds.

End of Chapter

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464.4 N225

Translated from the Russian by
S. I. Monson

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Naumov, N. A., ed. Spravochnik agronoma po zashchite rastenii. 1948.

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Naumov, N. A., ed. Spravochnik agronoma po zashchite rastenii. 1948.

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Baumov, N. A., ed. Spravochnik agronoma po zashchite rastenii. 1948.

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Nauzov, N. A., ed. Spravochnik agronoma po zashchite rastenii. 1948.

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Naumov, N. A., ed. Spravochnik agronoma po zashchite rastenii. 1948.

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Naumov, N. A., ed. Spravochnik agronoma po zashchite rastenii. 1940.

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Naumov, N. A., Spravochnik agronoma po zashchite rastenii. 1948.

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Naumov, N. A., ed. Spravochnik agronoma po zashchite rastenii [An agronomist's reference book on plant protection]. Moskva, 1948. 830 p. 464.4 N22S

Translated in part from the Russian by S. N. Monson

INTRODUCTION (p. 1-8)

Reference literature devoted to the control of pests and diseases of agricultural crops is extremely scarce. A special reference handbook on the control of pests of agricultural crops was published by Sel'khozgiz (Agricultural Government Publications) in 1934, and on diseases in 1936. These handbooks are no longer available and have, moreover, become obsolete.

The reference book recently published (Handbook on the control of pests and diseases of agricultural crops, Sel'khozgiz, 1945) is intended, as appears from the introduction by its writers, for the benefit of brigade leaders and instructors on pest and disease control.

The absence, in the book market, of special reference handbooks on the protection of plants from pests and diseases severely handicaps the practical work of agronomists. In recent years radical changes have taken place in the field of plant protection. Many new species of pests and diseases have been discovered. In the assortment of poisons, many new, formerly unknown preparations, have made their appearance, while many old poisons were discarded and replaced by more effective ones. The very technique of control has undergone considerable changes.

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All this calls for the necessity of publishing a new reference book for the benefit of agronomists, one that would reflect adequately contemporary achievements of Soviet science in the field of pest and disease control of agricultural crops. This task has become particularly timely now, when the new Stalin five-year plan demands a substantial increase in yields of all cultivated plants. In this vast, distinguished and responsible task, proper measures applied in time, with regard to the protection of yields from agricultural pests and diseases will undoubtedly carry considerable significance. The reference book we now submit to our readers has been compiled by a "brigade" of 27 specialists of the All-Union Institute of Plant Protection, the Institute of Applied Zoology and Phytopathology, the faculty of Plant Protection of the Leningrad Agricultural Institute, the Botanical Garden of the Academy of Sciences of the USSR, and other institutions.

The first, second and third parts of the "Spravochnik" were edited by Professor V. N. Shchegolev, doctor of agricultural sciences, while the fourth part was edited by the member-correspondent of the Academy of Sciences of the USSR, Professor N. A. Naumov.

The first and second parts of the volume present reference data on methods and measures of controlling pests and diseases of agricultural crops. Reference data on poisons used in pest and disease control, on machinery, used in the application of poisons, and mechanical methods of control is dwelled upon in particular detail. With respect to other methods an understanding is given of the principle of their operation and the conditions and techniques of their application. Using the first and second

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parts, the reader may obtain from the text and reference charts necessary information on chemical methods, the mechanization of pest and disease control and of other control methods.

The third part of "Spravochnik" provides reference data concerning the most important dangerous insects, slugs, mites, rodents and other pests of agricultural crops. For the convenience of readers the pests are distributed among groups of crops, while reference data on multi-poisonous species and rodents are printed elsewhere. In selecting harmful species which were included in "Spravochnik", the authors were guided primarily by the degree of their injuriousness and spread of distribution. With respect to every species brief data is given which characterizes its distribution, the plants it injures, the most important points in its biology, and cites lists of measures for its control. In the event of confusion concerning the application of any of the recommended methods of control the reader should turn to the corresponding sections of the first part of "Spravochnik".

In the fourth part of the volume general information is given concerning the most important types of plant diseases and reference data provided on diseases of individual agricultural plants.

The compilation of a single reference book for the immense and extremely varied territory of the Soviet Union clearly represents considerable difficulty. The authors aimed to give consideration to the peculiarities of local conditions in individual regions. We believe, nevertheless, that the material submitted in this volume may require some correction with respect to local characteristics. All remarks, wishes and offers concerning

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Naumov, N. A.

"Spravochnik" should be forwarded to the following address: Leningrad, Nevskii Prospect, 28, Leningrad Section of Sel'khozgiz.

THE INDIVIDUAL SECTIONS OF "SPRAVOCHNIK" WERE COMPILED BY THE FOLLOWING SCIENTISTS:

Prof. V. N. Shchegolev-general classification of methods, agro-technical methods of pest control, mechanical and physical methods, multi-poisonous pests, pests of cereals, legumes and technical crops.

Docent N. A. Briantsev-Significance of pest and disease control for increasing yields of agricultural crops; general information on agricultural pests; methods of appraising injuriousness; statistics on losses from insects; estimate of the efficacy of measures in controlling agricultural pests, pests of fruit trees, berry plants, grain pests and pests of grain products.

Sr. scientific collaborator, worker V. A. Shchepetel'nikova-Biological methods of controlling harmful insects;

Docent A. M. Il'inskii and docent M. G. Nerim-Poisons in chemical control;

Prof. I. P. Yatsenko-Machinery and equipment necessary in the control of agricultural pests and diseases.

Prof. M. N. Bogdanov-Fatkov-Pests of vegetable crops;

Prof. Y. I. Prints-Pests of grape vine.

Prof. B. U. Falkenstein-Harmful rodents;

Prof. S. M. Tupenevich-Agro-technical methods (disease control), general information on diseases, fusarium, sclerotia and root rot of cereals.

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Prof. N. A. Naumov-Basic data on fungi as inducers of plant diseases, parasites of the superior flowering plants.

Dr. M. V. Gorlenko-Bacterial plant diseases;

Candidate of biological science V. K. Zazhurilo-Virus plant diseases;

Candidate of agricultural sciences K. M. Stepanov-Prognosis on agricultural plant diseases, diseases of fruits, berry crops and grave vines, and calendars for controlling diseases of orchards, the drying of lemons;

Candidate of biological science M. K. Khorkhriakov-grain rust; diseases of wheat, rye, barley, oats, corn, millet, rice, and forage crops, helminthosporiose of cereals.

Candidate of biological science L. S. Gutner-Septoria of cereals, diseases of rubber-bearing, ether and medicinal plants.

Doctor of biology N. I. Vassilevskii-Diseases of clover.

Candidate of biology V. M. Bondartseva-Monteverde - Diseases of legumihous crops.

A. S. Letov and M. F. Letova - Diseases of the cotton plant, tobacco and makhorka.

Candidate of agricultural science M. M. Vladimirskaia - Diseases of flax and sunflower.

A. I. Kuznetsova - Diseases of hops;

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Naumov, N. A.

Candidate of agricultural science A. T. Tropova - Diseases of hemp, oil, spinning, and technical crops;

Candidate of agricultural science, dotsent T. L. Dobrozrakova - Diseases of potatoes, sugar beet, cabbage and other Cruciferae, Umbelliferae, and Cucurbitae crops; diseases of potatoes and vegetables in storing.

M. I. Boiko - Diseases of tomatoes, onions, garlic, spinach, paraley, lettuce, eggplants.

Prof. A. I. Lobik - Diseases of citrus plants.

Candidate of agricultural science V. I. Gusev - Reference data concerning VUZY and institutions.

INTRODUCTION

A considerable part of yields is frequently lost in agriculture for a variety of reasons. Along with unfavorable meteorological conditions (drought, wetting, etc. and causes of an organizational technical nature (improper techniques, non-utilization of means of mechanical equipment), one of the causes of losses yields is to be found in pests and various diseases of agricultural crops.

Insects, mites, slugs, nematodes and rodents, as well as various fungi and microorganisms, when settling and feeding upon cultivated plants, frequently cause the destruction or, in any event, reduce yields and deteriorate the quality. In years of mass propagation pests and diseases

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produce considerable losses in yields. In the pre-revolutionary period, when measures for the control of pests and diseases were not undertaken at all, large parts of harvests were not infrequently lost altogether. According to statistics provided by Professor Lebedev, annual losses in the national economy of pre-revolutionary Russia could be estimated, from insects alone, at 1430 millions of gold rubles, which equalled almost 25 percent of the national budget of that time.

The government of the USSR introduced measures to reduce and prevent the collossal losses caused by pests and diseases of agricultural crops. Large sums were assigned to their control; numerous cadres of specialists-entomologists and phytopathologists were trained and are in training; a special industry for the manufacture of equipment designed for control was established. The results of these measures reflected upon the reduction in losses of harvests. According to data of the NARKOMZEM of the USSR (Administration of Statistical Records on pests, 1934), in the period of the first five-year plan, when the collectivization of agriculture was first put into effect, and a powerful industrial foundation established in support of agriculture, annual losses from pests reduced radically.

The volume of practical measures used in the control of pests increases from year to year. The expansion of measures in the field of plant protection was temporarily stopped by the war. In the post war period, however, an enormous amount of work was done in restoring and advancing agricultural production.

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Naumov, N. A.

The decisions of the February (1947) Plenum of TSK VKP (b) [Central Committee of All-Union Communist Party] gave concrete directions concerning the fulfillment of the Stalin postwar five-year plan. These decisions drew attention, in part, to problems of pest and disease control of agricultural crops.

Despite the achievements reached by our collective and state farms, with regard to pest control, these losses remained, nevertheless, large. The aim set by the Party and Government for a vast increase in yields of agricultural crops demands decisive measures for the liquidation of these losses. With the reconstruction of our chemical industry and the establishment of new plants, producing special machinery, effective control of pests and diseases may be successfully conducted on a large scale.

The control of pests and diseases directed towards increasing the output of agricultural production represents a serious national problem of economic significance and it is necessary to solve it in full measure within the next few years. To solve the problem of pest and disease control of agricultural crops in the USSR means to utilize skilfully the experience and knowledge of advanced workers-stakhanovtsy, and apply advanced scientific and technological knowledge in industry on a wide scale. Stakhanovtsy and advanced workers in agriculture demonstrated that large yields may be obtained under a proper organization of labor and utilization of agricultural techniques, particularly with regard to measures for protecting agricultural crops from pests and diseases.

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This control should be conducted in a planned order, and only under these circumstances will it be sufficiently effective. Planned control demands the ascertainment of all areas infested by pests and diseases, in order to anticipate the volume of work in advance and to plan for proper ways in executing it. The application of measures organically connected with agricultural production is indispensable in planned control. Along with the selection of effective means and methods of control, periods of application are of major importance. Success in control also depends upon timely application of methods.

Post control should be the responsibility of the farms which organize and carry out measures themselves, under the supervision of agronomists, regional sections of agriculture and MTS. The organization of protecting plants from pests and diseases has its peculiar characteristics. Thus, to ensure timely planning of measures within the system for the Ministry of Agriculture and other Ministries, a special Service of Signalization [warning] and Prognoses concerning the appearance of pests and diseases of agricultural crops, was organized. This service utilizes the information provided by observation points, subordinated to sectors of the Record Service established at Ministries of republics, krai-and oblast administration of agriculture. These are united within a corresponding sector of the Signalization Service under the Ministry of Agriculture of the Union.

The task of the Service of Signalization and Prognoses consists in:

1. determining by systematic recording the species and quantitative composition of pests and inducers of diseases and to observe their appearance

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and propagation.

2. issuing timely warnings to farms concerning the appearance of pests and diseases to urge the application of necessary measures;

3. estimating (appraising) the efficacy of conducted measures.

4. studying plantings at farms, with respect to degree of infestation by pests or inducers of diseases.

5. providing prognoses concerning mass appearances of pests and diseases on the basis of collected data, taking into consideration conditions of specific environments.

In compiling plans for the control of pests and diseases the role of the Service of Signalization and Prognoses is reduced to the analysis of data obtained from mass observations conducted at farms under the supervision of agricultural personnel, and of the work of observation points.

Another specific characteristic in the organization of plant protection from pests and diseases is the Quarantine Service, connected with the Ministry of Agriculture ~~xQuarantinex~~, consists in a complex of measures directed towards protecting the territory of the USSR from the penetration of new species of pests and inducers of diseases from other countries or the restriction of their distribution within the boundaries of our country.

New species of pests and inducers of plant diseases may penetrate into new regions by a multitude of ways, specifically with planting material and seedlings, as well as with agricultural raw material. Under favorable conditions pests and inducers of diseases may become acclimatized and damage agricultural crops. An example of such acclimatization may be found in

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[phylloxera] of grape vines, the American mildew of gooseberries, phytophthora of potatoes, introduced in the past century from America into Europe. These diseases gained a wide spread abroad and, after penetrating into our country, have caused colossal damage; at present they constitute a large threat to yields of our agricultural crops.

The basic aims of the Quarantine Service are:

1. to establish quarantine objects and regions of their possible distribution;

2. to issue decisions and instructions on quarantine and observe their realization;

3. to issue permits for the privilege of importing heavyweight goods (plants, seeds, products, etc.).

Quarantine measures are of two kinds: external and internal.

External quarantine covers:

1. control and examination of heavyweight goods arriving from abroad;

2. disinfection and disinfestation of imported goods;

3. surveying and establishment of quarantine measures at nurseries of seed farms importing seed and planting stock from abroad;

4. the production of resistant varieties in border zones.

Internal quarantine has as its object:

1. Regulating the transfer of seed and planting stock within the limits of the USSR;

2. the elimination of focuses of infestation.

Planned control of pests and diseases is a task of the first order and its solution will lead to a significant increase in the production of agricultural goods. END OF INTRODUCTION 11 May 1951

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464.4 N22S

Translated from the Russian by
S. N. Monson

PESTS OF GRAIN CROPS (pp. 277-296)

Aside from special pests, grains are also injured by multi-poisonous pests: Locusts (p. 254), the winter "sovka" (Euxoa segetum Schiff) p. 262 with illustration, the meadow "sovka", the Agrotes, (p. 269), the Lethrus apterus Pall. (p. 273), the "Slizni", Agriolimax (p. 276, illustration 74).

The Hessian Fly - Mayetiola destructor Say (p. 277, illustration no. 75). Injures both winter and summer wheat, as well as rye and barley.

Spreads and is of particular harm, along the entire steppe and forest-steppe regions. Met also in the more northern regions, penetrating to the "Lodeini Pole" of the Leningrad district. However, it does not multiply in masses in the forest region.

Pupae winter everywhere on stalks of winter grain and grain weeds, the couch grass in particular. The flying out of the first generation of flies takes place in the steppe region usually by the end of April, and in the forest steppe - by the middle of May. The flies do not live longer than from 5-7 days and do not feed. They lay from 48 to 500 eggs on the upper surface of leaves of grain plants. Larvae appear within 4 to 7 days, and penetrate behind the leaves where they feed, sucking the etiolated soft parts of the stems. Here too takes place the change of

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larvae into pupae. The Hessian fly, depending upon the zone, has 2 to 5 generations.

The population of flies of the first and second generations develop in the steppe region primarily at the expense of the summer wheat; the third generation - nourishes on the fallen grain stalks of the post-harvesting period, and the fourth on winter crop. Summer generations are lacking occasionally in the steppe zone because of the lengthy dormant period of the larvae in the puparium (?) in times of drought. The Hessian fly is the most dangerous pest of all two-winged varieties. The injury caused to the stalks by the larvae leads to their destruction, and at an early stage of infection - to the loss of the entire plant. The infection at the stage of boot formation produces a joint in the stalk and a reduction in yield because of the sickly grain. Soft wheat is more subject to infection.

Of limited significance in the multiplying of the Hessian fly are the parasites which infect the larvae and fly out of the pupae.

Methods of Control:

1. Early sowings and vernalization which reduce the damage caused by the Hessian fly.
2. The sowing of winter crops on well fertilized and treated fallows which increase the resistance of germination to injuries (infection).

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3. The establishment of distance in the crop rotation of summer and winter grains for the purpose of reducing the degree of infection.
4. The disking of the stubbles of crops and early deep plowing. Wherever it is not possible to engage in this plowing prior to the germination of winter crops throughout the area, it is necessary to plow first the lots situated closest to the winter crop sowings.
5. A quick threshing and straw stacking of the crops to reduce the flying out of flies from the pupae, for they remain in the straw.
6. A chemical method of controlling Hessian fly on growing summer and winter crops in the period of the egg-laying of the Hessian fly. Poisons: Antratsendust (6 percent); anabadust (2.6 - 5.0 percent). Spraying with anabazin-sulphate (0.15 percent). According to tests made at the Odessa Experiment Station (1941) positive results were received from the spraying of growing crops with freshly slaked lime. Treatment with poisons should be undertaken twice in the very beginning of egg-laying at 5-7 day intervals. The chemical method demands production testing. Illustration of Hessian fly no. 75. p. 278.

MILLET MOSQUITO - Stenodiplosis panici Rodd. (illustration no. 76) Damages millet. Distributed all along the steppe and forest steppe region. The greatest damage was observed in the Kazakh SSR, The Tambov, Voronezh, and Kuibishev districts, and in many steppe districts of the Ukrainian SSR.

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The larvae winter in the seeds of the cultivated millet and in the seeds of the weed of the "chicken" millet (panicum crus gallii) which scatter over the soil, as well as in the waste after threshing. The flying out occurs in June. The females lay their eggs under the glume in the ovaries of the millet seeds prior to their heading. The larvae feed on the soft grain, frequently destroying it completely. The period of development of one generation lasts from 15 to 20 days. There are instances of prolonged dormancy of the larvae.

Method of Control:

1. Deep plowing of plots following the cultivation of the millet, as well as the plowing of those places where ~~there~~ the weed-chicken millet had formerly been.
2. Careful weeding, especially of the chicken millet.
3. The application of all measures ensuring a close, simultaneous ripening of millet.
4. Careful cleaning and sorting of the millet.
5. Optimal early periods of sowing of millet.
6. The destruction of wastes after threshing and winnowing the millet.

SWEDISH FLY - Oscinosoma frit L. (illustration no. 77, p. 281)

Injurious to all grain crops. Particularly damaging to wheats, barley, and rye. Damages also forage crops.

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Distributed in all areas where crops are cultivated. Greatest damage caused in the forest-steppe belt and the southern part of the forest zone.

The grown (adult) larvae winter on the growing winter crops and weed crops. The flying-out takes place at the end of April (steppe regions) and lasts to the end of May (Leningrad region). The eggs of these flies appear on the 10th day following the flying-out of the fly or later. They are deposited chiefly in back of the "prorostkovi -?" film of the crops, the fly preferring to infect the stems that have no more than 2-3 leaves. The larvae penetrate into the interior of the sheath and cause its destruction. The outward sign of injury is the yellowing of the central leaf. 22 to 46 days are required for the development of one generation. Depending upon the zone, the swedish fly develops from 1 to 5 generations each season. In many sections the flies of the second generation lay their eggs in back of the glume of rye and barley. In such cases the larvae feed on the grain causing its destruction. The swedish fly infects wastes after harvesting, and in the fall - the growing winter crops.

Methods of Control:

1. Early sowing of summer crops and vernalization. These measures permit only the infection of the lateral stems, which reduces the degree of injury.

