BULLETIN No. 321. DECEMBER, 1909.

New York Agricultural Experiment Station.

GENEVA, N. Y.

DIRECTOR'S REPORT FOR 1909.

W. H. JORDAN.

PUBLISHED BY THE STATION.
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ADIN H. HORTON, Computer and Mailing Clerk.
†DONALD REDDICK, Ph.D., Assistant Botanist.
†FRED Z. HARTZELL, M.A., Assistant Entomologist.
†FRED E. GLADWIN, B.S., Special Agent.

Address all correspondence, not to individual members of the staff, but to the NEW YORK AGRICULTURAL EXPERIMENT STATION, GENEVA, N. Y.
The Bulletins published by the Station will be sent free to any farmer applying for them.

* Riverhead, N. Y. † Connected with the Chautauqua Grape Work. ‡ Absent on leave.
BULLETIN No. 321.

DIRECTOR'S REPORT FOR 1909.

To the Honorable Board of Control of the New York Agricultural Experiment Station:

Gentlemen.—I have the honor to submit herewith for your consideration a report of the condition and work of this institution for the year 1909. In this connection I take the liberty of presenting a statement of the additional funds and equipment which I regard as essential to the continued progress and efficiency of the Station as an agency for the advancement of New York Agriculture. Suggestions are also offered as to the proper function of an experiment station in promoting the welfare and prosperity of the farming class.

ADMINISTRATION.

STATION STAFF.

A most gratifying continuity of service by the members of the Station Staff now exists. During the year now ending no changes in the staff have occurred excepting that Stockton M. McMurrnan, B. S., was appointed as Assistant Botanist to assume temporarily the duties of a member of the botanical staff now absent for the purpose of further study.

MAINTENANCE FUNDS.

The funds available for the support of the Station for the fiscal year beginning October 1, 1909, are as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries</td>
<td>$40,000</td>
</tr>
<tr>
<td>Labor</td>
<td>15,000</td>
</tr>
<tr>
<td>Maintenance and distribution of scientific work of Station departments</td>
<td>22,500</td>
</tr>
<tr>
<td>General expense, heat, light, repairs, etc.</td>
<td>5,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$83,000</strong></td>
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</table>
Expense of work required by Commissioner of Agriculture.

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizer inspection</td>
<td>$10,000</td>
</tr>
<tr>
<td>Feeding stuff inspection</td>
<td>3,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$13,500</strong></td>
</tr>
</tbody>
</table>

By order of your Board the following appropriations are to be requested of the Legislature of 1910, for the support of the Station for the fiscal year beginning October 1, 1910.

For the general maintenance of the Station:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Salaries</td>
<td>$47,000</td>
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<tr>
<td>Labor</td>
<td>15,800</td>
</tr>
<tr>
<td>Maintenance and distribution of scientific work of Station departments</td>
<td>22,500</td>
</tr>
<tr>
<td>General expense, heat, light, repairs, etc.</td>
<td>5,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$90,800</strong></td>
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</table>

Expense of work required by the Commissioner of Agriculture:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizer inspection</td>
<td>$10,000</td>
</tr>
<tr>
<td>Feeding stuff inspection</td>
<td>3,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$13,500</strong></td>
</tr>
</tbody>
</table>

The above items are similar to those allowed by the Legislature of 1909 excepting that $7,000 more is asked for salaries and $800 more for labor.

An addition to the salary item appears to be demanded by conditions over which the management of the Station has no control. On account of the competition among agricultural colleges and experiment stations in securing the services of well equipped and experienced teachers and investigators the maintenance of an efficient staff at the Station has assumed a somewhat critical stage. Persons competent to serve these institutions efficiently are not being trained in numbers proportional to the rapid increase of funds that are set aside for agricultural education and research; and other institutions now receiving increases of federal and State support, in seeking to enlarge their staffs, are offering larger salaries than the leading members of the Station Staff are
now receiving. In order to retain these men, whose places could be filled only at higher salaries, and with difficulty even then, it seems imperative that their compensation be increased. The efficiency of any institution is measured by the efficiency of its men. After a careful consideration of the whole question it was decided that the additional sum of $7,000 will be needed to maintain the Station Staff on its present basis.

The increased rates of wages and the enlarging equipment and activities of the Station are requiring a larger labor fund and it is estimated that a minimum increase to this fund of $800 will be needed for the next fiscal year.