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2. Treatment with nitrogen increases the tillering of crops and re-establishes the injured stems.
3. The disking of stubbles and early deep plowing provide an opportunity to destroy the larvae that developed on the fallen stems.
4. The separation - in crop rotation - of summer and winter crops.
5. Dusting of plants prior to theegg-laying with a 5 percent dust of DDT and GKHTSG (7 percent).

GREEN-EYE - Chlorops pumilionis Bjerk. (illustration no. 78, p. 281)

Injurious to wheat, barley, rye.

Distributed in all areas of cultivated crops. The greatest damage is done in the non-black earth zone, in regions having a high precipitation in the summer. The larvae winter on growing winter crops, changing into pupae in the spring. The flying-out occurs at an average daily temperature of 16.5°. The green-eye in this connection infects crops in the spring already in the period of their stem formation. The fly deposits eggs on the upper leaves. The larvae penetrate inside and feed on the spike, producing a groove. The injured spike usually does not head anymore or its heading is delayed, which reduces the yield. During the summer the fly develops on the fallen waste and in the fall on growing winter crops, causing a damage similar to that done by the swedish fly.

Methods of Control:

1. Early summer sowing of crops and vernalization.
2. Selection and sowing of varieties of wheats and barleys that head

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rapidly and are less subject to the infection by the green-eye.

3. Use of fertilization and feeding that stimulate the heading of plants. This measure may even lead to the considerable destruction of the larvae which when unable to develop prior to the heading, fall out of the furrows of the boot and perish.

4. Dusting of plants prior to egg-laying with DDT and GKHTSO.

SUMMER FLY - Phorbia genitalis Schnabl. Injures summer wheat exclusively. Distributed in the steppe and forest-steppe parts of the USSR. The greatest damage observed in the Ukraine, Transcaucasia, Saratov district, Eastern Siberia, Leningrad, Ivanov, Gorki districts.

The cycle of its development varies; false(?) cocoons winter in soil. The flyin -out occurs usually in the blooming period of the wild pear. The flies quickly begin laying their eggs, placing them in back of the leaf sheaths, preferably of those of the soft wheats. The duration of the egg development is from 2 to 8 days, of the larvae - one month. The larvae produce a spiral passage inside, at the base of the etiolated part of the stem which causes the destruction of the central leaf. The grown larvae disappear in the soil and remain there after pupating until spring in a state of dormancy. They always produce one generation in contrast to other species of flies.

Methods of Control:

1. Deep plowing.

2. The sowing of more resistant hard wheats.

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3. Early sowing and vernalization of summer wheat.

WINTER FLY - Hylemyia coarctata Fall. Damages winter crops; also frequently met on couch grass.

Develops everywhere in one generation. The eggs winter in the soil. Larvae grown at the beginning of the growth of the winter crops penetrate into the plants in the spring and cause the destruction of the tillering point. The growth and feeding of larvae end by the end of May (Poltava) or in June (Sverdlovsk), whereupon they disappear into the soil where the pupae form. The flies fly out by the end of June but do not lay eggs until August.

Methods of Control:

The measures designed to improve the growth of winter crops in general are of some significance, such as: well cultivated and fertilized fallows, a good cultivation prior to seeding, and feeding with fertilizers.

MILLET FLY - Elachiptera insignis Thoms. Damages wheat, barley, millet, rice, foxtail millet (Setaria italica)

Distributed in the Primorski and Khabarovsk regions.

The fly lays eggs on the leaves of crops in June. The larvae of the first generation penetrate back of the leaf sheath of the first internode where they feed, causing a whitening of the wheat stem. By the end of

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Kaumov, N. A., ed. Spravochnik ... [An agronomist's reference book on plant protection]. 1946.
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July flies of the second generation make their appearance, depositing their eggs primarily on millet and rice crops. One observes a blackening at the base of the rice leaf at the exit of the panicle in infected plants. Frequently the panicle does not protrude at all in infected plants or it whitens which causes the sickening of the grain.

Methods of control:

No effective measures have as yet been developed.

RICE MINER - Agromyza oryzae Bend. Damages rice.

The larvae undermine the leaves. The tunnels usually are concentrated on the upper part of the leaf. Develops two generations.

Methods of Control:

1. Plowing.
2. The destruction of chicken millet and Setaria upon which the fly frequently develops.

FOXTAIL MILLET FLY - Atherigona sp. Attacks foxtail millet and millet.

Distributed in the southern sections of the Khabarovsk region. The fly appears in the middle of June. The larvae feed on stems causing the destruction of the central leaf. The more adult larvae eat the lower panicles which causes non-heading or a partial loss of seeds. In August the grown larvae disappear into the soil where a part of them ass into

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dormancy and winter. A part of the larvae (10-15 percent) change into cocoons and by the end of August and September the flies of the second generation fly out.

Methods of Control:

1. Plowing
2. The destruction of chicken millet-and foxtail grass upon which the fly frequently develops.

RICE LONG LEG - Tipula conjugata Alex. Damages rice.

Distributed in the southern part of the Primorski region.

The larvae winter. They reach the rice plantations from the neighboring peat fields by crawling or are transported in the water used in the irrigation of fields. The larvae damage the root system of the rice plant and feed on stems. The damaged plants come up to the surface of the water. The larvae do their damage until some time in August when they enter the soil and turn into cocoons. The flying-out occurs in September. The eggs are deposited in the soil, chiefly on peat swamps.

Methods of Control:

1. Rationalization of the irrigation system which reduces the infection around rice plantations.
2. The treatment of water with sulphate of ammonia (2 g to a liter of water).

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YELLOW-LEGGED PILOUS - Dibio fulvicrus Duda. Damages wheat. Its distribution is not definitely established. Injury observed in the Amur region. Damage is caused by larvae that winter in the soil. The cocooning takes place in May.

Methods of Control:

1. Plowing
2. Careful cultivation of the fallow field.

COMMON GRAIN APHID - Toxoptera graminum Rond. (illustration 79, p. 285) Damages barley, wheat, rye, oats, sorghum, Sudan grass, corn. Distributed in the steppe and forest-steppe zones. Greatest damage caused in the steppe zones.

The eggs winter, deposited in the fall on leaves of fall and weed crops residue. They multiply by the parthenogenetic method throughout the entire vegetative period, producing 15 generations in the steppe zone. The feeding of aphids on crops increases the consumption of water, produces the discoloring of leaves, their rolling, which leads to retardation in heading and sickly grain. Badly infected plants when early attacked do not produce any harvest. The injury caused by the aphid is reduced by early summer sowings and optimal doses of fertilizers.

Methods of Control:

1. Early sowings of summer crops and ventralization.

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2. Sowing of early-ripening varieties.

3. Fertilization which speeds and strengthens the growth of plants.

4. Deep plowing.

5. Destruction of aphids by means of spraying with anabazin-sulphate (0.1 percent) with soap (0.4 percent) or the spraying with anabadust (3-5 percent).

BARLEY APHID - Brachycolus noxius Kordv. Damages barley and summer wheat. Distributed in steppe and forest-steppe zones.

Develops similarly to the common grain aphid. The injury is distinguished by a greater rolling of the leaves and the fact that the aphid feeds inside and frequently on the stalk. The injury delays the heading and produces a sickly grain.

Methods of Control - the same as in the case of the common grain aphid.

BIRD-CHERRY (ELDER) APHID - Siphonapis pade L. Damages oats, rye, barley, corn and other crops.
Distributed in steppe-and forest-steppe regions.

The principle plant upon which the eggs are deposited in the fall is the bird-cherry. In the spring the winged aphids transfer to crops where they develop parthenogenetically throughout the entire vegetative period.

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Methods of Control:

1. Early sowing of summer crops and vernalization.
2. Optimal doses of fertilizers.
3. Plowing for the purpose of destroying the aphids on waste crops.

COPPUS APHID - Anoecia corni F. Injurious to the greater part of crops. Distributed in steppe-and forest-steppe zones.

The principal plant is the Cornus ("kizil") from which the winged aphids transfer in the spring to crops and form colonies on roots. The infected plants are delayed in growth.

Methods of Control:

1. Early sowing and ventralization.
2. Optimal doses of fertilizers.
3. Plowing and disking.

ROOT CORN APHID - Tetraneura ulmi Dg., (damage corn, sorghum, millet, barley, rye, wheat)

RED GALLIC APHID - Tetraneura rubra Licht.

Distributed in steppe-and forest-steppe zones.

The principal plants affected are the species of the genus Ulmus on which the aphid eggs are deposited. In the spring the aphid develops in galls on the leaves of elms and then the winged aphids fly over to crops

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and form colonies on roots. The feeding of aphids on roots considerably interferes with the growth and development of plants.

Methods of Control: the same as in the case of the Cornus Aphid.

WHEAT THRIPS - Haplothrips tritici Kurd. Injures wheat and rye. Distributed in all sections where wheat is cultivated. Greater damage is done in steppe zones.

The larvae winter in the soil. The grown thrip appears in the period of the heading of rye and deposits eggs behind the glume. "Kinovarno" red larvae feed under the glumes causing it's disease. The degree of the grain's loss of weight depends upon the number of larvae in a spikelet, which may vary between 5-6 percent.

Methods of Control:

1. Early sowings of summer crops and ventralization.
2. Disking of the stubbles of crops and deep plowing which destroys the thrip in the soil.

OAT THRIP - Ctenothrips graminum Uz. Injures oats. Distributed in all sections where oats are cultivated; reaches up to 50° northern latitude in the north.

The grown thrips winter in the soil, penetrating frequently into a depth of 75 cm. They appear two or three weeks prior to the heading

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of oats, depositing eggs in the glume tissue. The larvae feed on soft grain for 7 to 10 days and then disappear in the soil. The feeding of larvae spoils the quality of the oat grain and increases its lamination. The infected plants show a premature whitening of glumes.

Methods of Control: the same as in the case of wheat thrip.

SIX-POINT CICADA - Cicadula sexnotata Fall. Injures wheat, rye, barley, rice, oats, corn.

Distributed in all regions where grain crops are cultivated. The greatest damage is caused in the steppe zone, especially in drought years.

The eggs winter in the leaves of winter crops. The larvae appear in the steppe region at the end of April or early May. They develop in 22-30 days. Depending upon the particular region there may be from one to three generations in a season. They develop on waste following harvest and then upon the growing winter crops. The injuries appear in the form of white spots, lead to a delay in growth, a lowering of frost resistance, and in dry weather - to the destruction of all summer crops. Aside from this, the Cicadula can transmit virus diseases.

Methods of Control:

1. Disking of stubbles of crops and deep plowing of wastes which destroy the eggs and larvae of the Cicadula.

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2. Early summer sowings and vernalization.

3. Spraying of plants with anabadust (3-5 percent) and DDT

4. Mechanical picking up of cicada by "voloki".

STRIPED CICADA - Deltocephalus striatus L. Injures the same plants as the above.

Is a transmitter of the mosaic diseases of wheat.

Distributed in the same locations as the Six-Point Cicada. Its cycle of development is the same as that of the above species.

Methods of Control: the same as in the case of the Six-Point Cicada.

DARK CICADA - Delphax striatella Fall. Injures wheat, rye, barley, rice, oats, corn, sesame. Distributed in same locations as the Six-Point Cicada.

The third generation of larvae winter. Grown cicades arrive about three weeks ahead of other species in the spring. As to the rest, there is no substantial difference from the six-point cicada in cycle of development and nature of injury. It transmits the pupating virus of oats.

Methods of Control: the same as for the six-point cicada.

HARMFUL EURYGASTER - Eurygaster intergriceps Put. (illustration no. 80, p. 287). Injurious to all cereal crops. Greatest damage done to summer and winter wheat and rye. In the Uzbek and other republics of Central Asia the feeding on many wild growing plants of the grain family was observed, as well as on Papilionaceae and Compositae, etc. The principal

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plants, however, are the grain crops.

Distributed in the steppe and southern part of the forest-steppe belt. The greatest damage is caused in the Ukraine, the Rostov and Crimea districts, the Stavropol and Krasnodar regions, the Stalingrad district, the Dagestan ASSR, the Azerbajian, Turkmen, Uzbek, and Tadzhik SSR.

The majority of the bugs winters on lots of woody vegetation where they penetrate under the leaves and humus. From these fields they are able to fly considerable distances and settle particularly in forests located on mountain slopes. A small number of bugs winters in the field-s- on corn, lucerne, under straw, etc.

In the spring the bugs come out from their wintering location at a temperature of 18° and appear in the fields by the end of April and early May. Here the bugs feed extensively, sucking on stems and thereby destroying them. Eggs are chiefly deposited on leaves, most frequently at the rate of 12-14 in two even rows. The fertility of one female may exceed 200 eggs. After 9 to 16 days, the larvae are hatched which at first feed on the leaves and stalks and next chiefly on stalks and the grain itself. A prick into the stalk produces its complete or partial whitening. The feeding of larvae and grown bugs on the grain causes its disease and spoils the bread-baking qualities of the flour. This because the bugs introduce ferments with their saliva into the grain. Flour obtained from infected

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grain is characterized by poor quality. The cicada appears in one generation everywhere. Its number varies throughout the years depending upon the influence of the wintering conditions (the freezing of the bugs), the infection of diseases and parasites, and the variation in the fertility of the bugs.

According to data provided by Larchenko, the multiplying of the cicada depends essentially upon whether the larvae, beginning with the second brood as well as grown bugs, feed exclusively on grain. Wherever the phases of development of plants do not coincide with the designated phases of the development of the cicada - the feeding is poorer and as a result there is reduced frost resistance during wintering and a reduced fertility on the part of bugs.

Methods of Control:

1. The use of chickens in destroying the bugs. This measure is indispensable in the fall and early spring, in places where the bugs winter, as well as in the sowing areas (in early spring prior to tillering), and next on the stubbles after harvesting. (see p. 17 for more details)
2. The destruction of the cicada in its wintering location by means of gathering the leaves and the upper layer of the humus into heaps (1.5 x 0.8 m) covered with a layer of soil of 15-20 cm.
3. The disturbance of the normal wintering conditions of bugs by breaking up the leaf layer in late fall.

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4. Mechanical collecting of cicadas in the field with the aid of manual, horse-driven, and auto bug traps (see p. 207 for illustration)
5. Use of equipment for combing off eggs.
6. The collecting of cicadas with the aid of stubble-cleaners.
7. The use of parasites of the cicada which infect its eggs. The parasites telenomus, microphanuris, dissolcus, specially developed in bio-laboratories and nurseries. For the technique of their use see p. 24.
8. Among the agro-technical methods that reduce the number of cicada and the damage they cause the following are used: a). early plowing after the harvesting of grain crops; b). all measures aiding a more rapid growth and development of grain crops; c). early harvesting and rapid threshing; d). reduction of the cloddiness of the surface of the soil, which stimulates the feeding of birds on the pest.
9. Spraying and dusting of zoned areas with "intestinal" poisons. Requires additional testing.

THE MAURUS BUG - Eurygaster maura L. Injures wheat, rye, barley. Distributed all through the steppe and forest-steppe areas of the USSR, including Siberia and Primorie.

The cycle of its development is the same as that of the Harmful Cicada.

Methods of Control: the same.

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THE AUSTRIAN BUG - Eurygaster austriacus Schr. Injurious to wheat, rye and barley. Distribution. It stands apart from all bug-cicada in that it penetrates farthest into the north; met also in the Moscow district. Cycle of development the same as that of the harmful cicada, so are the methods of controlling it.

SHARP-POINTED BUGS - Aelia (series of species). Injurious to rye and wheat. Distributed throughout the steppe zone and the southern part of the forest-steppe. Grown bugs frequently winter in the field, in parts where there are tree plantings, where they settle under the leaves. Eggs are deposited in groups on leaves, stems, stalks, Bugs and their larvae feed on the leaves and stalks, causing the appearance of white spots.

Methods of Control: The same measures may most likely be used as those used to control the harmful cicada.

(BREAD) GROUND BEETLE - Zabrus tenebrioides Goeze. Injures winter and summer wheat, and rye, and barley.

Distributed in the southern steppe part of the USSR. The greatest damage was observed on the right side of the river Dnepr in the Ukraine, in the Krasnodar region, the Crimea, and the Georgian and Turkmen SSR.

It develops everywhere in one generation. The larvae winter in the soil of winter lots. In the spring they damage the leaves of crops, and in May turn into pupae staying in the soil at a depth of 20 cm. Twelve or fourteen days later beetles appear, which feed at night on stalks of

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various grain crops. During the day the beetles hide under vegetative residue. After harvesting the beetles concentrate primarily on those plots where the grain has not been removed or where there has been much loss of grain. Here the beetles lay their eggs into the soil. Larvae appear after 10-14 days and feed upon the growth of residue and crop weeds, and later upon the growing winter crops destroying their leaves.

Methods of control:

1. The sowing of winter wheat and rye on well cultivated fallows, which interferes with the infection of the plots by beetle larvae.
2. To fight the loss of grain in harvesting crops.
3. Rapid harvesting and threshing.
4. Disking of stubbles and early plowing.
5. Spraying with arsenate of calcium or with fluorosilicic acid, Paris green or sodium fluorite. Poisoned bait (dug into the soil) or in ditches. Chemical treatment is carried on in the fall on winter grain and in the spring for the purpose of destroying larvae.

MILLET GROUND BEETLE - Pardilcus calceatus Duft. Injures millet, corn, barley, wheat, rye.

Distributed in the steppe and forest-steppe zones of USSR.

A mass flight of beetles is usually observed in July. The beetles feed on grain at night. During the day they hide in the ground and under any

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waste remainders. Eggs are deposited in the soil. Larvae feed on animal food.

Methods of Control:

1. The catching of beetles with the aid of light traps.
2. Disking of stubble.

HAIRY GRAIN GROUND BEETLE - Pseudoophonus pubescens Mull. Injurious to millet, corn, barley, wheat, rye.
Distributed in the steppe region of European USSR, Siberia, Central Asia.
The cycle of development is the same as that of the Grain Beetle (p. 289).

Methods of Control: those used for the millet beetle.

STEM GRAIN BUGS - Chaetocnema (2 species), illustration no. 81, p. 289.
Injure summer and winter wheats, and barley.
Distributed everywhere except in the extreme North.

The beetles winter under vegetative matter, at forest edges, forest shelter belts, in gardens, borders, sod, in boards. They appear in early spring and soon lay eggs in leaves close to the roots (ch. aricula) or in the soil (Ch. hortensis). Larvae penetrate and feed inside the stems, causing their destruction. In 14-20 days the grown larvae dig into the soil and change into pupae from early June to July. In another 15-20 days beetles appear which feed on the leaves. There is but one generation everywhere.

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Methods of Control:

1. Early sowing and vernalization of summer crops which lower the damage caused by the larvae.
2. Spraying of germinating plants with sodium fluorite, anabadust (5 percent) and DDT, prior to the egg laying in the spring.

LEECHES - Lema melanopus L. Illustration no. 82, p. 290. Injures wheat, barley, oats, rye.

Distributed everywhere, except for the extreme North. Greatest damage is caused in the Krasnodar region, the Crimea, Volga region, and the Bashkir ASSR.

The beetles winter in the soil, appearing by the end of April. Having fed upon the leaves they lay their eggs on them in groups (3-7 pieces), placing them usually into one row. Soft wheats, and from among other crops - the furry kind - are less attractive for egg laying and therefore less likely to be infected. Larvae feed "skeletonizing" the leaves and develop in 13-14 days. Pupating takes place on the surface of the soil (2-3 cm) in holothurian earthy pupae. The grown beetles do not leave the soil and remain there all winter. One generation is observed everywhere.

Methods of Control:

1. Spraying with a 5 percent dust of DDT (20 kg per hectare) prior to the egg laying; with arsenate of calcium (4-5 kg per hectare) or

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Sodium fluorite (8-10 kg per hectare); with Paris green (2 g. to 1 liter of water), with lime or arsenic acid sodium (?) (2 g. to 1 liter of water) with lime.

2. The shaking off of larvae with the aid of cords and sweeping.

MILLET LEECHES - Lema dilecta Baly. Injures millet and foxtail millet. Distributed in the Primorski region.

The beetles winter on stubbles under lumps of soil and vegetative matter. Both beetles and larvae are injurious, eating long strips off leaves. Larvae turn into pupae in the soil.

Methods of control: Spraying with arsenate of calcium or sodium fluorite.

RICE LEECH - Lema Cuvorovi Jacobs. Injurious to rice.
Distributed in the southern part of the Primorski region.

The beetles winter and appear on rice in June. Eggs are laid in groups (6-12 pieces) on the upper part of the leaves. The beetles and larvae, feeding on leaves, cause the latter to whiten and produce a weak grain. The pupating takes place on the leaves of rice - in a white pupae from the set secretions of larvae.

Methods of Control:

1. Spraying with paris green (0.1 - 0.2 percent) and lime.
2. Spraying with arsenate of calcium (8-10 kg per hectare)

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3. Shaking off of larvae with the aid of a rope; larvae that fall into water - perish.

4. The destruction of weeds around the sowed area.

STRIPED GRAIN FLEA - Phyllotreta vittaula Redt. Injurious to wheat, rye, barley, corn, anis, coriandre.

Distributed everywhere except in the extreme north.

Beetles winter under various vegetative matter and in the soil. In the spring they feed and injure the leaves of germinating plants. Eggs are laid in the soil at a depth of 1-3 cm. Larvae are feeding on various roots and do not appear to cause much damage.

Methods of Control:

1. Spraying with intestinal poisons and DDT.

2. Earliest possible sowings of cereal crops.

GRAIN ...Dorcadion carinatum Pall. Injures all cereal crops. Distributed in the steppe region of the USSR.

Beetles winter, so do larvae. Beetles lay eggs on plants above the surface of the soil in April and May, particularly on virgin soil, waste land, and lots overgrown with couch grass. Larvae live in the ground feeding on roots of cereal crops. After wintering they change into pupae at the end of the summer. Beetles formed in the soil remain there to winter.

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Methods of Control:

1. Sowing of grain crops on fallows and furrow plowing.
2. Enclosed ditches with wells and waste deposits at the boundaries.

The beetles do not fly and this method therefore proves effective.

GRAIN AMUR.... - Neodorcadion humerale Fall. Injures wheat. Distributed and causes damage in the Amur region and the Jewish AO.

Larvae live in the soil and damage the root system of wheat and other cereal crops. The cycle of development ends in two years. Larvae of various ages winter.

Methods of Control:

1. Early plowing.
2. Plowing of waste lands and fallows.

WATER RICE SNOUT BEETLE - Echinocnemus bipunctatus Roel. Injurious to rice. Distributed in the Primorski region. In Tadzhikistan more harm is caused to rice by another biologically related species - Hydronotus sinuaticollis Est.

Appears on rice at the beginning of July. The beetle feeds for the most part under water, eating up roots and the stems of rice. Also feeds, in addition, upon the stems of the weed "povoinichek" (Elatine L).

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Methods of Control: not sufficiently worked out.

GRAIN BEETLE-FUZKA - Anisoplia austriaca Herbst. (illustration 82, p. 292)

Damaging to winter and summer wheat and rye.

Distributed in the steppe region of the European USSR (up to the Volga).

Has a two-year cycle of development. Larvae of the current year, as well as the previous years.winter in the soil. The pupating takes place in the soil after the second winter. This occurs chiefly at the end of May and early June. The beetles fly out during the tillering of crops and feed at that time upon the soft unripe grains in the stalks.

Damage is caused by the direct consumption of grain, as well as by it being shattered. After 10-12 days following the "flying-out", the beetles begin to lay eggs, depositing them in the moist layers of soil on plots sowed with cereal crops or in fallows and plowed land. Fertility - about 50 eggs. Eggs are hygrophilite. The larvae nourish on the rootlets of many plants producing vertical shiftings in the soil depending upon its moisture and temperature.

Methods of control:

1. Gathering of beetles with the aid of beetle traps (manual and horse-driven) (see p. 211).
2. Disking of the stubble following the harvesting of grain crops, in order to exterminate the beetle.

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3. Cultivation of fallows and plowed land in the period of pupating of larvae and during the time of egg laying.

4. Early and deep plowing.

WIDE GRAIN BEETLE - Anisoplia lata Fr. Injures winter and summer wheat, rye. Distributed in the southern part of the USSR steppe zone.

Appear in fields somewhat earlier than the beetle-kuzka. Observed in masses during the stage of early ripening of winter wheat. Otherwise does not differ from the beetle-kuzka in character or cycle of development.

Methods of Control: the same as for the grain beetle-kuzka. (see p. 292)

BEETLE-CROSS CARRIER - Anisoplia agricola Poda. Damages summer and winter wheat and rye.

Met in the steppe, as well as in the forest-steppe zones. Observed in the forest belt. Its cycle of development and nature of injury - the same as that of the beetle-kuzka. (p. 292). So are the methods of control.

GRAIN BEETLE-ERASUN - Anisoplia segetum Erbst. Injurious to wheat and rye. Distributed in the steppe and forest-steppe zones. Appears earliest, ahead of any of the other beetles belonging to the genus Anisoplia. Because of this it feeds first on wild crops and rye. Least damaging of all grain beetles. Does not differ substantially from the beetle-kuzka in its cycle of development. Methods of control are the same. (p. 292)

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SOUTHERN STEM SOWBA - Oria musculosa Hb. Injures summer wheat, barley, corn, oats, millet, and sorghum. Distributed in the steppe zone. Particularly damaging in the Stalingrad district and the Krasnodar region.

The butterflies fly-out in July, depositing eggs on grain weeds after harvesting. One female may deposit some 350 eggs. In the fall caterpillars develop from the eggs but they do not leave the egg shell and winter in it. The caterpillars develop in April and May (at medium temperatures of about 8°), penetrate into the stems of the crops and feed upon them. This usually causes the destruction of the stems and, at a late infection, - the decrease of the weight of the grain. Caterpillars develop in the course of some 50 days, then change in the soil at a depth of 10 cm. into pupae.

Methods of Control:

1. Deep plowing of plots formerly under cereal crops and of the fields choked with couch grass, wild oats, bristly foxtail grass, and other weeds of the cereal family.
2. Sowing of grain crops on fallows and other non-cereal prodecessors, This matters because the eggs are then distributed only upon the grain crop.

SUMMER SOWBA - Apamea paludis Tutt. Damages summer wheat, barley, oats. Distributed in the forest-steppe region and steppe zone. Greatest damage

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caused in the Tartar ASSR. Same cycle of development as in the southern stem sovka. Same methods of control.

GRAIN SOVKA - Parastichtis basilinea Sch. Damages winter and summer wheat, rye, and barley. Distributed in the Leningrad district down to the southern borders of the USSR. Particular damage observed in the grain regions of the Kazakh republic where another biologically similar species (Hadena anceps) is also causing injury.

Caterpillars winter in the upper surface of the soil. Some of them may get into the barns along with the grain. Butterflies fly-out during the ripening of winter grain. Eggs are deposited on the surface and beyond the glume, at the foot of the stalk and the upper leaves. Caterpillars feed on the grain eating first its inner part, then the outer part. They have not completed their growth by the time of harvesting and feed later on fallen grain during harvest.

Methods of Control:

1. Harvesting of grain by combines which permits the destruction of some caterpillars (gathering of caterpillars in a "bunker"(?)
2. Rapid harvesting of sheafs and threshing which make for poorer feeding of caterpillars in the fall.
3. Attempts to curtail the loss of grain during harvesting.
4. Disking succeeded by deep plowing.

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5. Poisonous bait of bran, thrown along stubbles. Demands checking.

RICE WATER SNOUT MOTHS (PARALID) - Nymphula vittalis Brem. Damages rice. Distributed in all southern sections of the Premorski region.

Caterpillars appear on rice plantations in early July. They gnaw at sections of rice leaves, binding them with a web. Such "web covers" swim on the surface of the water. The caterpillar protrudes from it and eats up other sections of rice leaves changing the "web cover" periodically. Pupating occurs in July. The second generation develops apparently in August and September.

Methods of Control: Treatment of water in the "chaka" with sulfate of ammonia or the draining for one or two days of water from the "chaka", resulting in the destruction of caterpillars in the depressions by sand soaked with kerosine.

RICE STOUT-HEAD - Parnara guttata Brem. Damages rice. Especially observed in the USSURI district. Feeds on rice leaves, rolling and tying them in the web. Weaves a pupa between the leaves forming a sort of 3-facet tube of 35 to 50 mm in length. Prior to pupating the leaves are gnawed off and fall into the water.

Methods of Control: Spraying with arsenate of calcium or sodium fluorite during period of mass egg laying and the growth of caterpillars.

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TWISTING SOVKA - Baranga senescens Moore. Injurious to rice. Distributed in the Primorski region.

The flying-out of butterflies from wintering pupae occurs in the middle of June. Eggs are deposited on the upper part of leaves, in groups of 10-12 pieces, in the shape of a chain. Fertility - 150-350 eggs. The caterpillars damage the leaves. Prior to pupating they roll the leaves horizontally; these then fall into the water. Two generations.

Methods of Control: Spraying with arsenate of calcium or sodium fluorite.

METALLIC GRAIN PEST - Phytometra festucae L. Injures wheat, barley, oats. Damages observed in the Primorie, the Ussuri region.

The caterpillars openly devour the leaves, from June to early September. Change into pupae on the plant itself. Winter in this stage.

Methods of Control: Spraying with arsenic-acid calcium or sodium fluorite.

RICE LEAF TURNER - Chaphalocrocis bistrigalis Grey. Injures rice. Damage caused in the southern regions of the Primorski district.

Pupae winter; butterflies appear in the middle of July. Eggs are deposited in groups in the shape of a chain on the upper surface of the rice leaves. The caterpillars feed on the leaves, rolling and fastening them with silky white thread. In August the caterpillars change into pupae within the rolled leaves and produce a silk pupa. The flight

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of the butterflies of the second generation takes place in the second part of August, while the caterpillars feed up to the second half of September.

Methods of Control:

1. Spraying with intestinal poisons.

2. Cutting of the wild crop vegetation around rice plantations.

STEM RYE MOTH - Cohsenheimeria taurella Schiff. Injures winter rye, more seldom winter wheat. Distributed in the forest, forest-steppe, and steppe zones of the European USSR.

Caterpillars winter on the germinating winter crops. In the spring they feed within the stems. During the period of tillering caterpillars produce white stalks.

Methods of control have not been developed.

STEM GRAIN SAW FLIES - (illustration no. 64, p. 295) - Coreal - Cephus pygmaeus L.; Black - Trachelus tabidus L. Injure winter and summer wheat, rice, oats, barley, rye. Distributed and damaging in the steppe and forest-steppe regions.

This pest penetrates as far north as the Leningrad district.

The grown larvae winter in the underground part of the stubble. Here they also change into pupae in May. The flying-out takes place during the early tillering of the winter crops. The cereal fly usually

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appears 12-20 days before the black one. Eggs are deposited singly within the stem of the cereal crop. The females prefer varieties of crops with full stems. Fertility - up to 50 eggs. The larvae gnaw at the nodes in the straw, eat through the inner walls and at the time of doughy ripening chew the stem at its foundation. The damaged stems break and the grain is sickly. The weight of the grain in damaged stems decreases from 5 to 23 percent, depending upon the time of infection.

Methods of Control:

1. Deep plowing.
2. Early sowing of summer crops and vernalization.
3. As early harvesting as is possible, which decreases the number of chewed stems.

RICE CADDIES FLIES - Limnophilus stigma Curt. Injurious to rice. Distributed and damaging in the Primorski region, the Jewish AO, and the Khabarovsk district.

Larvae fall upon rice plantation from containers during watering. They eat up the roots and seedlings, frequently necessitating a second sowing. Form pupae in June, in "bags".

Eggs usually deposited in September. The larvae of the early ages winter.

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Methods of Control:

1. The setting up of obstacles of metallic wiring (nets) - mesh - 2-3 mm; to prevent the larvae from penetrating into the irrigation channels.
2. Treatment of the water with nicotine-sulfate (0.012 - 0.025 g. to 1 liter) or of sulfate of ammonia (1-2 g to 1 liter of water).
3. If poison is lacking, the water from the "cheka" is drained for 1-2 days to destroy the larvae in the puddles (depressions) in sand soaked in kerosine.

End of Chapter

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CONDITIONS CONTRIBUTING TO THE INFECTION OF PLANTS (pp.424-428)

In all diseases of plants caused by fungus or bacteria it is necessary to consider the parasite itself, its properties (virulence, cycle of development, wintering) and the reaction of the plant to the infection by the parasite at definite environmental conditions. In other words, the successful infection of plants is determined by: 1. the presence of the focus of infection of the parasite - live conidium, spores, mycelium; 2. the adaptability of the parasite to a specific plant; 3. the susceptibility of the plant; 4. the presence of favorable external conditions.

THE ORIGIN AND SOURCES OF INFECTION

The focus of infection of a parasite fungus winters and is transmitted from year to year mostly in the form of spores, occasionally in the form of sclerotia that keep in the soil and among seeds, or in the form of mycelium. One may observe examples of various forms of the focus of infection, with regard to wintering, of parasite fungi in table 52, p. 425.

As to the sources of infection, these may be caused (in) various organs and parts of the plants, seeds in particular, planting stock - plumps, roots, bulbs, seedlings, cuttings or slips - as well as the soil where sclerotia chlamy - dospores and mycelium of parasitic fungi settle.

In this manner man may further the distribution of disease through seed and planting material in other ways, if essential prophylactic

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measures were not observed in the course of economic activity.

Aside from these water may also contribute to the spread of an infection, and so will soil and air. Insects and sometimes animals (birds) will act as transmitters of infection.

In the process of the infection of the plant the sprout (haustorium?) of the spore of the fungus or bacteria penetrate into the tissue of the feeding plant, most frequently through apertures (Plasmopara viticola, Puccinia triticina, etc.), water bacteria, through a variety of wounds and injuries of the covering tissues on roots, stem, fruits (Verticillium, Fusarium, Monilia fructigena, and others.)

The infection of plants by parasites occurs less often directly through the cells of covering tissues (Erysiphaceae).

ADAPTABILITY OF THE PARASITE TO THE PLANT

Coordination or adaptability of the parasite plays a considerable role in the infection and development of diseases in the plant upon which it feeds (specialization of parasites).

Fungi parasites and bacteria are capable of infecting only a specific plant or a small group of the latter. Few fungi are capable of infecting several species of a genus or even several genera belonging to one family; still less likely are they to effect representatives of different families. The ability of fungi for selection is worth noting in choosing predecessors for crops, crop rotation, etc.

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TABLE 52

FORMS OF WINTERING OF THE FOCUS OF INFECTION OF INDUCERS OF DISEASES OF AGRICULTURAL PLANTS

CAUSES OF DISEASES	NAME OF DISEASE AND INFECTED CROP	FORM AND PLACE OF SETTLEMENT OF INFECTIOUS FOCUS OF FUNGI
Puccinia graminis	Stem rust of grain crops	Spores winter (teleto-
Puccinia coronifera	Crown rust of oats	tospores, oospores,
Plasmopara viticola	Mildew of grape	sumcospores, seldom
Peronospora brassicae	Peronospora of cabbage	conidium) on infected
Sphaerotheca mors-uvae	Amer. starchy dew of gooseberry	organs of plants.
Sclerotinia Libertiana	White rot of cucumbers, phaseolus, lupine, cabbage, carrots, hemp, sunflower, etc.	Wintering sclerotia
Botrytis cinerea	Grey rot of beet, lupine, conaph, etc.	in the soil or remains between seeds.
Claviceps purpurea	Spurred rye, smut of barley, wheat, cereal crops.	
Rhizoctonia solani	Black scab of potatoes	Wintering mycelium of
Helminthosporium sativum, Fusarium culmorum, etc.	Root rot of wheat and other crops.	fungus in the vegetative remainders of infected plants (stubbles of crops, etc.)
Puccinia glumarum	Yellow rust of cereal crops	Wintering myceliums in
Uromyces striatus	Rust of lucerne	the tissue of wintering
Gymnosporangium juniperinum	Rust of apple-tree	plants, winter cereals, milkwort, junipers, etc.,
Phytophthora infestans	Phytophthora of the potato	potatoe tubers.

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Other inducers of diseases of agricultural plants have a more restricted selection capacity and therefore include only a limited number of botanically related plants. This capacity on the part of parasites is called specialization. One may observe such parasites, not differing from each other morphologically, but differing in the adaptability to specific plants for feeding. Such parasites produce special forms of physiological races (biotypes) within the limits of a species. For instance, the inducer of stem rust of many cereal crops - Puccinia graminis - is divided into specialized forms: P. graminis f. avenae, P. graminis f. tritici, etc., of which every one infects specific plants: oats, wheat, etc.

Continued on p. 5 (Table 53)

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TABLE 53

INDUCERS OF DISEASES, CONNECTED WITH VARIOUS SOURCES OF INFECTION.

SOURCES OF INFECTION	ORGANISMS CAUSING DISEASES	NAME OF DISEASE AND INFECTED CROPS
SEEDS	Tilletia tritici, Ustilago tritici and other inducers of cereal crop smut	Wet and dust smut of wheat
	Fusarium culmorum, F. avenaceum, etc.	Fusarium of cereal crops
	Ascochyta pisi	Ascochyta of the pea, etc.
	Bact. campestre, etc.	Bacteria of the Cruciferae
TUBERS	Phytophthora infestans,	Phytophthora and black scab of potatoes
ROOTS	Rhizoctonia solani Rhizoctonia violacea	Rhizoctonia of the sugar-beet
SEEDLINGS	Plasmodiophora brassicae	Club root of cabbage plants
"SAZHENTSI"	Bacterium tumefaciens	Root cancer of fruits
SLIPS	Sphaerotheca mors-uvae	American mildew of gooseberry
VEGETATIVE WASTES (guespaia)	Verticillium dahliae Bacterium malvacearum	Withering of cotton plant of gummosis cotton plant
SOIL	Bacillus phytophtorus	Black leg of potato, etc.
	Plasmodiophora brassicae	Club root of cabbage
	Fusarium - various forms	Fusarium of many plants, incl. cereals
	Synchitrium endobioticum	Cancer of potato tubers
	Sclerotium Rolfsii	Southern sclerotic rot of agricultural plants.

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Physiological races of bio-types of rust present an even closer specialization within the limits of every specialized form.

Physiological races are known among species of rust and smut of cereal crops of Helminthosporium sativum and other parasitic fungi.

SUSCEPTIBILITY AND RESISTANCE OF PLANTS TO PARASITES.