**STATION PUBLICATIONS.**

The following is an approximately accurate statement of the number of names on the Station mailing lists at the present time to which Station bulletins are sent:

<table>
<thead>
<tr>
<th>Popular Bulletins</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents of New York</td>
<td>37,155</td>
</tr>
<tr>
<td>Residents of other states</td>
<td>2,730</td>
</tr>
<tr>
<td>Newspapers</td>
<td>770</td>
</tr>
<tr>
<td>Experiment stations and their staffs</td>
<td>1,481</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>42,236</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Complete Bulletins</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment stations and their staffs</td>
<td>1,481</td>
</tr>
<tr>
<td>Libraries, scientists, etc.</td>
<td>200</td>
</tr>
<tr>
<td>Foreign list</td>
<td>276</td>
</tr>
<tr>
<td>Individuals</td>
<td>3,700</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5,760</td>
</tr>
</tbody>
</table>

Early in 1909 the publication known as “The Grapes of New York,” being Part II of the Station Report for 1907, became available for distribution. Nine thousand copies were printed, of which two thousand were assigned to this institution. There is an active demand for this work, not only in New York but throughout the United States, and the supply does not meet the demand for even our own State. Requests for “The Apples of
New York," the distribution of which was begun in 1904, are still being made in considerable numbers, many of which cannot be met.

The third publication in the series, "The Plums of New York" is now in preparation and the copy will be submitted as a part of the Station Report for 1910.

REPAIRS.

By the use of a special appropriation of $2,500 granted by the Legislature of 1909, all of the Station buildings excepting the new houses have been painted and numerous other needed repairs have been made. Before long quite an extensive renovation should be given to the Chemical Laboratory which has had little attention since its erection in 1891–2.

ELECTRICAL EQUIPMENT.

Since the opening of the year the Station has become equipped for the use of electricity as a motor power and for lighting. Motors are now used for running the refrigerating plant, the mills for grinding samples in the Chemical Laboratory, and the milking machine; and the main buildings, including the stables, are thoroughly equipped with electric lights.

A BUILDING NEEDED FOR ADMINISTRATIVE AND DEMONSTRATION PURPOSES.

The Legislature of 1909 appropriated $40,000 for the erection at the Station of a new building to be used mainly for the purposes of administration and demonstration. This sum was $20,000 less than was asked for this purpose. The Governor felt the necessity of disallowing this item and so it is necessary to again make an appeal for the funds necessary for the erection of the proposed structure.

The reasons why this building is needed have been fully presented in two previous reports, a brief abstract of which is given in this connection:
(1) The building, formerly a dwelling house, now occupied for administration purposes should be devoted to caring for unmarried members of the Station Staff who now must procure their meals at a mile or more and a half distance from the Station. Administrative quarters should, therefore, be provided elsewhere.

(2) The Station is greatly in need of space in which to make an objective display of the results it has reached.

(3) There is no place at the institution where even a small audience can be assembled excepting out of doors in pleasant weather.

For a fuller statement of the above considerations reference is made to the Station Reports for 1907 and 1908.

INVESTIGATIONS IN THE INTEREST OF GRAPE GROWING IN CHAUTAUQUA COUNTY.

The Legislature of 1909, by special enactment, appropriated $10,000 for the purpose of inaugurating an extended study of the conditions attending grape growing in Chautauqua County. This action was taken without solicitation on the part of the Station authorities at the earnest request of a large body of grape growers. The reason assigned for this demand for help was that the vineyards of western New York appeared to be suffering a marked drop in condition and productiveness, brought about undoubtedly by a combination of causes such as bad methods of culture, unfavorable moisture conditions and the serious ravages of fungus and insect pests. It was the belief of the grape growers themselves that some underlying hidden influences were menacing the vineyards and that the industry which is the sole dependence of many of them was in danger of being destroyed, but in view of the satisfactory crop of 1909 such a view is hardly tenable. It is more rational to conclude that a combination of known causes which for a few years operated in unusual numbers and with unusual severity is the explanation of the decreased output of grapes.
In obedience to legislative action the work of inquiry into vineyard problems has been organized in Chautauqua County. Thirty acres of land near Fredonia on which are twenty acres of vineyard, have been leased for a period of years, and temporary facilities have been established in connection therewith for carrying on the necessary laboratory studies.

The following persons have been employed in addition to the regular Station Staff to carry on the necessary studies:

Fred E. Gladwin, A. B., Special Agent.
Donald Reddick, Ph. D., in plant pathology.
Fred Z. Hartzell, M. A., in entomology.

Cultural experiments to extend over a series of years have been begun in the leased vineyard, and studies of fungus and insect pests have been inaugurated. During the past summer records were secured of the past and present conditions existing in not less than 75 per cent. of all the vineyards in the grape belt. It is expected that another season experiments and observations on fungus and insect pests will be considerably extended to those localities that offer good opportunities for such studies.

THE RELATION OF THE STATION TO THE EXTENSION OF AGRICULTURAL KNOWLEDGE.

There is now in progress a notable movement for the extension of knowledge among the agricultural people of the United States. This movement, which had its small beginnings more than a half century ago and has now developed to great magnitude, is taking several forms, the principal ones of a popular nature being farmers' institutes, bulletins, reading courses and other literature issued by the United States Department of Agriculture, agricultural colleges and experiment stations, demonstration work on individual farms, exhibits at fairs, addresses before agricultural bodies and personal advice to farmers by correspondence or visitation. In certain sections of the United States so called demonstration farms have been established. At least twenty-five of the
agricultural colleges have established extension departments and at the last convention of the Association of Agricultural Colleges and Experiment Stations, the constitution of the Association was amended to provide for a section to be devoted to the consideration of extension work. It is practically certain that Congress will be asked to further endow the agricultural colleges in order that these institutions may greatly enlarge their activities in the popular education of the agricultural masses. All of this effort has for its purpose, of course, the promotion of larger intelligence on the part of farmers and, as a consequence, a higher and more productive type of agriculture.

Recently several gentlemen prominent in industrial affairs have wisely and opportunely discussed in a public way the economic future of this country from the standpoint of its agricultural efficiency. They have called attention to the low yield of staple products in many parts of the United States, to the approaching balance between our production of food stuffs and our home needs and point to the time when, unless our agricultural methods improve, we will not produce the bread we consume.

It is undoubtedly true that the maximum productive capacity of the farms in the older states has not been maintained, even approximately. It is equally true that by proper methods the fertility of run-down farms may be restored and through better farm practice the average acreage production increased in New York by a large percentage, even doubled. Granting, then, the economic necessity of better farming and the possibility of attaining it, we are confronted with the question as to how this is to be brought about and what relation this institution has to the effort.

Long association with the effort of agricultural betterment generally convinces an intelligent observer that the practice on any given farm will not rise above the level of the farmer's capacity and intelligence, and that even in our most prominent agricultural states there are thousands of farms where improved methods may not reasonably be expected because the owners are
not susceptible to improvement themselves. This is the type of man who for several decades has withstood the appeals that have been made to his intelligence and business sense through agricultural literature, farmers' institutes, the example of successful neighboring farms and other influences, direct and indirect. It is urged by several prominent men, whose advice is not to be ignored, that so called model or demonstration farms be established at public expense in perhaps every county in the older states as a sure means of rescuing our agriculture from its alleged low state through the educational influence of observation and the power of example. This question cannot be discussed at length in this connection but it may well be remarked that such a scheme is almost certain to prove very disappointing. Official farming in such an extensive way would be precarious on the practical side, it would certainly be very expensive if a farm was equipped to demonstrate along all lines of agriculture important to even a single county, and there are grave reasons for believing that official success would have less influence than private success. There are thousands of farms in New York on which it is being demonstrated that generous and profitable crops may be grown, the lessons from which pass unheeded by many other neighboring farmers. Many who have had experience in the field of agricultural education in its various forms are convinced that the establishment of model farms is unwise and that the most effective demonstrations are those made on private farms, as opportunity offers for teaching a lesson important to a given locality. This plan permits the adaptation of the work to changing needs and a great variety of conditions, and involves less expense and less danger of failure than the equipment of permanent extensive establishments. But admitting, as we should, that such demonstrations may be effectively educational, it is still true that the future of agriculture will be determined by the slow processes of education that operate principally on the growing generation. We must depend upon the training and development of a type of man and not upon panaceas,
What place has the experiment station in this educational work? There seems to be a general expectation on the part of the public that an experiment station is to participate in all forms of agricultural teaching outside of school or college instruction. There exists a widespread and insistent public demand that members of the Station Staff engage in the various forms of extension teaching at institutes, from the convention platform, by means of literature and as a correspondence bureau, a demand which constitutes a real and perplexing problem for those who are attempting investigation of agricultural problems in a way that requires concentration and continuity of effort.