The possibility of the infection of a plant by a parasite depends upon a mutual coordination between them. With regard to the parasite it is called - specialization of the parasite, with respect to the plant - it involves its stability or susceptibility. Every organism, including the plant, fights off a disease - born focus, which tries to penetrate it.

Agricultural science has for thousands of years depended upon the properties of inheritance. In creating conditions with the aid of agricultural methods, as demanded by the plant, and in selecting the best specimens for seeds, the people have, as shown by Darwin, improved the very inheritance of a plant.

The improvement of plant's properties with the aid of agricultural methods and favorable conditions of nutrition, may be seen in the example of summer sowings of potatoes in the south. During summer potato plantings good conditions are prevalent, as seen from the fact that the tubers reach a weight of 300-500 g. This indicates that even the nature of the tubers improves with every generation. Tubers taken from the harvest of summer plantings in the south, upon being transplanted into any other region in the USSR, produce a yield 2-3 times as large as compared to the yield of

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of tubers of spring southern reproductions of potatoes (Academ. Lysenko).

It is most characteristic that virus diseases of the potato achieve only weak development in summer plantings.

Soviet selection obtained considerable successes in producing stable varieties not alone as a result of selection but also because of crossing, using the studied method concerning the selection of components for hybridization. The stability of varieties to inducers of diseases is determined by the physiological reaction of the plant to the penetration of the parasite and the plant's reaction to the change of environmental conditions in cultivation. The leading role is played here by the biochemical properties of the content of cells. It is known that the juice of the cells of a plant, even if extracted will serve to a certain extent as an indication of the degree of stability of the varieties. Shevchenko has developed a method of appraising the sugar-beet with regard to its stability to the "cagat" rot, by cultivating the parasite on slices cut from living roots.

The stability of a variety is connected to a smaller degree with its structural characteristics (enclosed bloom, etc.). Several biological characteristics of a plant, such as rapid ripening (speed in passing through several phases of vegetation) are considered valuable from a practical standpoint since they lead to a large harvest. The exceptionally fast ripening varieties of the wheat China ("Kitai") escape from brown rust

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because of their rapid ripening, while they are not distinguished by a physiological resistance to the inducer of the disease. The stability of a plant changes with age. Some parasites infect crops (rust), others - mature plants (phytophthora). We also know of varieties of wheat that are stable to rust in the germinating stage, as well as in a mature state (variety of wheat "Democrat").

The stability of plants to parasites varies to a certain extent depending upon the environment. If the environment is changed in the necessary direction with the aid of agricultural methods, one may always increase the stability of plants and expect a higher yield.

THE INFLUENCE OF ENVIRONMENTAL FACTORS.

The growth of conidium or spores of parasitic fungi, and the development of mycelium always precede the infection of a plant. They require suitable environmental conditions, such as a specific combination of moisture, heat, light, the presence of oxygen, etc. Moisture in the form of raincrops or dew at a corresponding temperature serves as a stimulant for the growth of spores and the development of mycelium. The spores of almost all fungi (phytophthorae rust) require a drop-like moisture, while the spores of other fungi develop at a comparatively higher humidity of the air (90 percent and over); only conidia of the mildew fungi are able to develop at a 8-10 percent of relative humidity. The limits of temperature within which the development of spores of fungi is possible vary between 0 to 30-36° and higher, depending upon their biological differences. One may observe

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that the development of the spores of fungi takes place at a wider amplitude of temperature than with the subsequent development of mycelium (Ustillago avenae, Puccinia graminia). Conditions of temperature are frequently limiting the possibility of the infection of plants by parasites. Oxygen in the air is also essential for the development of spores of fungi. Light has a certain significance, though only at the stage of formation and ripening of spores (Sclerotinia graminearum), and evidently does not exercise any influence upon their growth.

Environmental factors exercise a certain amount of influence upon the development of diseases throughout the entire period of vegetation since the non-susceptibility of the plant depends not alone upon its inner properties but also upon the effect of environment upon the plant. Aside from that, environmental factors react upon the parasite directly in lowering its activity or limiting the development of spores. The development of cabbage club root is heightened with the increased acidity of the soil. The best reaction for this parasite is considered pH 6 or somewhat lower. At pH 7.2 - 7.4 the disease does not develop, as a rule. The liming of the soil is therefore one of the measures in combatting cabbage club root, this method possessing in addition other beneficial effects upon the increase of the yield. The scab of potato does not appear at an acidity of soil higher than pH 5.2, while at pH4.8 the parasite does not develop at all. Its optimum in acidity lies above pH.6.5.

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The change in the moisture and temperature of the soil may also react upon the parasite. The cabbage club root and the black-leg potato develop more rapidly at a high degree of moisture of the soil (75 - 90 percent at a full moisture capacity). Common potato scab and root rots of wheat are on the contrary infecting the plant stronger because of a lack or considerable variation in the degree of moisture in the soil. The curtailing of the development of diseases may be observed at early stages of the sowing of many crops when the phase of germination proceeds at a lowered temperature.

Fertilization exerts a remarkable influence upon the increase of stability of plants to diseases. Examples of an increase in resistance of cereal crops to rust under the influence of introduced potassium-phosphate fertilizers are well known. The same fertilizers increase the stability of wheats to root rots, raise the wintering capacity of winter crops and limit the degree of their infection by "snow mould", etc. in the spring.

In using types and forms of fertilizers as a means to increase the resistance of plants, one has to adjust to the characteristics of the plant and bear in mind the final result - the size of the harvest. It is frequently more advantageous to introduce fertilizers that contribute to the increase in the yield of wheat, although in doing so the degree of infection by rust may also be slightly increased.

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INJURIOUS DISEASES AND LOSSES OF HARVESTS (p. 428-431)

The following groups of diseases may be set apart as judged by the reaction of pests upon plants and the harm they cause among the latter.

1. Diseases which lead to an untimely loss of the plant (rot in germination, withering, some bacterium)
2. Diseases affecting and rendering worthless those organs of plants that are essential to their development (smut of breadstuff crops, "karmashki" of the plum). The degree of infection in this case will be one and at that a maximum one (100 percent). A direct ratio is observed betwen disease and loss.
3. Diseases characterized by a diverse degree of spreading and varied intensity of the infection of the plant organ (rust, spottiness, root rot of bread crops, scab of apples). These diseases cause a lowering of the amount and quality of the harvest. There is no direct ratio between the degree of infection and loss.

In order that the latter may be determined it is necessary to possess data on the spread of the disease and the degree of its harmfulness. This is obtained be a corresponding calculation of the crop in the affected area. The terminology used in this connection will have the following meaning:

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1. Spreading - the frequency of diseased plants or the frequency of infected organs of the same type.
2. The intensity of the infection and the relative determination of its degree in the individual organs (weak, medium, strong; the mark.)
3. The degree of injury - the ability of the pest to lower the harvest yield of an infected plant. The degree of injury varies in the different diseases and changes depending upon a number of conditions (applied measures, the particular kind, etc.)
4. The coefficient of harmfulness - the degree of reduction in yield is established on the basis of the study of the physiological influence of the disease upon the plant.
5. Injury. This conception takes in the injury and the spread of the disease. The disease may be well spread but not harmful and vice versa.

The calculations of the spread of diseases, as indicated in the above first and second groups, are called quantitative. They establish the frequency of the occurrence of diseased plants or organs and indicate this in percentage in relation to the total number of counted plants or organs. The percentage of the loss in germination, smut of bread crops, the spikes of rye infected by ergot (Claviceps purpurea Tul.), etc. In approving, for instance, the variety sowings of wheat, the percentage of damp smut is established in counting the infected spikes among 2000 healthy and diseased stalks taken from a small test sheaf. If the former number is 24, the degree

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of infection by damp srut will be rated at 1.2 percent.

In the third group it is necessary to consider the two points - the quantitative and qualitative ones - in diseases characterized by a diverse degree of spread and intensity of infection. The following scales are used for the purpose:

Scale of Calculation of Spottiness

0 - Absence of disease

1. No more than one third of leaves infected

2. About two-thirds of leaves infected

3. More than two-thirds of leaves infected or all infected.

Scale of Calculation of Withered Plants

0 - Absence of Disease

1. Withering apparent to the eye and fall of leaves

2. Complete fall of leaves; part of beans satisfactory for gathering.

3. Complete fall of leaves; absence of any beans or their inadequacy.

Scale of Calculation of Scab on Fruits

0 - Absence of Disease

1. Well noticeable spots of a diameter up to 0.5 cm, without cracks or light cracks; single (1-3)

2. Spots of a 0.5-1 cm diameter without cracks or with few light cracks which may be easily counted.

3. Same size or larger size spots without cracks or with deep cracks, which are difficult to count.

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In calculating the infected area it is necessary to examine from 10-20 samples of 100 plants and to mark down the results of the analysis (the number of diseases plants in each degree of infection; the final result of calculation to be expressed in a percentage degree with relation to the development of the disease. The formula for the calculation of the percentage of disease development: $x = \frac{\Sigma(ab).100}{AS}$

a) for the number of plants belonging to one of the degrees indicating the intensity of the infection; b) - the mark corresponding to this intensity; Σ - the sum of the "ab" results; A - the number of counted plants (fruits); S- highest mark.

If the spread of disease is uniform throughout the entire plant, as is the case in the rust of bread crops, the calculation of the spread of disease and the intensity of the infected area may be represented by one scale, each degree of infection corresponding to a definite coefficient of the injury.

Stem and all leaf-rust of crops, with the exception of yellow rust, are calculated according to these scales. Stem rust is estimated according to the number of diseased stems between the first and the second upper leaves, while the diseased leaves are counted from the second leaf upwards. 10 samples of 10 stems each are examined for calculation. The entry and the estimate of data are figured in the manner indicated above.

Yellow rust is estimated in tenths of parts of the leaf surface covered with pustules.

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Once the degree of harmfulness and spread of one or the other disease are known one may estimate the degree of injury it will cause. The harmfulness caused by the diseases of the second group which reduce the yield 100 percent are easiest to determine. If, for instance, the spread of damp smut of wheat is 1.2 percent, the loss caused by it will also equal 1.2 percent.

In determining the losses from such diseases as rust, spottiness and others, belonging to the third group, one uses the coefficient of harmfulness established for it. The winter wheat "Kooperatorka" on the Krasnodar variety lot was, for instance, struck by yellow rust in 1936. At a medium coverage of leaf with pustules, estimated at 0.5, the harmfulness of the disease was figured at 17.4 percent. Consequently, the actual grain harvest, equalling 22.97 centners per hectare, represented 82.6 percent of a potential harvest, and the loss of the yield was expressed in 4.83 centners per hectare (Naumov, 1939).

One may judge the degree of losses from plant diseases in agriculture by individual examples. In pre-revolutionary Russia smut of grain frequently destroyed 20-30 percent of the harvest. The medium loss from smut of the four principal crops (rye, wheat, barley, and oats) constituted between the years 1900-1914 - 56.8 million centners a year or 12.2 percent of the total harvest. With the introduction of measures controlling smut the losses in harvest were radically reduced in the years of two five-year plans of the USSR. In 1930 - 1935 the losses from smut amounted to 12.8 million centners or 1.8 percent of the total harvest gathered.

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HOSTS OF PHYTOPATHOGENIC BACTERIA WITH WIDE SPECIALIZATION (pp. 466-467)

Phytopathogenic bacteria, as well as fungi, may infect several species or only one species or genus of plants. We are presenting below data on plant-hosts inducers of bacteria in plants that infect many species. With regard to species having one or two hosts, see table 61, p. 447.

1. Bact. amylovorum - almost exclusively on Rosaceae: almost all the representatives of the genus Prunus (10 species), among them the plum, the apricot, the cherry, and the Pirus (36 species); among these the pear - and apple trees. In addition, the raspberry, quince, the Japanese medlar, the hawthorn; while a series of others were experimentally produced, among the latter - the rose, peach, almond, species of strawberries, etc.
2. Bact. aroideae. The list presented below probably does not exhaust all plant-hosts of this micro-organism, since - experimentally it infects many more plants. The tests made by Matsumoto and Iran (1941) established that the Bact. aroideae is the cause of the wet rot of the opium poppy. It is known to appear on the Calla L. ("belokrilnik"), the opium poppy, tobacco, tomatoes.
3. Bact. atrofaciens: Wheat, oats, barley, rye (according to Galachian), and according to Kalinenko - also kok-saghyz. The list of hosts has not been definitely established.

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4. Bact. campestre: concentrates on Cruciferae. Known to infect varieties of cabbage, turnips, radishes, Raphanus L., mustard, stock.

5. Bact. carotovorum: artichoke, eggplant, turnip, pear, melon, potato, iris, cabbage (variety of species), corn, kok-saghyz, krim-saghyz, onion, carrot, Raphanus v. radicula Pers., Phaseolus L., violet, chickory.

6. Bact. cerasi: apricot, mazzard cherry, peach, plum, apple.

7. Bact. hetaroeceum: probably a very multiple-poisonous micro-organism. Acts in many cases as a saprophyte. Observed on asters, peas, sesame, maize, oleaster (wild olive), soy, phaseolus L., tobacco, makhorka, sunflower, black currant, tung tree (Aleurites), Jerusalem artichoke (Helianthus tuberosus), wheat, burdock,("shchiritsa"), clover (Amaranthus L.) field convolvulus, yellow sonchus, Agrostema L. (cockle), Chanopodium album L., (pigweed), Hyoscyamus L., coriander, Lens Gr. et Godr.

8. Bact. solanacearum - known to infect the following plants (according to Johnson's last work). Strongly infected species of plants (from 71 to 100 percent): tobacco, tomatoes, makhorka, blue eggplant, Datura L., Solanum L. (black), batata, melon, potato, Croton gradulosum, Bidens bipinnata, Xanthium pennsylvanicum, tropaeolum minus, Sepica alba.

Less infected are: (51-70 percent) - pepper, Mexican tomato, sunflower.

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Slightly infected (21-50 percent are: phaseolus, aster, chrysanthemum, "kleveshchina" - castor plant (Ricinus communis), petunia, peanut, Ambrosia elatior, Aster pilosum, Tagetes erecta.

Very lightly infected (1-20 percent) are: Laptica canadensis, Ambrosia trifidum, Solanum carolinense, Xanthium chinense, Verbena hybrida, Cosmos bipinnatus. According to other data, it infects among plants growing in our country - beets, Polygonaceae, peas, soya, flax, castor plant, balsam, carrot, parsley, zinnia, sesame, eggplants, cowpeas.

9. Bact. syringae: considered identical with Bact. citriputeale. The hosts of both these micro-organisms are therefore listed here. Observed on apple and pear trees, lilacs, citrus plants, peach, ash, pigweed (Chenopodium), coriander, stock, cyclamen.

10. Bact. tabacum: causes most damage to tobacco and makhorka, but is also observed on tomatoes, cowpeas, thorn apple (Datura), "Shchiritsa", Amaranthus L., clover, field convolvulus, yellow sonchus, Chenopodium album L. (pigweed, white), burdock, Mexican tomato, eggplants.

11. Bact. tumerfaciens: usually infects a series of species from among the genera listed below: The following hosts are indicated: Quince, Althaea L., (Crataegus), Celastraceae, Balsaminaceae (impatiens), Ligustrum L., Vaccinium vitis-idaea, begonia, grape, carnation, chrysanthemum, pear, pea, Caprifoliaceae, strawberry tree, strawberry, Salix L. (pussy-willow), cabbage, chestnut, castor plant, clover, hemp, cypress,

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Naumov, N. A., ed. Spravochnik ... Hosts of phytopathogenic bacteria with wide specilization. (pp. 466-467) 1948.

lucerne, stock, clematis, juniper, almond, raspberry, man'ok, carrot, calendula, nasturtium, walnuts, sedum, opuntiam oleander, Pastinaca L., Solanum, sunflower, Raphanus L., reseda, rose, "smokovnitsa", Ficus carica L., beet, plum, poplar, tobacco, fuchsia, phlox, citrus trees, "khurma" (Diospyros L.) Humulus L., ("Khmel"), chrysanthemum, Salvia L., Vaccinium myrtillus L., Rumex L. (sorrel, sour dock), eucalyptus, apple tree, etc.

End of Chapter

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44.4 N229

Translated from the Russian by
S. M. Monson

VIRUS DISEASES (p. 468)

Virus diseases of plants occupy a somewhat intermediate position between non-parasitic and parasitic diseases. According to many external symptoms, (chlorosis, various anomalies in growth and development, and several others) they resemble diseases that are caused by unfavorable external conditions upon plants (unfavorable temperature, lack or excess of moisture or nutritious elements in the soil, etc.). In some cases the external resemblance of virus diseases to non-parasitic diseases is so complete that only special research offers an opportunity to establish the real nature of the disease. At the same time virus diseases are infectious, which relates them to parasitic diseases. The infection focus which produces virus diseases, is called virus (meaning poison) or filtrable virus. The latter name points to the ability of the infection focus to pass through bacteriological filters and even colloid ultrafilters, through which even the smallest microorganisms, the inducers of various kinds of human, animal, and plant diseases, including bacteria are unable to penetrate.

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DISTRIBUTION AND INJURY

pp. 468-470.

Virus diseases are extremely wide-spread in nature. They infect an enormous number of the most varied cultivated and wild-growing plants,

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causing considerable losses to agricultural farming and the branches of industry that are related to it. So far some 170 viruses have been established which infect representatives of 45 families of plants (10 families of monocotyledons and 35 families of dicotyledons).

Almost all cultivated plants are subject to infection by viruses. Some cultivated plants, such as potatoes, tobacco and tomatoes, are particularly susceptible to them.

Only those diseases have been included in this listing where the virus nature cannot be held in doubt.

The large economic significance of virus diseases is dependent upon their wide distribution and high degree of injury. Of particular harm are the virus diseases of cereal crops, potatoes, tobacco, tomatoes, beets, cotton plant, berries, and fruit trees. Virus diseases frequently destroy entire harvests of one or the other crop or reduce it very considerably. In many cases the reduction in yield is accompanied by a significant deterioration in quality. For instance, in cases of the infection of cereal crops by mosaic or pupa, the grain gets shriveled and it is of little use in planting. In case of an infection of tomatoes by "stolbur", the fruits are unfit for consumption because of their lignification, while if the same disease attacks tobacco, its leaves dry poorly and get moldy, thereby reducing the quality of those bundles which include leaves of diseased plants. Virus diseases of plants are also distinguished by the circumstance that once they make their appearance, they rapidly spread and progress from year to year. The virus disease of the cotton plant,

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in yield is observed from year to year and a deterioration of its quality.

In the USSR attention has only recently been directed to virus diseases of berry - and fruit crops, but already the first data concerning the distribution of these diseases points to the exceptional harmfulness of the viruses of these crops. Data on the harm and distribution of virus diseases of the principal agricultural crops establishes that this group of diseases is the cause of tremendous losses and inadequate yields.

Continued on next page with Table 64.

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for instance, - leaf roll - was first observed in the Azerbajian Republic in 1934. The percentage of diseased plants on plantations was estimated at 0.6 at that time, but already four years later (1938)-38.2 per cent of plants were affected by this disease.

The above facts cause one to watch very closely for new, yet unestablished virus diseases in certain localities and to take measures for their eradication or the stopping of their further development since it is obvious that the disease may be controlled with greater ease at an earlier stage than when already widely distributed and permanent nucleus of the disease have been created. The greatest damage is caused by virus diseases in the southern regions.

Crops are also heavily infected in conditions of protected grounds (nurseries, hothouses, conservatories). Several cultivated crops, may however, also become heavily infected in the northern zones, for instance - cereal crops, potatoes, tomatoes, berry-and fruit crops. The significance of virus diseases is particularly large in the case of perennial plants. This is because, on one hand, plants once infected by virus diseases, almost never recuperate and diseased plants, as a result, continue to serve for a long time as a source of infection for healthy plants on a given plantation; On the other hand, because the infection is easily carried by vegetative parts which serve as propagators for perennial crops.

Virus diseases usually cause the rapid destruction of a diseased plant. But in those cases when an infected plant continues to develop, a reduction

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TABLE 64 (p. 469)

NUMBER OF KNOWN VIRUSES OF AGRICULTURAL CROPS

CROP	NUMBER OF OBSERVED VIRUSES	CROP	NUMBER OF OBSERVED VIRUSES
GRAIN CROPS		FORAGE GRASSES	
Rye	3	Clover	2
Wheat	4	Lucerne	3
Oats	2		
Barley	4	LEGUMINOUS	
Buckwheat	4		
Millet	2	Tomatoes	17
Corn	6	Cucumbers	6
Rice	2	Carrots	1
		Onions	2
GRAIN LEGUMINOUS		FRUIT - AND BERRY CROPS	
Peas	4	Strawberries	4
Lupine	2	Raspberries	4
Phaseoli	4	Currant	1
Soya bean	1	Pear	1
Peanut	1	Apple	1
		Plum	1
TECHNICAL		Peach	6
		Apricot	1
Potatoes	22		
Sugar Beet	6		
Cotton	2		
Tobacco	18		

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Translated from the Russian by
S. N. Monson

MEASURES OF CONTROLLING VIRUS PLANT DISEASES (pp. 466-488)

The introduction into cultivation of varieties of greatest resistance is the most radical means of controlling virus and the majority of other diseases. The creation of such varieties presents considerable difficulties, however, particularly because they have to be equally resistant to fungus and bacteriological diseases. Only a few crops may therefore be named today having varieties of greater or lesser resistance to viruses and possessing important economic characteristics as well. Among such varieties are several numbers of cigarette tobaccos, (of the selection of the All-Union Institute of the Tobacco and Makhorka industry), that are resistant to tobacco mosaic (tobacco virus 1). The availability of a resistant variety to such viruses as is tobacco virus 1, represents a vast achievement in the Soviet selection work and indicates the possibilities of using variety resistance for the control of other viruses striking numerous plants.

The production of varieties resistant to the more narrowly specialized viruses is much simpler. It has frequently already been possible to segregate from the available assortment the slightly or not at all affected varieties. In a comparatively brief period, for instance, AZNIVKHI segregated several varieties of cotton, highly resistant to the cotton virus 2 (of leaves), and these are at present recommended for sowing in the AZ-SSR (var. GIZA 7, No. 75, and others).

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A proper place is accorded prophylactic measures in the control of virus diseases, those aiming at making the sowing material healthier and preserving the sowings from carried-in outside infection and the stopping of the spread of disease in the field if once introduced.

Measures for the improvement of the sowing material have particular significance for all perennial plants propagating vegetatively (potatoes, fruit-and berry crops) and for several annual crops where viruses are transmitted by the seeds (grain crops, tobacco, tomatoes).

The improvement of the sowing material may in some instances be achieved by the chemical treatment of seeds (in cases where the virus is located on their surface) or the heating of seeds. In the latter case, the virus inside the seed may be "inactivated" by the choice of suitable temperatures and the duration of heating without reducing the germination and energy of growth. The chemical method treatment produces good results in disinfecting the seeds of tomatoes from the virus of the tobacco mosaic. Considering the great resistance of this virus to chemicals, repeated treatment is necessary. At first seeds are treated for two hours with formaline (1:300) or over a period of 5 minutes in a solution of mercuric chloride (1:3000), and next are kept for an additional 5 minutes in a 1-percent solution of permanganate.

Thermic disinfecting of seeds is extremely "perspective" in controlling the virus diseases of tobacco makhorka (variegation, ring spot, and clearing of veins or vein banding). Seeds of an initial moisture content,

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not exceeding 6 percent are heated at an increasing temperature from 30 - 40 up to 90° C, kept at 85-90° for no less than an hour. This method of treatment is also equally effective against fungus and bacterial diseases transmitted by seeds.

A much more complicated task is the problem of treating the leguminous sowing material since the temperatures required to neutralize the viruses are injurious to the seeds. In order to obtain healthy seeds of these crops it is necessary to introduce weeding in sowing areas (the elimination of diseased plants from the sowing area). The weeding to be done shortly before or during blooming time.

Diseased plants appearing after the weeding no longer endanger the seeds since the virus penetrates the seeds only in cases where the plant was infected in the early stages of its development. It stands to reason that such methods may produce the best results only if applied at all stages of the propagation of the variety - from the elite experimental stations down to the sowing fields of the collective and state farms.

The anti-virus weeding method is equally applied with respect to potatoes. In controlling the virus disease of this crop in the south additional significance is achieved besides by the summer-sowing method advocated by Lysenko. Summer sowing brings about a radical reduction in the infection of the potato crop by the most prevalent virus affecting this plant - Solanum virus 2 which together with another virus - Solanum

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virus 1 - causes the most injurous virus disease of the potato. Summer sowings radically solve thereby the problem of obtaining healthy potato roots in the south and south-east where virus diseases are particularly wide-spread and harmful.

In order to obtain a healthy potato sowing material, it is also necessary to isolate the sowing areas at a distance no less than 100 meters from other fields of potato plants and other Solanums.

With regard to the control of virus diseases affecting fruit trees and berry bushes, a timely segregation and elimination of diseased plants (seedlings, other wildings, and graft material) represent at present the most important measure.

Other measures of controlling viruses are primarily directed towards the protection of sowings or individual plants from outside infection. It is not possible to present here a general review of such measures that take in all methods of controlling even the most important viruses, because of the specific characteristics of produced individual crops and ways of transmitting the diseases. We shall therefore limit ourselves to an enumeration of the most important methods, indicating at the same time in which cases they have to be applied.

The destruction of the sources of infection carries considerable significance in the control of virus diseases. In vegetable growing and tobacco culture this is accomplished by a careful cleaning of the seedbeds from last year's residues, the keeping of seedbeds free from weeds, the

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disinfection of the nursery mixture by the application of steam, the disinfection of frames, mats, and the rest of nursery equipment with formaline, etc. Of great importance are also sanitary-hygienic measures, such as the washing of hands prior to digging and selecting of seeds (seedlings). Attention has to be given to measures designed to protect the seeds from infection through smoking tobacco.

Particular care has to be exercised in the planting of seedlings into the ground. Before selecting the seedlings, all diseased plants have to be destroyed. Good results are obtained from treating roots of the seedlings prior to planting with a 1-percent Bordeaux solution. The destruction of sources of infection in the field is achieved by the elimination of diseased plants and the destruction of weeds in the sowed areas, roads, as well as by a selection of plants after harvesting, this to be followed by deep plowing.

Weeds play a large role in the spread of virus diseases in leguminous, cotton and sugar beet crops, while among grain crops - volunteer plants and the stalks grown after the gathering of the harvest ("podgon") are of equal importance.

The timely destruction of weeds and the plowing of lots after harvesting eliminate the sources of infection from insects-transmitters, reducing the number of the latter considerably at the same time.

In some cases the creation of specific conditions for the growing of

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plants is of great significance in eliminating the harm caused by virus diseases. The planting in in-between-rows in the garden or in crowding tomato plants as a means of controlling "stolbur" is helpful since the shading of plants derived from this method acts negatively upon the development of the disease.

The control of insect-transmitters is essential for all cultivated crops: field, garden, and fruit-berry crops. An entire series of agro-technical methods and chemical means of control prove most effective in this respect.

At present various systems have been worked out for individual cultivated plants which, if applied carefully, not only lower the harm caused by virus diseases but in some instances succeed in eliminating altogether the harvest losses produced by some virus diseases. Methods of this type have been worked out for virus diseases affecting grain crops, leguminous, potato, sugar beet, cotton, tomato, fruit and berry crops.

It is important to revise and amplify these methods every year keeping in mind local conditions of production.

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464.4 N22S

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S. F. Monson

RUST OF CEREAL CROPS (p. 515)

Rust belongs to the number of the most widely spread and harmful diseases of crops since it causes a radical lowering of the yield at the expense of the formation of shrivelled and light-weight grains if the infection is strong and of an early stage. It also results in a decrease in the number of grains in a stalk. In cases of heavy infection of winter crops in the fall, rust lowers the resistance to frost and causes a considerable loss of plants.

End of Chapter

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FORMS OF RUST (pp. 515-521)

The species of rust may be divided into two groups according to the character of their development.

1. The forms of rust at which a full cycle of development is observed and whose spring resumption of activity depends upon the presence in nature of intermediate host-plants. Those that belong here are: the stripe (stem) rust of crops and the crown rust of oats (Puccinia coronata).
2. The forms of rust of a reduced cycle of development or of a tendency for a reduced cycle. Their development depends upon the presence in the field of infected volunteer plants and of unplowed infected stubble field residue from which rust is transmitted in the fall onto the winter

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plants and winters on the latter in an uredo-stage. In the spring it continues its development and transfers from winter sowings to summer crops. The forms of leaf rust belong into this group. They are: the brown rust of wheat, yellow rust of crops, brown rust of rye, and dwarf rust of barley.

All forms of rust of cereal crops possess under favorable conditions, the capacity to produce within one summer several generations of uredospores which are easily distributed by wind, thereby spreading the disease rapidly and producing at the end of the vegetative period usually a mass accumulation of infection of grain crops. The control of rust has therefore to be conducted by all economies, taking in large areas.

The principal factor that regulates the development of the disease in nature is temperature, at the lowering of which the incubation period of the disease is prolonged. In very hot weather the development of rust is discontinued. Moisture is essential to the parasite only at the time of the infection of the plant.

The characteristic systems and principal data concerning the biology of all forms of rust are presented in tables 75 and 76. (pp. 518and 519). We shall limit ourselves here to a reference of the geographical distribution, the char cter of specialization, and the dependence of the development of rust upon environmental factors.

BROWN RUST OF WHEAT (Puccinia triticina) is spread all over, wherever wheat is cultivated, in the north up to the polar region. It appears unequally,

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however, in the various zones where wheat is cultivated. The zones it develops strongest in - in the USSR - are several districts in the Ukraine, Kursk, Voronezh, and Rostov districts, the Krasnodar and Stavropol regions, Western Siberia, etc.

This form of rust consists of a complex of physiological races or biotypes which, while not differing among themselves from the standpoint of morphology, possess the capacity of infecting in a variety of ways not alone various types of wheat but also other crops and even intermediate host-plants. Over 100 of these biotypes have been established for the brown rust of wheat, of which 15 have been recognized on the territory of the USSR. Some of these are distributed widely, others are limited only to specific zones. Each natural-geographic region possesses therefore its assemblage of physiological races adapted to it. In Siberian conditions the teliospores of local races showed an ability to develop in the same fall without going through a wintering stage, and to infect - in reaching the aecidial stage - not the species of the Thalictrum ("Vassilistnik"), also found there, but the widely spread weed Isopyrum fumarioides (ill. 146, p. 516). This weed plays a more important role in this section, compared to the species of the Thalictrum L. - in view of the absence of winter wheat crops - with regard to the spring renewal of rust -; since the parasite winters on the Isopyrum f. in the aecidial stage, while in the

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European USSR rust winters during the uredo-stage on winter crops. The teliospores forming here are capable of growing only in the spring, following the winter ripening, and have no practical significance.

During a weak snow fall or a lack of it in severe winters, rust as a rule, does not winter and perishes along with the infected leaves of the winter crops. At temperatures of about 1-2°, when winter crops are normally surviving a winter, rust usually does not perish and even shows a weak development. The optimal conditions for its development is a temperature of 10-25°, but at 30-31°, the uredo-spores of rust no longer develop. The incubation period of this form of rust - during optimal conditions - requires from 6-8 days; with a lowering of the temperature it may be lengthened to 18-20 days. Its maximum development is reached in the majority of zones of the Soviet Union during the stage of the milky ripening of wheat.

Methods concerning its early prognosis have been developed on the basis of the established dependence of the development of rust upon temperature. This may be used in instances of applying chemical and other prophylactic control measures.

LINEAR (STEM) RUST OF CROPS (Puccinia graminis) is also spread all over where cereal, forage, and wild crops are found. On cereals, however, especially wheat, it is spread mostly in the pre-mountainous districts of the Stavropol and Krasnodar regions, in the south-western and forest-

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steppe parts of the Ukraine, and in the Far East.

This type is not homogeneous, according to the character of forms composing it which, while morphologically alike, differ in their capacity to infect these or any other crops in the uredo- and telio-stages. In this connection specialized (or biological) forms are distinguished within the species of rust of which 10 (see table 75, p. 518) have at present been experimentally established.

Some of the indicated forms, the P. graminis, for instance f. phlei pratensis, and P. gr. f. airae, form their aecidia with difficulty on the Berberidaceae (Berberis L.) and are able to survive the winter on suitable crops in the uredo-stage. All the rest of the specialized forms are evidently unable to germinate under our conditions if they lack an intermediate host. There are only some indications that in the conditions of Eastern Siberia the rye form (f. secalis) may survive the winter in the roots of couch grass during the stage of uredo-mycelium and then transfer from the couch grass to rye.

As seen from Table 75, several other crops, aside from couch grass, also transmit their rust to cereal crops in the uredo-stage. Among these are, for instance, the Avenas and Dactylis L. group, which are dangerous in this connection for the cultivation of oats. Barley may be infected by either the rye or the wheat form, or even by both forms simultaneously, and in the latter case may transmit its rust to wheat and rye.

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TABLE 75

SPECIALIZED FORMS OF PUCCINIA GRAMINIS

Form of Rust	Crops Most Susceptible	Susceptible and act as transmitters	Lesser degree of susceptibility but may act as transmitters
f. secalis....	Rye	Couch Grass, Barley	Elymus, Bromus L.
f. tritici....	Wheat	Barley	Rye, Couch Grass, Bromus L.
f. avenae.....	Oats	Avenae, Dactylis L. (gathered)	Rye, French Rye-grass
f. phlei-pratensis Phleum L.		Festuca L.	Rye, Dactylis (assembled), etc.
f. agrostis ... Agrostis L.		-	Rye, oats, barley
f. poae	Poa L.	-	Dactylis (assembled)
f. arrhenatheri .. French Rye-Grass		-	-
f. aperae....	Apera	-	-
f. airea.... Deschampsia P.B.		-	Oats
f. calamagrostidis Calamagrostis Roth		-	-

Each of the above forms consists in turn of physiological races of which the reaction in infection differs with regard to any variety of crops.

There are 150 races known for the P. graminis tritici, 14 for P. graminis secalis, and 10 for P. graminis avenae.

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In spite of such differences the ecological conditions of development exert almost identical influences upon all forms and races of stem rust. The optimal temperature stands here at 20°, the maximum at about 30°. The incubation period at optimal temperatures is 8-10 days, while at 0-1°. it stretches to over 70 days. The teliospores, produced towards the end of the vegetative period of crops, germinate only in the spring following winter maturing.

Because of the fact that stem rust produces its original growth on Berberidaceae and only gradually collects on plantings of cereal crops, it reaches a mass development at the end of the milky stage - the beginning of the dough stage. Frequently in such cases several wild crops would act the role of an intermediate link between Berberidaceae and cereal crops, the wild varieties, as observed, getting infected by rust before the cereal crops.

CROWN RUST OF OATS (Puccinia coronifera f. avenae) is one of the 10 specialized forms established for the crown rust of crops which form their aecidial stage on the Rhamnaceae cathartica L., Rh. Pallasee, and Rh. Dahurica. This form infects principally oats and Avenae fatua L. (the wild species of oats), to lesser degree the Dactylis L. group, still less couch grass, Brorus L., and other crops. Other forms of crown rust are incapable of infecting oats.

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TABLE 76

SPECIALIZED FORMS OF CROWN RUST OF CROPS

Form of Rust	Host Susceptible Crops	Susceptible and Serve as Transmitters	Lesser degree of susceptibility but may act as transmitters
Puccinia coronifera - (intermediate hosts - Rhamnus cathartica and Rh. dahurica)			- Rh. Pallasii
f. avenae.....	Oats	Wild oats, Dactylis L. (group)	Couch grass, Bromus L. etc.
f. arrhenatheri...	French rye-grass		
f. festucae.....	Festuca L.		Dactylis L. (group)
f. lolii.....	English rye-grass		
f. alopecuri.....	Alopecurus L.		Phleum L.
f. agropyri.....	Couch grass		Rye, barley, wheat
f. bromi.....	Bromus L.		Couch grass, oats
f. epigaei.....	Calamagrostis		
f. holci.....	Holcus L.		
f. glyceriae.....	Glyceria R. Br.		
Puccinia coronata (intermediate host - Rh. frangula)			
f. agrostis.....	Agrostis		
f. calamagrostis..	Calamagrostis Roth		
f. holci.....	Holcus L.		
f. phalaridis.....	Phalaris L.		

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Naumov, N. A., ed. Spravochnik agronoma... [An agronomist's reference book on plant protection]. Forms of rust. (pp. 515-521) 1948.

The oats form of crown rust is distributed all over but it is chiefly prevalent in the forest-steppe region of the USSR, in the southern part of the White Russian SSR, in the Kursk and Voronezh districts, and further out East. It also consists of a complex of physiological races of which up to now more than 40 are known.

According to its ecological indicators this rust is closely related to stem rust. In mass quantity it also appears only in the second half of the summer. Rainy weather favors its development most, if this alternates with bright days and abundant dew. The incubation period varies from 7 to 14 days, depending upon the temperature and variety of oats. At a temperature of 36° and over the aecidiospores and uredospores do not germinate. The parasite winters only in the teliospore stage. The optimal conditions for their germination in the spring are the combination of maximum moisture of air along with a temperature of 15 - 20°. For the germination of basidiospores temperatures of 12-22° are required. Judging from all these indicators one may make an early prognosis of the development of crown rust of oats. YELLOW RUST OF CROPS (Puccinia glumarum) possesses a somewhat limited distribution. It systematically appears in Transcaucasia, in the pre-mountainous regions of Central Asia, Western and Eastern Siberia, as well as in the northwestern regions of the European USSR.

One usually considers this form of rust, as divided into 5 specialized forms: f. tritici, f. isecalis, f. hordei, f. agropyri, and f. elymi. Still,

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the most recent data indicates that the matter of specialized forms demands a more accurate definition. One thing is certain that the form found on wheat - f.tritici - also infects barley, to a lesser degree rye, and among the wild crops - Bromus L., etc., altogether about 60 various crops. In its turn this form of rust on wheat represents a complex of physiological races, known at present to number 22.

Yellow rust easily withstands low temperatures and is on the contrary not adapted to high temperatures. The optimal conditions for the germination of its uredo-stage lie within the limits of 6-20°. The incubation period is on an average 11 days. Its mass development is therefore observed in the spring-summer and fall periods (on winter crops). A method of early prognosis has been worked out on the basis of all these indicators with respect to yellow rust.