The work of an experiment station relates primarily to the acquisition of knowledge rather than to its dissemination. All teaching, whether academic or popular, indeed, all farm practice, must rest upon a body of knowledge that should be scientific and reliable, which it is the function of an experiment station to enlarge. Agriculture now suffers from the limitations of knowledge as well as from so-called science that is utterly unreliable, and no more essential or useful service can be rendered to the farmer and to the public in general than the discovery of new truth that makes possible greater efficiency and economy in farm management. Inquiry must precede instruction of all forms from the college class room to educational efforts of the most popular kind, and it is a serious mistake to so dissipate the energies of agricultural investigators as to render them inefficient in the peculiar field to which they are assigned.

In 1907 the Association of American Agricultural Colleges and Experiment Stations appointed a commission to consider and report on the conditions that should surround the effort at agricultural research in the United States. This Commission found that a large amount of publicity work had been required of those persons holding positions of scientific responsibility in agricultural colleges and experiment stations, thereby greatly minimizing the efficiency of the agencies that are established for agricultur-
tural research. On this point, and in relation to freeing the investigator from hampering conditions the Commission made the following statements:

"The progress of agricultural knowledge now demands that agricultural research agencies shall deal as largely as possible with fundamental problems, confining attention to such as can be adequately studied with the means available."

"The work of research in agriculture should be differentiated as fully as practicable, both in the form of organization and in the relations of the individual investigator, from executive work, routine teaching, promotion and propaganda, and should be under the immediate direction of an executive trained in the methods of science who should not be hampered by other duties of an entirely unlike character."

"The investigator should be free from all coercion whatever. In reaching his conclusions he should be equally free from the prescription of received opinion and the temptation to exploit his results for the purpose of obtaining future support. To this end, his work should be as far removed from immediate dependence upon legislation as is consistent with due responsibility to the public, and his relations to the public and to the organization of which he is a member should be such as to promote individual initiative and not interfere with freedom of conclusion or utterance on scientific questions."

REVIEW OF THE YEAR’S WORK.

DEPARTMENT OF BACTERIOLOGY.

Inoculation and lime as factors in growing alfalfa.—The object of the co-operative experiments reported in Bulletin 313 was to get a measure of the real need of inoculation and of lime in connection with the growing of alfalfa on the farms of this State, and, so far as possible, to determine the relative importance of these lines of treatment in connection with the growing of this crop.
The results from more than 100 co-operative experiments in growing alfalfa, located in over one-half of the counties of the State, indicate that where neither lime nor inoculation is applied the chance of a successful crop is not more than 20 per ct., or one chance in five. Where lime is added to the land at the rate of 1,500 pounds per acre the chance of success is raised to about 60 per ct., or about three chances out of five. Where both lime and inoculation are applied as above directed the chance of a successful crop is raised to about four out of five.

Each farmer intending to try the growing of alfalfa should restrict his seeding to a single acre and so arrange that acre as to determine what line of treatment is required by his field.

These results, obtained during 1905-08, were rendered possible only through the active co-operation of approximately 200 farmers.

_Milking machines._—The perfection of a mechanical cow milker would be a more important advance in dairying than has occurred since the introduction of the centrifugal cream separator.

For the past three years milking machines have been in use in the Station dairy and some of our observations are given in Bulletin 317. These are confined to the effect of methods of handling the machines upon the germ content of the milk.

Where the machines were given only a good washing each day the milk had a very high germ content and soured quickly. Keeping the rubber parts of the machine in a 10 per ct. salt solution between milkings markedly reduced the germ content. When the machines were provided with sufficiently large air filters and these were properly filled with cotton the germ content was still further reduced. When both of these matters were attended to and the machines were handled carefully in all respects the germ content of the milk compared favorably with that ordinarily obtained under similar barn conditions.

_Bacterial soft rots of certain vegetables._—The common vegetables are often subject to soft rots which are of considerable
economic importance, particularly in the cabbage and cauliflower industry of Long Island. For some years certain of these rots have been studied jointly at this Station and the Vermont Agricultural Experiment Station and the results of a part of this study are given in Technical Bulletin 11. The first part of the bulletin shows that the organisms are identical and the second part describes the bacterial enzymes by means of which the bacteria destroy the plant tissue.

DEPARTMENT OF BOTANY.