BROWN RUST OF RYE (Puccinia dispersa) is met all over in regions where rye is planted and appears in a variety of degrees depending upon conditions. This form of rust resembles to a great extent the brown rust of wheat differing from it only in a narrower specialization (it infects only representatives of the genus Secale and Eremopyrum Buonapartis), as well as by its capacity of teliospore germination in the fall. The parasite survives the winter in the uredo- and the teliospore stages on winter crops. If intermediate hosts for this rust are present in the fields, such as weeds from the genus - Anchusa and Lycopsis - the latter may serve as fairly powerful

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additional sources of spring - and partly fall infection of rye crops.

It is very close to Puccinia tritioina ecologically. The incubation period varies from 4-8 days depending upon the temperature.

DWARF RUST OF BARLEY - (Puccina anomala) - its distribution is more pronounced in Transcaucasia, the Northern Caucasus, the Crimea, and in the southern Ukraine where winter crops of barley and intermediate hosts of this rust, the species Ornithogalum,- are observed. As a result, the parasite survives the winter either in the uredo stage on winter crops of barley or in the teliospore stage with a succeeding infection of intermediate hosts. It is found in a weaker state in other parts of the Union, the sources of the spring infection remaining unexplained since the species of Ornithogalum and winter barley are absent there.

Nevertheless, the possibility of this rust surviving the winter in the uredo-stage on the volunteer spring barley is not excluded, as has been established in the case of the northern Ukrainian regions.

It consists of a complex of physiological races of which close to ten are known today.

The optimum temperature lies between 20-25°. The incubation period is 7 days, on an average. In mass quantity the disease prevails, in the majority of zones of the USSR, in the second half of the vegetative period.

End of Chapter

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Naumov, N. A., ed. Spravochnik agronoma po zashchite rastenii [An agronomist's reference book on plant protection. Moskva, Sel-khoz. iz, 1948. 830 p.
464.4 N228

Translated from the Russian by
S. E. Monson

METHODS FOR THE CONTROL OF RUST (pp. 521-524)

The principal measures in controlling rust of grain crops are of the economic-organizational and agro-technical type, directed towards reducing the introduction of infection on planted crop areas. With regard to stripe and crown rusts of crops, the intermediate hosts are also subject to eradication.

Proper organizational-economic methods and a high level of agricultural technique increase the resistance of plants to rust and contribute in part to the reduction of the infectious focus in that they create better conditions for the growth and development of grain crops.

ORGANIZATIONAL-ECONOMIC MEASURES. From among the methods that carry a decisive role in controlling rust, it is necessary to apply first of all the following measures:

1. The inculcation and extension of sowings of varieties of cereals resistant to rust, valuable also in other economic aspects chiefly from among those recommended in varietal adoption. (Table 78)
2. Timely gathering of the harvest in closely connected periods, without too long standing and shattering of grain. The use of "spike-lifters", during harvesting, grain-catchers, the manual gathering of stalks etc. Otherwise, aside from a direct loss of part of the harvest, the shattering of grain will lead to self-sowings in the field which may soon get

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Baumov, B. A., ed. Spravochnik ... [An agronomist's reference book on plant protection. Methods for the control of rust. (pp. 521-524) 1948.

infected by rust. Rust passes on from volunteer plants onto winter crops in the fall.

3. The distribution of fields under crop rotation with such calculation as not to allow the immediate proximity of sowings of identical winter and summer crops, with plantings of other crops in-between; since in the spring rust transfers from winter to summer crops.

4. In the event that the field planted in the fall adjoins other fields on which there has been much rust, one should preferably begin the sowing on plots lying further away from the latter in order that those plots closest to the infected fields may be planted last.

5. The gathering of scattered straw during transportation, since rust spores that have remained in it may become the source of infection of crops. The needs of the farm for straw for fodder are to be met first by the straw gathered from the non-infected or least infected sown areas. Straw heavily infected with rust and not possessing any fodder value should be used for fuel, bedding, and compost piles of long duration.

6. The current location for threshing should be established at a distance of less than 0.5 km. from fields intended for winter plantings.

AGRO-TECHNICAL MEASURES. From among the methods carrying a decisive significance in controlling rust the following should be used:

1. The disking of stubble, to be followed by deep plowing with a plow

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equipped with a coulter. The disking should be done immediately following the harvesting of summer and winter crops. The plowing has to be completed 3 to 4 days prior to the germination of winter crops, in order that rust may not transfer from stubble and volunteer neighboring fields to germinating winter crops.

In cases where winter sowings are intended for winter crops, it is necessary to destroy the volunteer plants and weeds by systematic cultivation following deep plowing.

2. The planting of winter crops at optimal, most closely connected periods, established for each region. Early sowings are generally heavily infected by rust and they in turn infect optimal sowings. Later plantings are less resistant to frost, are of delayed development, and get heavily infected by rust in the succeeding year.

3. If winter wheat is infected in the fall by brown rust, it should receive a fertilizing of phosphorous-potassium or a complete mineral fertilizer. The established norms of the feeding, depend upon conditions of the soil. They should not become substitutes for the principal fertilisation, since they represent only separate links in the General scheme of fertilizing.

4. The sowing of summer crops in close and early periods, with the use of vernalized seeds, because early and vernalized sowings are not susceptible to rust.

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5. The fertilization of soft summer wheat with phosphorous-potassium or complete mineral fertilizer in cases of a pronounced development of rust beginning in the fall, in order to prevent the infection of summer wheat. Those fertilizers should be added to the spring pre-sowing cultivation. The latter method is compulsory for sowing plots and seed-planting economies in regions where summer wheat is frequently and heavily infected by brown rust.

6. The utilization of manure, nitrogen, phosphoric-acid, and potassium fertilizers which aid in increasing the yields and the stability of plants to withstand diseases of rust. Only well-rotted manure should be introduced into the soil; otherwise a non-rotted straw, infected by rust, may serve as a source of infection.

7. Careful destruction of volunteer material and weeds prior to their blooming, on road edges, empty lots, ditches, along with the absolute removal of the cut grass from the field. Many weeds (couch grass, Bromus L., Dactylis, L., goat (?) wheat, Lycopsis, medicinal Lumianka (?), the Ornithogalum, Corylus L., Thalictrum L., etc., strengthen the infection of grain crops by rust.

8. Spring harrowing of winter crops. This measure improves conditions helping the development of plants and reduces infection by rust.

ERADICATION OF INTERMEDIATE HOST-PLANTS OF RUST. This is imperative since they carry the source of spring-plants infection by rust and serve as a

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focus for the development of new forms. The formation of the latter complicates, however, the work of producing and establishing varieties of grain crops resistant to rust.

The source of the spring renewal of the stripe rust of grain crops in the European USSR is Berberis vulgaris, and in Siberia - B. sibirica, in Khabarovsk and the Premorie regions - B. amurensis; for crown rust of oats - throughout the greater part of the zones of the Union - Rhamnus cathartica, and in the Far East - Rh. dahurica; in the Caucasus, in addition, Rh. Pallasii. Other species of rust make use of grass plants as intermediaries which have to be destroyed along with weeds.

BERBERIS VULGARIS is a bush with upright runners, reaching up to 3 m. in height, with a grey bark. The fresh wood pulp and the inner surface of the bark are of bright yellow color, the core - white. The buds are distributed in a wide base of triple spines. The leaves of oval shape open in late spring in clusters of 2-5, margin - serrated. The yellow flowers consist of 6 petals, gather into drooping clusters; berries-elongated, red, sour in taste, with a kernel sitting firmly on the branches, not dropping until spring. Distributed all over as a decorative-or park shrub; also wild growing.

BERBERIS AMURENSIS - a shrub resembling B. vulgaris, but has narrower leaves and a more sharply serrated margin. Its regions - Premorie and Khabarovsk.

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RHAMNUS CATHARTICA (local name - "zhoster", spine (thorn)) - small tree of up to 6 m. in height, forked or irregularly branching. The bark of young branches is dark grey and smooth, on old branches - rough. The side branches terminate in a stiff (tough) and brittle spine (distinguished from the brittle rhamnus where there are no spines). The pulp - hard and yellowish. Buds - egg-shaped - conical, covered with dark brown scales. Leaves-opposite, occasionally alternate, more seldom in clusters of ovate shape, finely serrate margin, (as distinguished from the brittle Rh. of which leaves have an entire margin). The leaf has 3-4 pairs of curved upwards side veins, (as distinguished from the brittle Rh. of which the leaves have many veins). Flowers are yellowish-green, of 4-5 petals. Fruit - black berry of pea size with 4 hard kernels. Distributed almost everywhere as a wild-grown and cultivated (park or garden) plant. RHAMNUS PALLASII - low shrub with spiny, thin, reddish-brown runners. Buds are covered with scales. Leaves linear, alternate or in alternate clusters, sometimes opposite, first furry, later bare, dark-green on surface, light-green underneath, finely serrated margin. Flowers - small, greenish, single or in clusters. Berries - small, reverse - ovate, black. Grows wild on meadows, forest edges and on mountain cliffs in the Northern Caucasus.

ORGANIZATION OF THE ERADICATION OF THE BERBERIS AND RHAMNUS.

In order to properly organize the work of exposing and eradicating Berberis and Rhamnus, the Departments of Agriculture of the individual

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republics and the district and regional administrations of agriculture assign this task to responsible personnel. In the separate regions the work is delegated to the superintendents of the regional departments of agriculture, and within the territory of machine and tractor service stations - to the director of the respective station; in collective farms - to the director of the farm.

The president of a kolkhoz is held responsible for the above work on state farms.

The eradication of the shrubs is being attended to by the personnel and at the expense of those farms and organizations where the plants grow. In the areas of railways, electrical transmission lines, oil pipe lines, and other areas of non-agricultural use, the eradication is taken care of by the organizations where the plants grow. In exposing the location of the barberry and Rhamnus shrubs, the data pertinent to forest - and forest industrial farms are to be taken into account.

All single barberry and Rhamnus shrubs are subject to eradication, as well as their overgrowth in the fields, the territories of the farms and those adjoining them - in boards, gullies, as well as in neighboring gardens and lots, nurseries - that furnish seedlings to enclosures - in field-protective and meliorative plantings, and along railway beds. The eradication of intermediate plants in forests of local and state significance must be carried through to a depth of 250 meters from the edge of the forest. In open spaces where there are overgrowth of these shrubs, the latter have to be completely eradicated.

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It is easiest to expose the shrubs when they are in the leafage stage. The account of eradicated shrubs is kept in special report sheets which indicate the location of shrubs, i.e. whether 1. in open spaces, 2. on edges of forest, 3. deep in woods at a distance up to 250 meters. The entries are made in the following manner:

.....district.....region

....."Sel-Soviet" (Village Council)

Name of Farm	Number of destroyed shrubs					
	In open spaces, fields, gardens, nearby lots, etc.		On borders		In forests, at depths of up to 250 meters	
(kolkhoz)	Berberris	Rhamnus	Berberis	Rhamnus	Berberis	Rhamnus
Total:						

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Naumov, N. A. ed.
Spravochnik Agronoma po Zashchite Rastenii [An Agronomist's Reference Book on Plant Protection] Moscow, Sel'khozgiz, 1948.
1:779-782. 830 p. 464.4 N22S

Transl. 13: Plant Protection

Translated by S. N. Monson

REFERENCE DATA* (p. 779-786)

Institutions of Higher Learning

This list includes those higher educational institutions (and their addresses) which prepare agronomists for work on plant protection from pests and diseases:

Ordena Lenina Moskovskaia Sel'skokhoziaistvennaia Akademiia im. Timiriazeva. (Moscow Agricultural Academy imeni Timiriazev of the Order of Lenin) Moskva, 8, Novoe Shosse

Institut Prikladnoi zoologii i fitopatologii. (Institute of Applied Zoology and Phytopathology) Leningrad 187, Ul. Chaikovskogo, 7

Gruzinskii Gosudarstvennyi Sel'skokhoziaistvennyi Institute im. Beriia (Georgian Government Agricultural Institute imeni Beriia) Tbilisi, Ul. Marra, 33

Leningradskii Sel'skokhoziaistvennyi Institut (Leningrad Agricultural Institute) Leningrad, Naberezhnaia B. Nevki, 18/20

Saratovskii Sel'skokhoziaistvennyi Institut (Saratov Agricultural Institute) Saratov, Revoliutsionnaia, 55

Tashkentskii Sel'skokhoziaistvennyi Institut (Tashkent Agricultural Institute) Tashkent, Ul. Kirova, 32

Khar'kovskii Sel'skokhoziaistvenny Institut (Kharkov Agricultural Institute) Kharkov, Ul. Artema, 44

Scientific-Research Institutions

This list contains those principal institutions and organizations that conduct scientific-research work on plant protection from pests and diseases. Agronomists may apply to these whenever they wish to have an accurate determination given a scientific name of a discovered pest or disease, as well as for aid on consultations on problems of plant protection.

*Compiled by Candidate of Agricultural Science V. I. Gusev.

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Organizations (and their addresses) to which material for determination should be directed:

Gosudarstvennoe Biuro Opredelenii pri Institut Prikladnoi Zoologii i Fitopatologii (Government Bureau of Determination at the Institute of Applied Zoology and Phytopathology) Leningrad, 187, Ul. Chaikovskogo, 7

Zoologicheskii Institut Akademii Nauk SSSR (Zoological Institute of the USSR Academy of Science) Leningrad, Universitetskaia Naberezhnaia, 1

Botanicheskii Institut imeni V. L. Komarova Akademii Nauk SSSR (Komarov Botanical Institute of the USSR Academy of Science) Leningrad, 22, Ul. Prof. Popova, 2

Institute Mikorbiologii Akademii Nauk SSSR (Institute of Microbiology of the USSR Academy of Science) Moskva, B. Kaluzhskaia, 33

Gosudarstvennoe Entomologicheskoe Obshchestvo (Government Entomological Institute) Leningrad, Universitetskaia Naberezhnaia, 1

Institut Entomologii Akademiia Nauk USSR (Institute of the UkSSR Academy of Science) Kiev, Vladimirskaia Ul., 55

INSTITUTIONS AND ORGANIZATIONS PROVIDING CONSULTATIONS ON PROBLEMS OF PEST AND DISEASE CONTROL OF AGRICULTURAL CROPS*

I. Vsesoiuznaia Akademiia Sel'skokhoziaistvennykh Nauk im. V. I. Lenina [All-Union Academy of Agricultural Science im. V. I. Lenin]

Sektsiia Zashchity Rastenii Vsesoiuznoi Akademii Sel'skokhoziaistvennykh nauk im. V. I. Lenina (ВАСХНИЛ). [Section of Plant Protection of the All-Union Academy of Agricultural Science im. V. I. Lenin]. Moskva, B. Kariton'evskii per., 21.

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Zashchity Rastenii (ВИЗР). [All-Union Scientific Research Institute of Plant Protection (VIZR)]. Laboratories: prognosis of propagation of mass pests, diseases, attractant methods of control; biological and micro-biological methods of control, phyto-immunity, zoological, bio-chemical, phyto-toxicology, entomo-toxicology; methods of applying and specialization in insecto-fungicides, systematization of fungi. Leningrad, 1, Ul. Gertsen, 42.

Moskovskaia Stantsiia Zashchity Rastenii VIZR. [Moscow Station of Plant Protection of VIZR.] Laboratories: on entomology, phytopathology,

*In addition to the organizations listed above, scientific-research work is conducted at agricultural "VUZY" (higher educational institutes).

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virus diseases of agricultural plants, their bacterial diseases, storage pests, chemical methods of control, economics. Moskva 15, Butirskii Khutor, Dmitrovskoe Shosse, 2.

Moldavskaia Stantsiia Zashchity Rastenii VIZR. [Moldavian Station of Plant Protection of VIZR.] Laboratories: entomology, phytopathology, immunization, chemical-toxicology, mechanization of pest and disease control. Fruit crops and grapes. Moldavskaaia SSR, Kishinev, Ul. Shchuseva, 125-a.

Voronezhskaia Stantsiia Zashchity Rastenii VIZR. [Voronezh Station of Plant Protection of VIZR.] Laboratories: entomology and phytopathology. Grain crops and forage grass primarily. Voronezh, Ul. 27 Febralia, 30.

Rostovskaia Stantsiia Zashchity Rastenii VIZR. [Rostov Station of Plant Protection of VIZR.] Laboratories: entomology, phytopathology, zoology, chemical methods. Grain, fruit and vegetable crops. Rostov-na-Donu, Ul. Tel'mana, 6.

Azerbaidzhanskaia Stantsiia Zashchity Rastenii VIZR. [Azerbaidjan Station of Plant Protection of VIZR.] Laboratories: entomology, phytopathology, zoology, chemical-toxicology. Fruit, vegetable, nut-and subtropical crops. Azerbaidjan skaia SSR, Baku, Ul. Kaganovich 5.

Slavianskaia Nauchno-Proizvodstvennaia Baza VIZR. [Slaviansk Scientific-production Base of VIZR.] Entomology, phytopathology, biomethod, chemical method. Fruit and vegetable crops. Krasnoderskii Krai, St. Slavianskaia, Bazarnaiia, 7.

Irkutskii Opornyi Punkt VIZR. [Irkutsk Support Point of VIZR.] Entomology and phytopathology. Grain and fruit crops, potatoes. Irkutsk, Naberezhnaia Angary, 20.

Sochinskii Opornyi Punkt VIZR. [Sochi Support Point of VIZR.] Fruit and subtropical crops. Krasnoderskii Krai, Sochi, Pionerskaia, 10.

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sel'skokhoziaistvennoi Mikrobiologii. [The All-Union Scientific-Research Institute of Agricultural Microbiology.] Biological method of controlling diseases of agricultural plants and rodents. Leningrad, 1, Ul. Gertsena, 42.

Vsesoiuznyi Nauchno-Issledovatelskii Institut Rastennevodstva (BNP). [All-Union Scientific-Research Institute of Plant Industry (VIR).] Immunity laboratory. Leningrad, 4, Ul. Gertsena, 44.

Gosudarstvennyi Nikitinskii Botanicheskii Sad im. Molotova. [Government Nikitin Botanical Garden, imeni Molotova.] Krimskaia Oblast, Ialta.

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II. Republic, Krai and Oblast Institutes and Stations Of Plant Protection

Altaiskaia Kraevye Stantsiia Zashchity Rastenii. [Altai Krai Station of Plant Protection.] Barnaul, Korolenko Street, 30.

Gruzinskii Institut Zashchity Rastenii. [Georgian Institute of Plant Protection.] Crops: citrus, subtropical, tea. Tbilisi, Marra Street, 33.

Kazakhskaia Stantsiia Zashchity Rastenii. [Kazakh Station of Plant Protection.] Laboratories: entomology, phytopathology, zoology, mechanization, toxicology. Crops: fruit, grain, vegetable. Alma-Ata, 10, Kazakh Institute of Agriculture.

Krasnodarskaia Kraevaia Stantsiia Zashchity Rastenii. [Krasnodar Krai Station of Plant Protection.] Krasnodar, Street of Communards, 68.

Krymskii Institut Zashchity Rastenii (Krym IZR). [Crimean Institute of Plant Protection (Crimean IZR).] Pests and diseases of grain, fruit, vegetable crops and grapes; mechanization of the work of plant protection. Sinferopol, Kuibishev Street, 25.

Latviiskii Institut Zashchity Rastenii. [Latvian Institute of Plant Protection.] Riga, Tserkov (Church) Street, 4-a.

Leningradskaia Stantsiia Zashchity Rastenii. [Leningrad Station of Plant Protection.] Leningrad, Tschaikovskii Street, 7.

Litovskaia Stantsiia Zashchity Rastenii. [Lithuanian Station of Plant Protection.] Lithuanian SSR. Dotnuva. Academy.

Novosibirskaia Oblastnaia Stantsiia Zashchity Rastenii. [Novosibirsk Oblast Station of Plant Protection.] Novosibirsk 7, Krivoshchekov Street, 1.

III. Laboratories, Departments and Groups of Plant Protection In Branch Institutes and Stations: Grain Crops and Crop Complexes

Azerbaidzhanskii Nauchno-Issledovatel'skii Institut Zemledeliia. [Azerbaidjan Scientific-Research Institute of Agriculture.] Grain crops. Cotton plant. Kirov-Abad, Railroad Station.

Bashkirskaia Respublikanskaia Opytnaia Stantsiia Polevodstva. [Bashkir Republic Experiment Field Station.] Ufa, Prunze Street, 40.

Belorusskii Nauchno-Issledovatelskii Institut Sel'skogo Khoziaistva. [White-Russian Scientific-Research Institute of Agriculture.] Minsk, Pushkin Street.

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Gorkovskaia Oblastnaia Opytnaia Stantsiia Polevodstva. [Gorki Oblast Experiment Field Station.] Grain and vegetable crops. Gorki Maiakovskii Street, 45.

Dal'nestochnyi Nauchno-Issledovatelskii Institut Zemledeliia i Zhivotnovodstva, Ovoshchnye i plodivye Kultury. [Far Eastern Scientific-Research Institute of Agriculture and Husbandry.] Field, vegetable and fruit crops. Khabarovsk, P. O. Box 195

Denepropetrovskaia Gosudarstvennaia Selektionnaia Stantsiia. [Dnepropetrovsk Government Selction Station, Grain, oil and forage crops.] Dnepropetrovsk Oblast, Sinellnikovo P. O.

Ivanovskaia Oblastnaia Opytnaia Stantsiia. Zemledelliia. [Ivanov Oblast Experiment Station of Agriculture.] Field, vegetable, fruit and berry crops. Ivanov Oblast, Bogorodskoe P. O.

Institut Zemledeliia Akademiia Nauk Armianskoi [Institute of Agriculture of Academy of Science of Armenian SSR.] Erevan, Abovian Street, 123.

Institut Zemledeliia i, Dokuchaeva. [Dokuchaev Institute of Agriculture.] Talov P. O. Voronezh Oblast.

Kazanskaia Gosudarstvennais Selektsionnaia Stantsiia. [Kazan Government Selection Station.] Grain, leguminous and oil crops, potatoes and grasses. Kazan, P. O. Box 8.

Karelo-Finskaia respublikan-skaia Sel'skokhoziaistvennaia Opytnaia Stantsiia. [Karelian-Finnish Republic Agricultural Experiment Station.] Field, vegetable and forage crops. Petrozavodsk.

Kirovskaia Oblastnaia Opytnaia Stantsiia. [Kirov Oblast Experiment Station.] Grain, vegetable, fruit and berry crops. Kirov Oblast, Lenin Street, 164-a.

Krasnodarskaia Cosudarstvennaia Stantsiia. [Krasnodarsk Government Selection Station.] Grain; legumes; grasses. Krasnodar, P. O. Box 12.

Kurskaia Oblastnaia Sel'skokhoziaistvennaia Opytnaia Stantsiia. [Kursk Oblast Agricultural Experiment Station.] Field, crops, forage grasses. Kursk Oblast, Bukreev Station, Moscow-Kursk Railroad.

Leningradskaia Oblastnaia Sel'skokhoziaistvennaia Opytnaia Stantsiia. [Leningrad Oblast Agricultural Experiment Station. Field, vegetable and forage crops. Leningrad Oblast, Siversk Station, Belogorka.

Mirovnovskaia Gosudarstvennaia Selektsionnaia Stantsiia. [Mironov Government Selection Station. Grain, legumes, forage crops.] Sugar beet. Kiev Oblast, Mcronovka P. O.

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Nauchno-Issledovatel'skii Institut Zernovogo Khoziaistva Nechernozemnoi Polosy. [Scientific-Research Institute of Grain Industry of Non-Black Earth Belt.] Moscow Oblast, Nemchinov Station, Western Railroad.

Nosovskaia Gosudarstvennaia selektsionnaia Stantsiia. [Nossov Government Selection Station.] Grain, vegetable, peas, clover. Chernigov Oblast, Nossov Station, South-Western Railroad.

Odesskaia Nauchno-Issledovatel'skaia Stantsiia Polevodstva. [Odessa Scientific-Research Field Station.] Field crops, soya bean. Odessa Oblast, Vygoda Station, Odessa Railroad.

Ordena Trudovogo Krasnogo Znameni Nauchno-Issledovatel'skii Institut Zernovogo Khoziaistva Iugo-Vostoka SSSR. [Scientific-Research Institute of Grain Industry of South-Eastern USSR, awarded Red Labor Banner.] Saratov, P. O. Box 20.

Penzenskaia Oblastnaia Opytnaia Stantsiia Polevodstva. [Penza Oblast Experiment Field Station.] Field crops, hemp, Penza Oblast, Lunino P. O.

Poliarnaia Opytnaia Stantsiia VIR. [Polar Experiment Station of VIR. Murmansk, city of Kirovsk.

Sibirskii Ordena Trudovogo Krasnogo Znameni Nauchno-Issledovatelskii Institut Zernogovo Khoziaistva (SibNIIZKOZ.) [Siberian Scientific-Research Institute of Grain Industry, awarded order of Red Labor Banner.] Omsk, P. O. Box 12.

Ukrainskii Nauchno-Issledovatel'skii Institut Zernovogo Khoziaistva im. Kuibysheva (УНИИЗХ). [Ukrainian Scientific-Research Institute of Grain Industry imeni Kuibyshev (UNIIZKH)] Knepropetrovsk, Dzershinskii Street, 29.

Ukrainskii Nauchno-Issledovatel'skii Institut Sotsialisticheskogo Zemledeliia (УНИИСОЗ). [Ukrainian Scientific-Research Institute of Socialist Agriculture. (UNIISOZ)] Field crops, makhorka, kok-saghyz. Kiev, Lenin Street, 46.

Kar'kovskaia Gosudarstvannaia Selektsionnaia Stantsiia. [Kharkov Government Selection Station.] Grain, legumes, sunflower, sugar beet. Kharkov, Stalin Prospect, 142.

Kar'kovskaia Nauchno-Issledovatel'skii Institut Sotsialisticheskogo Zemledeliia (УНДИСОЗ). [Kharkov Scientific-Research Institute of Socialist Agriculture (UNDISOZ).] Field, legumes and new crops. Kharkov, Tschaikovskii Street, 4.

Chakinskaia Gosudarstvennaia Selektsionnaia Stantsiia. [Chakin Government Selection Station.] Grain, leguminous crops; sunflower. Tambov Oblast, Rzhakinsk raion, Chakino P. O.

Chiskaia Sel'skokhoziaistvennaia Opytnaia Stantsiia. [Chisk Agricultural Experiment Station.] Field and new bast crops. Kirghiz SSR. Kaganovich raion, Nishne Chuiskou P. O.

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Shatilovskaia Gosudarstvennaia Selektsionnaia Stantsiia. [Shatilov Government Selection Station.] Grain, oil-and forage crops, flax. Orlov Oblast, Shatilovo P. O.

FORAGE GRASSES

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Kormov im. Vil'iamsa (ВИК). [Williams All-Union Scientific-Research Institute of Forage Crops, (VIK).] Moscow Oblast, Lugovaiia P. O.

Ukrainskii Filial Vsesoiuznogo Instituta Kormov. [Ukrainian Branch of All-Union Institute of Forage Crops. Poltava, Swedish (Shvedskaia) Street, 86.

FLAX AND CLOVER

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Lyna (ВНИИЛ). [All-Union Scientific-Research Institute of Flax (VNIIL).] Kalinin Oblast, city of Torzhok, Lunacharskii Street, 37.

COTTON PLANTS

Azerbaidzhanskii Nauchno-Issledovatelskii Institut Zemledeliia. [Azerbaidjan Scientific-Research Institute of Agriculture.] Azerbaidjan SSR, Kirov-Abad, Railroad Station.

Nauchno-Issledovatelskii Institut Khlopkovodstva Novykh Raionov (НОВНИХИ). [Scientific-Research Institute of Cotton Industry of New Regions. (NOVNIKHI)] Cotton and other crops of cotton crop rotation. Stavropol Krai, Budennovsk.

Ukrainskaia Opytnaia Khlopkovaia Stantsiia. [Ukrainian Experiment Cotton Station.] Cotton, alfalfa. Kherson, P. O. Box 489.

Tsentralnaia Stantsiia Zashchity Rastenii SOIUZNIKHI. [Central Station of Plant Protection of SOIUZNIKHI.] Pests and diseases of cotton and other field crops and fruits. Tashkent 17, 3-rd Chimkentsk tupik [blind alley].

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RUBBER BEARING PLANTS

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Kauchukonosov (ВНИИК) [All-Union Scientific-Research Institute of Rubber-Bearing Plants (VNIIK).] Moscow 61, Cherkizovo, Pugachev Street, 17

RICE

Vsesoiuznaia Risovaia Opytnaia Stantsiia. [All-Union Rice Experiment Station.] Krasnodar, Sedin Street, 104.

Azerbaidzhanskaia Risovaia Opytnaia Stantsiia. [Azerbaidjan Rice Experiment Station.] Azerbaidjan SSR, Lenkoran', P. O. Box 26.

Uzbekskaia Risovaia Opytnaia Stantsiia. [Uzbek Rice Experiment Station.] Tashkent, Post Office Box 36.

Ukrainskaia Risovaia Opytnaia Stantsiia. [Ukrainian Rice Experiment Station.] Kherson Oblast; city of Voznesensk. P. O. Box 67.

HEMP AND NEW BAST CROPS

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Lubianykh Kul'tur (ВНИИЛК). [All-Union Scientific-Research Institute of Bast Crops. (VNIILK)] Hemp, [Hibiscus canna], jute, ramie. Sumy Oblast, city of Glukhov, Lenin Street, 27.

Severokavkazskaia Opytnaia Stantsiia Lubianykh Kul'tur VNIILK. [North-Caucasian Experiment Station of Bast Crops of VNIILK.] Hemp, [Hibiscus canna], Chinese bell flower, jute. Krasnodar, Yankovskii Street, 56.

OIL PLANTS

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Maslichnykh kul'tur (ВНИИМК). [All-Union Scientific-Research Institute of Oil Crops. (VNIIMK)] Krasnodar, Kruglik 1, P. O. Box 10.

TOBACCO

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Tabaka I Makhorki (ВИТИМ). [All-Union Scientific-Research Institute of Tobacco and Makhorka. (VITIM)] Krasnodar, P. O. Box 55.

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Ukrainskii Filial VITIM. [Ukrainian Branch of VITIM.] Chernigov Oblast, Prikumsk raion. Perevalochnoe village.

Abkhazskaia Zonal'naia opytnaia Tabachnaia Stantsiia VITIM. [Abkhaz Zonal Experiment Tobacco Station of VITIM.] Sukhum, Engels Street, 35.

Krymskaia Zonal'naia Opytnaia Stantsiia Po Tabaku VITIM. [Crimean Zonal Experiment Station for Tobacco of VITIM.] Yalta, Khalturin Street, 47.

Frunzenskaia Zonal'naia Opytnaia Stantsiia po Tabaku VITIM. [Frunze Zonal Experiment Station for Tobacco of VITIM.] Khirghiz SSR, Frunze, P. O. Box 25.

MEDICINAL PLANTS

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Lekarstvennykh Rastenii (ВИЛАР). [All-Union Scientific-Research Institute of Medicinal Plants (VILAR).] Moscow Oblast, Lenino-Dachnoe P. O.

ETHER-OIL PLANTS

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Efiromaslichnykh Rastenii (ВИЭМТП). [All-Union Scientific-Research Institute of Ether-Oil Plants (VIEMP).] Moscow Oblast, Station Pushkino, Northern Railroad, 1st Serebriansk Street, 1.

HOPS

Respublikanskaia Nauchno-Issledovatel'skaia Stantsiia Khmelevodstva. [Republic Scientific-Research Station of Hop Industry.] Moscow Oblast, Ashunino P. O.

Ukrainskaia Nauchno-Issledovatel'skaia Stantsiia Khmelevodstva. [Ukrainian Scientific Research Station of Hop Industry.] Zhitomir.

SUGAR BEETS

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sveklovichnogo Polevodstva (ВНИИСП). [All-Union Scientific-Research Institute of Sugar Beet Crops (VNIISP).] Moscow Oblast, Station Butovo, Dzerzhinskii Railroad.

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Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sakharnoi Promyshlennosti (ВНИС). [All-Union Scientific-Research Institute of Sugar Beet Industry (VNIS).] Batyev Mountain, Clinic Street, 23.

Ramonskaia Selektsionnaia Opytnaia Stantsiia VNIS. [Ramon Selective Experiment Station of VNIS.] Voronezh Oblast, Berezovsk raion, Ramon P. O.

Biiskaia Sveklovichnaia Selektsionnaia Stantsiia. [Biisk Sugar Beet Selection Station.] Altai Krai, Sveklovichnoye P. O.

POTATOES.

Nauchno-Issledovatel'skii Institut Kartofel'nogo Khoziaistva (ННИКХ). [Scientific-Research Institute of Potato Industry. (NIIKH).] Moscow Oblast, Malakhov Station, Lenin Railroad.

Leningradskaia Zonal'naia Kartofel'naia Opytnaia Stantsiia NIIKKH. [Lenin Zonal Potato Experiment Station of NIIKH.] Leningrad Oblast, Volosov raion, Kurkovitsy P. O.

Ul'ianovskaia Opytnaia Stantsiia Kartofel'nogo Khoziaistva NIIKH. [Ulianovsk Experiment Station of Potato Industry of NIIKH.] Ulianovsk, P. O. Box 20.

Kievskaia Opytnaia Stantsiia po Kartofeliu VNIIS. [Kiev Potato Experiment Station of VNIIS.] Kiev Oblast, Borodiansk raion, Nemeshaevo P. O.

VEGETABLE CROPS

Nauchno-Issledovatel'skii Institut OvoshchnogoKhoziaistva NIIOKH. [Scientific-Research Institute of Vegetable Industry of NIIOKH.] Moscow 129, Tekstilshchik Textile Place, Kursk Railroad.

Adlerovskaia Ovoshshnaia Opytnaia Stantsiia NIIOKH. [Adler Vegetable Experiment Station.] Krasnodar Krai, Adler P. O.

Gribovskaia Selektsionno-Ovoshchnaia Opytnaia Stantsiia NIIOKH. [Gribov Selection - Vegetable Experiment Station of NIIOKH.] Moscow Oblast, Pioneer Station, Western Railroad.

Biriuchekutskaia Ovoshchnaia Opytnaia Stantsiia NIIOKH. [Biriuchekutsk Vegetable Experiment Station of NIIOKH.] Rostov Oblast, Novocherkassk, Krasnoarmeisk (Red Army) street, 59.

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Verkhnekhavskaia Selektsionno-Ovoshchnaia Opytnaia Stantsiia NIIOKH. [Verkhnekhavsk Vegetable Selection Experiment Station of NIIOKH.] Voronezh Oblast, Verchniaya (Upper) Khava.

Zapadnosibirskaia Ovoshchnaia Opytnaia Stantsiia NIIOKH. [West-Siberian Vegetable Experiment Station of NIIOKH.] Altai Krai, Barnaoul, Lebiazhie, P. O.

Dal'nevostochnaia Ovoshchnaia Opytnaia Stantsiia NIIOKH. [Far-Eastern Vegetable Experiment Station of NIIOKH.] Khabarovsk Krai, Viazemsk Station.

Vsesoiuznyi Opornyi Punkt po NIIOKH. [All-Union Base Station for Onion Culture of NIIOKH.] Penza Oblast, Bessonovka village.

Dnepropetrovskaia Selektsionno-Opytnaia Ovoshche-Bakhchovaia i Kartoffel'naia Stantsiia. [Dnepropetrovsk Selection-Experiment Vegetable, Melon Field and Potato Station.] Dnepropetrovsk Oblast, Karl Marx village.

Odesskaia Selektsionnaia Ovoshche-Kartofel'naia Opytnaia Stantsiia. [Odessa Selection Vegetable-Potato Experiment Station.] Odessa, Lenin posolok (village).

Khar'kovskaia Selektsionno-Opytnaia Ovoshch-Kartofel'naia Stantsiia, [Kharkov Selection-Experiment Vegetable-Potato Station.] Kharkov Oblast, city of Merefa.

Turkmenskaia Plodoovoshchnaia i Kartofel'naia Opytnaia Stantsiia. [Turkmen Fruit-Vegetable and Potato Experiment Station.] Ashkhabad, Bagir.

Uzbekskaia Respublikanskaia Ovoshchnaia Opytnaia Stantsiia. [Uzbek Republic Vegetable Experiment Station.] Tashkent, Kara-Su P. O.

FRUIT CROPS

Mleevskaia Opytnaia Stantsiia Plodovodstva. [Mleev Experiment Station of Fruit Industry.] Kiev Oblast, Gorodishchensk raion, Mleevo village.

Nauchno-Issledovatel'skii Institut Plodovodstva im. I. V. Michurina, [I. V. Michurin Scientific-Research Institute of Fruit Industries.] Michurinsk.

Tadzhikskii Nauchno-Issledovatel'skii Institut Plodovinogradnogo i Ovoshchnogo Khoziaistva. [Tadzhik Scientific-Research Institute of Fruit, Grape and Vegetable Industry.] Fruit, berry, vegetable and melon crops, grapes, potatoes. Stalinabad, P. O. Box 154.

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Ukrainskii Nauchno-Issledovatelskii Institut Plodovo-Iagodnogo Khoziaistva. [Ukrainian Scientific-Research Institute of Fruit and Berry Industries.] Kiev, Kitaevo, 46.

GRAPE VINES.

Anapskaia Opytnaia Stantsiia Vinogradarstva. [Anapa Experiment Station of Grape Industry.] Krasnodar Krai, Anapa, Novorossiisk Street, 157

Gruzinskii Nauchno-Issledovatelskii Institut Vinogradarstva i Vinodeliia. [Georgian Scientific-Research Institute of Grape and Viniculture.] Georgian SSR, town of Telave.

Nauchno-Issledovatel'skii Institut Vinogradarstva i Vinodeliia. [Scientific-Research Institute of Vini-and Wine Industry.] Rostov Oblast; Novocherkassk, Arsenal Street, 15.

Uzbekskii Nauchno-Issledovatel'skii Institut Vinogradarstva i Vinodeliia. [Uzbek Scientific-Research Institute of Vini-and Wine-Industry.] Samarkand, P. O. Box 46.

Azerbaidzhanskaia Opytnaia Stantsiia Vinogradarstva i Vinodeliia. [Azerbaidjan Experiment Station of Vini-and Wine-Culture.] Azerbaidjan SSR, Kirov-Abad, Railroad Station.