Potato spraying experiments.—During the season of 1908 the potato spraying experiments begun in 1902 were continued along the same lines as in previous years. The results have been published in Bulletin 311. In the ten-year experiment at Geneva six sprayings increased the yield 29 bu. per acre, while three sprayings increased it 29.5 bu. In the duplicate of this experiment at Riverhead, Long Island, the gain due to five sprayings was 15.3 bu. per acre and to three sprayings 10.75 bu. In fourteen farmers' business experiments, including 200 acres, the average gain due to spraying was 18.5 bu. per acre; the average total expense of spraying was $4.30 per acre and the average net profit $8.53 per acre. Eleven volunteer experimenters reported gains averaging 66.3 bu. per acre.

Thus far the results are highly favorable to the practice of spraying. In the ten-year experiments at Geneva the average gain for seven years from spraying every two weeks has been 110 bu. per acre, and from spraying three times during the season, 84 bu. At Riverhead the corresponding gains have been smaller — 54 and 29.3 bu. respectively. In 76 business experiments made in six years the average gain due to spraying has been 43.8 bu. per acre and the average net profit from spraying $17.94 per acre. In 188 volunteer experiments reported in five years the average gain from spraying was 50.5 bu. per acre.
A *Mycosphaerella* wilt of melons.—The muskmelons in one of the Station greenhouses were much damaged during 1907–8 by an uncommon disease. The vines were parasitized by a fungus (*Mycosphaerella*) shortly before the earliest melons were ripe. The disease was preceded, in both instances, by the attacks of a red spider, though in 1908 the damage by the spiders was but slight. The fungus is reported as causing a disease of several cucurbits in the fields in some parts of Delaware, but had never been recorded for this State. Since the Delaware reports differed in some respects from the observations made at this Station in 1907, nothing was published till further information could be obtained on the points of difference. The observations were repeated and extended in 1908.

The pathogenicity of the fungus and the relation of its two spore-forms are established. Inoculation experiments were effective, and, with but a few exceptions, the spore-forms of the fungus always appeared successively on the inoculated vines.

Though this disease has recently been found destructive in several of the southeastern States, it is seemingly harmful only in melon greenhouses of this State. For a fuller report see Technical Bulletin 9.

*Crown-rot, arsenical poisoning and winter-injury.—* Crown-rot has been attributed to parasitic organisms, to arsenical poisoning and also to low temperature. From the available literature reviewed and from recent observations (though there are many contradictions) there seems little doubt about its being due to low temperatures, primarily. But the relation of the main secondary factors, such as the type of soil, soil moisture, stock-scion relations, and wood-maturity, to each other and to the primary cause, need investigation; and as a consequence proper preventive measures, based upon general principles cannot be formulated, but long expensive tests must be made to determine these matters for each locality.

A fuller account is found in Technical Bulletin 12,
A **simple casein test.**—There has long been a need for some simple and rapid method by which the amount of casein in milk can be determined. Such a method has been finally worked out in our chemical department. The method can be readily used by any one who is accustomed to the determination of acidity of cream at creameries or of whey at cheese factories. It calls for simple apparatus only and involves the use of no complicated, expensive machinery. The method will find extensive application in dairy schools, in all investigations of milk calling for casein determinations, at cheese factories, where, in case of abnormal milk, as in times of drouth, it is desirable to know the amount of casein in order to make cheese to best advantage. This test is described in Technical Bulletin 10.

A **chemical study of lime-sulphur washes.**—This investigation was undertaken to solve some of the difficulties which fruit growers have met in making and using lime-sulphur washes. Conditions of preparation were studied and also the composition of commercial washes. The results, as given in Bulletin 319, indicate that a concentrated preparation can be best made by using 125 pounds of sulphur, 60 pounds of lime of best commercial quality and water enough to make 50 gallons, the whole to be boiled about 60 minutes. The presence of magnesium oxide in lime is a serious detriment, since it causes loss of sulphur by producing hydrogen sulphide gas, which is also poisonous and may affect uncomfortably persons who are near the boiling mixture for any length of time. The addition of lime to a diluted wash causes marked chemical changes which affect seriously the insecticidal value of the wash. The commercial preparations examined varied considerably in composition. One brand contained considerable sediment, for which peculiar insecticidal value was claimed. This sediment consists largely of sulphite of lime which has not been reliably shown to have any marked insecticidal properties.
ENTOMOLOGICAL DEPARTMENT

The tussock moth in orchards.—The tussock moth (Hemero-campa leucostigma) appeared in more than its usual numbers during the summer of 1908 in the rural districts of western New York. A noteworthy feature of the outbreak was the presence of the caterpillars in orchards in several communities, where they did considerable damage to young fruits. The ravages of the pests were especially noticeable in the vicinity of Lockport, Ransomville and Middleport. A bulletin prepared by the Station, No. 312, contains a very complete account of the life history and habits of the insect, with full instructions by which destructive outbreaks may be completely prevented.