SUBTROPICAL CROPS

Azerbaidzhanskii Nauchno-Issledovatel'skii Institut Mnogoletnikh Nasazhdenii (АЗНИИМН). [Azerbaidjan Scientific-Research Institute of Perennial Plantings; (AZNIIMN).] Subtropical, nut-bearing, and fruit crops, tung. Baku, Mardakiani P. O.

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sukhikh Subtropikov. [All-Union Scientific-Research Institute of Dry Subtropical Plants.] Subtropical fruit, nut-bearing, medicinal, ether-oil crops. Stalinabad, New (Novaia) Street, 10.

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Chaia i Subtropicheskikh Kul'tur. [All-Union Scientific-Research Institute of Tea and Subtropical Crops.] Georgian SSR, Makheradzievsk raion; Anaseuli village.

Sochinskaia Opytnaia Stantsiia Subtropicheskikh i Iuzhnykh Plodovykh Kul'tur. [Sochi Experiment Station of Subtropical and Southern Fruit Crops.] Subtropical and southern fruits, citrus, tea. Krasnodar Krai, Sochi, Bzugu.

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POLAR AGRICULTURE

Nauchno-Issledovatel'skii Institut Poliarnogo Zemledeliia i Zhivotnovodstva. [Scientific-Research Institute of Polar Agriculture and Husbandry.] Leningrad, Rakov Street, 17.

INSECTO-FUNGICIDES

Vsesoiuznyi Nauchno-Issledovatel'skii Institut Udobrenii i Insektofungitsidov (НИУИФ). [All-Union Scientific-Research Institute of Fertilizers and Insecto-Fungicides. (NIUIF).] Moscow, Kaluga Road, 71-a.

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Spravochnik Agronoma po Zashchite Rastenii
[An Agronomist's Reference Book on Plant Protection]
Moscow, Sel'khozgiz, 1948. 1: 779-782. 830 p. 464.4 N22S

Translated by S. E. Monson

REFERENCE DATA

This list includes those higher educational institutions which prepare agronomists for work on plant protection from pests and diseases.

Moscow Agricultural Academy, imeni Timiriazev, of the Order of Lenin, Moscow 8, New Highway

Institute of Applied Zoology and Phytopathology, Leningrad 187, Tchaikovsky Street 7

Georgian Government Agricultural Institute, imeni Beria, Tbilis, Marra Street 33

Leningrad Agricultural Institute, Leningrad, Quai of the Large Nevka 18/20

Saratov Agricultural Institute, Saratov, Street of the Revolution, 55

Tashkent Agricultural Institute, Tashkent, Kirov Street 32

Kharkov Agricultural Institute, Kharkov, Artem Street 44

Scientific-Research Institutions

This list contains those principal institutions and organizations that conduct scientific-research work on plant protection from pests and diseases. Agronomists may apply to these whenever they wish to have an accurate determination given a scientific name of a discovered pest or disease, as well as for aid on consultations on problems of plant protection.

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Organizations to which material for determination should be directed:

The Government Bureau of Determination at the Institute of Applied Zoology and Phytopathology, Leningrad 187, Tchaikovski Street 7

Zoological Institute of the USSR Academy of Science, Leningrad, University Quai, 1

Komarov Botanical Institute of the USSR Academy of Science, Leningrad 22, Professor Popov Street 2

Institute of Microbiology of the USSR Academy of Science, Moscow, Large Kaluzhskaia, 33

Government Entomological Institute, Leningrad, University Quai, 1

Institute of Entomology of the USSR Academy of Science, Kiev, Vladimir Street 55

Part I

INSTITUTIONS AND ORGANIZATIONS PROVIDING CONSULTATIONS ON PROBLEMS OF PEST AND DISEASE CONTROL OF AGRICULTURAL CROPS

VASKHNIL Lenin All-Union Academy of Agricultural Science. The Division of Plant Protection of VASKHNIL, Moscow, Large Kharitonovski Per. 21

VIZR All-Union Scientific Research Institute of Plant Protection. Laboratories: the prognosis of propagation of mass pests, diseases, attractant methods

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of control; biological and micro-biological methods of control, phyto-immunity, zoological, bio-chemical, phyto-toxicology, entomo-toxicology; methods of applying and specialization in insecto-fungicides, systematization of fungi. Leningrad, 1, Herzen Street 42

VIZR — Moscow Station of Plant Protection. Laboratories: on entomology, phytopathology, virus diseases of agricultural plants, their bacterial diseases, storage pests, chemical methods of control, economics. Moscow, 15, Butirski Khutor, Dmitrovski Highway, 2

VIZR — Moldavski Station of Plant Protection. Laboratories: entomology, phytopathology, immunization, chemical-toxicology, mechanization of pest and disease control. Fruit crops and grapes. Moldavskaiia SSR, Kishinev, Shuzev Street, 125-a

VIZR — Voronezh Station of Plant Protection. Laboratories: entomology and phytopathology. Grain crops and forage grass primarily. Voronezh, Street of February 27, 30

VIZR — Rostov Station of Plant Protection. Laboratories: entomology, phytopathology, zoology, chemical methods.

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Grain, fruit and vegetable crops. Rostov-on-the-Don, Tellman Street 6

VIZR — Azerbaijan Station of Plant Protection. Laboratories: entomology, phytopathology, zoology, chemical-toxicology. Fruit, vegetable, nut-and sub-tropical crops. Azerbaijan SSR, Baku, Kaganovich Street 5

VIZR — Slavic Scientific-production Base. Entomology, phytopathology, bio-method, chemical method. Fruit and vegetable crops. Krasnodarski Krai, Slavianski Street, Bazarnaiia, 7

VIZR — Irkutski Base Station. Entomology and phytopathology. Grain and fruit crops, potatoes. Irkutsk, Angara Quay, 20

VIZR — Sochi Base Station. Bio-method. Fruit and subtropical crops. Krasnodarski Krai, Sochi, Pioneer Street 10

The All-Union Scientific-Research Institute of Agriculture. Microbiology. Biological method of controlling diseases of agricultural plants and rodents. Leningrad, 1, Herzen Street 42

VIR — All-Union Scientific-Research Institute of Plant Growing. Immunity laboratory. Leningrad, 4, Herzen Street 44

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Government Nikitin Botanical Garden, imeni Molotova;

Crimea Oblast, Yalta.

Part II

REPUBLIC, REGIONAL AND DISTRICT INSTITUTES AND STATIONS OF PLANT PROTECTION

Altai Regional Station of Plant Protection. Barnaul, Korolenko Street 30

Georgian Institute of Plant Protection. Crops: citrus, subtropical, tea. Tbilisi, Marra Street 33

Kazakh Station of Plant Protection. Laboratories: entomology, phytopathology, zoology, mechanization, toxicology. Crops: fruit, grain, vegetable. Alma-Ata, 10, Kazakh Institute of Agriculture.

Krasnodar Regional Station of Plant Protection. Krasnodar, Kommunar Street 68

Crimean Institute of Plant Protection (Crimean IZR). Pests and diseases of grain, fruit, vegetable crops and grapes; the mechanization of the work of plant protection. Simferopol, Kuibishev Street 25

Latvian Institute of Plant Protection. Riga, Tserkovnaiia 4-a

Leningrad Station of Plant Protection. Leningrad, Tschaikovski Street 7

Lithuanian Station of Plant Protection. Lithuanian SSR. Dotnuva Academy

Novosiberian Regional Station of Plant Protection. Novosibirsk 7, Krivoshchiakovski 1.

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Part III

LABORATORIES, DEPARTMENT AND GROUPS FOR THE PROTECTION OF PLANTS AND BRANCH INSTITUTES AND STATIONS;

GRAIN AND COMPLEX CROPS

Azerbaijan Scientific-Research Institute of Agriculture. Grain crops. Cotton plant. Kirov-Abad, Railroad Station

Bashkir Republic Experiment Station of Field Culture. Ufa, Frunze Street 40

White-Russian Scientific-Research Institute of Agriculture. Minsk, Pushkin Street

Gorki Oblast Experiment Station of Field Culture. Grain and vegetable crops. Gorki, Maiakovskaiia Street 45

Far Eastern Scientific-Research Institute of Agriculture and Husbandry. Field, vegetable and fruit crops. Khabarovsk p/ya 195

Dnepro-petrovsk Government Selection Station. Grain, oil and forage crops. Dnepro-petrovsk Oblast, p/o Sinelnikovo

Ivanovo Oblast Experiment Station of Agriculture. Field, vegetable, fruit and berry crops. Ivanovo Oblast, p/o Bogorodskoe

Institute of Agriculture of the Armenian SSR Academy of Science. Yehevan (Erevan), Abovian Street 123

Dokuchaev Institute of Agriculture. Branch Talovaiia, Voronesh Oblast

Kazan Government Selection Station. Grain, leguminous and oil crops, potatoes and grasses. Kazan, p/ya 8

Karelo-Finnish Republic Agricultural Experiment Station. Field, vegetable and forage crops. Petrozavodsk

Kirov Oblast Experiment Station. Grain, vegetable, fruit and berry crops. Kirov Oblast, Lenin Street 164-a

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Krasnodarski Government Selection Station. Grain, leguminous crops; grasses. Krasnodar, p/ya 12

Kursk Oblast Agricultural Experiment Station. Field crops, forage grasses. Kursk Oblast, Bukreevo Station, Moscow-Kursk Railroad

Leningrad Oblast Agricultural Experiment Station. Field, vegetable and forage crops. Leningrad Oblast, Siverskaiia, Belogorka

Mironovskaiia Government Selection Station. Grain, legumes, forage crops. Sugarbeet. Kiev Oblast, p/o Mironovka

Scientific-Research Institute of Grain Economy of the Non-Black Earth Belt. Moscow Oblast, Nemchinov Station, Western Railroad

Nossov Government Selection Station. Grain, vegetable, peas, clover. Chernigov Oblast, Nossov Station, South-Western Railroad

Odessa Scientific-Research Station of Field Culture. Field crops, soya bean. Odessa Oblast, Vigoda Station, Odessa Railroad

Scientific-Research Institute of Grain Economy of the South-Eastern USSR, accorded the Red Labor Banner. Saratov, p/ya 20

Penza Oblast Experiment Station of Field Culture. Field crops, hemp, Penza Oblast, p/o Lunino

VIR — Polar Experiment Station. Murmansk, Kirovsk

SIB-NIIZKHOZ — Siberian Scientific-Research Institute of Grain Economy, accorded the order of Red Labor Banner. Omsk, p/ya 12

UNIIZKH — Ukrainian Scientific-Research Institute of Grain Economy, imeni Kibishev. Dnepropetrovsk, Dzerzhinski Street 29

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UNIISOZ — Ukrainian Scientific-Research Institute of Socialist Agriculture. Field crops, makhorka, kok-saghyz. Kiev, Lenin Street 46

UNDISOZ — Kharkov Scientific-Research Institute of Socialist Agriculture. Field, legumes and new crops. Kharkov, Tschaikovsky Street 4

Kharkov Government Selection Station. Grain, legumes, sunflower, sugar beet. Kharkov, Stalin Prospect, 142

Chakin Government Selection Station. Grain, leguminous crops; sunflower. Tambov Oblast. Rshakinski region, p/o Chakino

Chuiski Agricultural Experiment Station. Field and new bast crops. Kirghiz SSR. Keganovich region, p/o Mishne Chuiskoe

Shatilov Government Selection Station. Grain, oil-and forage crops; flax. Orlov Oblast, p/o Shatilovo.

End of List

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Moscow, Sel'khozgiz, 1948. 830 p. 1: 783-786. 464.4 N22S

Translated by S. N. Monson

FORAGE GRASSES

VIK - All-Union Scientific-Research Institute of Forage Crops, imeni Williams. Moscow Oblast, post office Lugovaiia.

- Ukrainian Branch of All-Union Institute of Forage. Poltava, Shvedskaiia, 86.

COTTON PLANTS

- Azerbaijan Scientific-Research Institute of Agriculture. Azerbaijan SSR, Kirov-Abad, Railroad Station.

NOVNIKHI - Scientific-Research Institute of Cotton Growing in New Regions. Cotton and other crops of cotton crop rotation. Stavropol region, Buddenovsk.

- Ukrainian Experiment Cotton Station. Cotton, lucerne, - Kherson, p/ya 489.

SOUZNIKHI - Central Station of Plant Protection. Pests and diseases of cotton and other field crops and fruits. Tashkent 17, Chimkentski tupik 3-rd, 10.

FLAX AND CLOVER

VNIIL - All-Union Scientific-Research Institute of Flax. Kalinin District, city of Torzhok, Lunacharski Street 37.

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RUBBER BEARING PLANTS

VNIIK - All-Union Scientific-Research Institute of Rubber-Bearing Plants. Moscow 61, Cherkizovo, Pugachev Street 17.

RICE

- All-Union Rice Experiment Station. Krasnodar, Sedin Street, 104.
- Azerbaijan Rice Experiment Station. Azerbaijan SSR, Lenkoran, p/ya 26.
- Uzbek Rice Experiment Station. Tashkent, p/o p/ya 36.
- Ukrainian Rice Experiment Station. Kherson District, city of Voznesensk p/ya, 67.

HEMP AND NEW BAST CROPS

VNIILK - All-Union Scientific-Research Institute of Bast Crops. Hemp, Hibiscus canna, jute, ramie. Sumskii District, city of Gluchov, Lenin Street 27.

VNIILK - North-Caucasian Experiment Station of Bast Crops. Hemp, Hibiscus canna, Chinese bell flower, jute. Krasnodar, Yankovski Street 56.

OIL PLANTS

BNIIMK - All-Union Scientific-Research Institute of Oil Crops. Krasnodar, Kruglik 1, p/ya 10.

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TOBACCO

VITIM - All-Union Scientific-Research Institute of Tobacco and Makhorka. Krasnodar, p/ya 55.

VITIM - Ukrainian Branch, Chernigov District, Prikumski region, Perevaloohnoe village.

VITIM - Abkhazski Zonal Experiment Tobacco Station. Sukhumii, Engels Street 35.

VITIM - Crimean Zonal Experiment Station for Tobacco. Yalta, Khalturin Street 47.

VITIM - Frunze Zonal Experiment Station for Tobacco. Khirghiz SSR, Frunze, p/ya 25.

MEDICINAL PLANTS

VILAR - All-Union Scientific-Research Institute of Medicinal Plants. Moscow Oblast, p/o Lenino-Dachnoe.

ETHER-OIL PLANTS

VIEMP - All-Union Scientific-Research Institute of Ether-Oil Plants. Moscow Oblast, Pushkino Station, Northern Railroad, 1st Sorebrianskaya, 1.

HOPS

- Republic Scientific-Research Station of Hop Growing. Moscow Oblast, p/o Ashunino.

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SUGAR BEETS

VNIISP - All-Union Scientific-Research Institute of Sugar Beet Crops. Moscow Oblast, Butovo Station, Dzerzhinski Railroad.

VNIS - All-Union Scientific-Research Institute of Sugar Beet Industry. Kiev, Batiev Mountain, Klinicheskaya, 23.

VNIS - Ramon Selective Experiment Station. Voronezh Oblast, Berezovski district, p/o Ramoni.

- Biiski Sugar Beet Selection Station. Altai Territory, p/o Sveklovichnoye.

POTATOES

NIIKH - Scientific-Research Institute of Potato Economy. Moscow Oblast, Malakhov Station, Lenin Railroad.

NIIKH - Lenin Zonal Potato Experiment Station. Leningrad Oblast, Volosov district, p/o Kurkovitsi.

NIIKH - Ulianovskaya Experiment Station of Potato Economy. Ulianovsk, p/ya, 20.

VNIIS - Kiev Experiment Station for Potato Culture. Kiev Oblast, Borodianski district, p/o Nemeshaevo.

VEGETABLE CROPS

NIIOKH - Scientific-Research Institute of Vegetable Economy. Moscow 129, Tekstilshchik Place, Kursk Railroad.

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- Adler Vegetable Experiment Station. Krasnodar Territory, p/o Adler

NIIOKH - Gribov Selection - Vegetable Experiment Station. Moscow Oblast, Pioneer Station, Western Railroad.

NIIOKH - Biruchekutskaya Vegetable Experiment Station. Rostov Oblast, Novocherkassk, Krasnoarmeiskaya, 59.

NIIOKH - Verchnekhavskaya Vegetable Selection Experiment Station. Voronezh Oblast, Verchniaya Khava.

NIIOKH - West-Siberian Vegetable Experiment Station. Altai Territory, Barnaoul, p/o Lebiazhie.

NIIOKH - Far-Eastern Vegetable Experiment Station. Khabarovsk Territory, Viazemsk Station.

NIIOKH - All-Union Station for Onion Culture. Penza Oblast, Bessonovka village.

- Dnepropetrovsk Selection-Experiment Vegetable-Melon Field and Potato Station. Dnepropetrovsk Oblast, Karl Marx village.

- Odessa Selection Vegetable-Potato Experiment Station. Odessa, Lenin village.

- Kharkov Selection-Experiment Vegetable-Potato Station. Kharkov Oblast, city of Merefa.

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- Turkmen Fruit-Vegetable and Potato Experiment Station, Ashkhabad, Bagir.
- Uzbek Republic Vegetable Experiment Station. Tashkent, p/o Kara-Su.

FRUIT CROPS

- Mleev Experiment Fruit Growing Station. Kiev Oblast, Gorodishchenski district, Mleevo village.
- Tadzhik Scientific-Research Institute of Fruit, Grape and Vegetable Growing; fruit, berry, vegetable and melon crops, grapes, potatoes. Stalinabad, p/ya 154.
- I. V. Michurin Scientific-Research Institute of Fruit Growing, Michurinsk.
- Ukrainian Scientific-Research Institute of Fruit and Berry Growing. Kiev, Kitaevo, 46.

GRAPE VINES

- Anapski Experiment Station of Grape Culture. Krasnodar Oblast, Anapa, Novorossiisk, 157.
- Georgian Scientific-Research Institute of Grape and Viniculture. Rostov Oblast, Novocherkassk, Arsenalnaia, 15.
- Uzbek Scientific-Research Institute of Vini-and Wine-Culture. Samarkand, p/ya 46.

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- Azerbaijan Experiment Station of Vini-and Wine-Culture. Azerbaijan SSR, Kirov-Abad, Railroad Station.

SUB-TROPICAL CROPS

AZNIIMN - Azerbaijan Scientific-Research Institute of Perennial Plantings; Sub-tropical, nut-bearing, and fruit crops, tung. Baku, p/o Mardakiani.

- All-Union Scientific-Research Institute of Dry Sub-Tropical Plants. Sub-tropical fruit, nut-bearing, medicinal, ether-oil crops. Stalinabad, New Street 10.

- All-Union Scientific-Research Institute of Tea and Sub-Tropical Crops. Georgian SSR, Makheradzievski region, Anaseuli village.

- Sochi Experiment Station of Sub-Tropical and Southern Fruit Crops. Sub-tropical and southern fruits, citrus, tea. Krasnodar Territory, Sochi, Baugu.

POLAR AGRICULTURE

- Scientific-Research Institute of Polar Agriculture and Husbandry. Leningrad, Rakov Street 17.

INSECTO-FUNGICIDES

NIUIF - All-Union Scientific-Research Institute of Fertilization and Insecto-Fungicides. Moscow, Kaluzhski Road, 71-a.

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