Commercial lime-sulphur mixtures.—During recent years, commercial preparations of the lime-sulphur wash have been introduced into this state, and in several centers of fruit production they have been extensively used to combat certain injurious insects and plant diseases. Thorough spraying with these mixtures at effective strengths has generally given satisfactory results on the scale and the blister-mite. The commercial brands appear to be efficient substitutes for the home-made wash.

The attention of fruit growers is especially called to the variations in the densities of the clear solution, and in the amounts of sediment in the different brands. The range of density was from 26.8 to 33.9 degrees Beaumé, and the variation in sediment was from 0 to 19.42 per ct. Manufacturers of the leading brands are now establishing a standard strength for their solutions which they guarantee to the purchaser.

The strengths of effective mixtures for the scale, using a solution testing 33 degrees Beaumé, range from one gallon of the concentrate diluted with eight gallons of water to one gallon diluted with eleven gallons of water. In orchards in which the scale is not thoroughly controlled the stronger mixtures are recommended. A dilution of one gallon of the concentrate to eleven gallons of water makes an effective spray. Present evidence indi-
cates that the common spraying arsenicals may be safely combined with diluted lime-sulphur solutions.

Directions are given for making the home-made concentrated lime-sulphur wash. This method of preparing a sulphur spray has several advantages and should be tested by fruit growers to determine its applicability under their own conditions.

DEPARTMENT OF HORTICULTURE.

A comparison of tillage and sod mulch in an apple orchard.—In Bulletin 314 an attempt is made to answer the question as to whether the apple thrives better under tillage or in sod. The method of tillage chosen for the experiment was to plow in the spring, cultivate until late July, and follow with a cover crop. The sod method chosen was that known as the sod-mulch method in which the grass is cut as a mulch. The experiment was begun in 1903 in the orchard of W. D. Auchter, near Rochester, New York. This orchard consists of nine and one-half acres of Baldwin trees set in 1877, forty feet apart each way. The number of trees in the sod plat is 118; in the tilled plat, 121. In typography the Auchter orchard is rolling. The soil is a Dunkirk loam to a depth of ten inches, underlain by a sandy subsoil. The trees in the two plats received identical care in all orchard operations excepting soil treatment. The grass in the sod plat was cut twice in three of the five years, in the other two but once. The tilled land was plowed each spring and cultivated from four to seven times. Statements of results follow:

The average yield on the sod plat for the five years was 72.9 barrels per acre; for the tilled plat, 109.2 barrels; difference in favor of tilled plat, 36.3 barrels. Estimates made at blooming and fruiting time showed a far greater number of fruits on the tilled trees. Actual count showed 434 apples per barrel on the sod land weighing 5.01 ounces each and 309 apples per barrel on the tilled plat weighing 7.04 ounces each. The fruit from the sod-mulch plat matures from one to three weeks earlier than that on the tilled plat. In common storage fruit from the tilled plat
keeps four weeks longer than that from the sod plat. In cold storage, the keeping quality of the two fruits is the same. The tilled fruit is decidedly better in quality, being crisper, more juicy and of better flavor. The advantage of tillage over the sod-mulch in the matter of uniformity of trees and crops is marked. The trees in sod showed abnormalities in foliage, branches, roots and particularly in fruit-bearing and in fruit characters. The average gain in diameter of trunk for the trees in sod for the five years was 1.1 inches; for the trees under tillage 2.1 inches; gain in favor of tillage, 1 inch. The dark, rich green color of the foliage of the tilled trees indicated that the tilled trees were in the best of health. The leaves of the tilled trees were much larger and much more numerous. Leaves from sodded trees and the same number (2,400) from tilled trees were weighed and gave 8.7 grams as the average weight per leaf for the sodded trees and 11.5 grams for the tilled trees. The leaves of the tilled trees came out three or four days earlier and remained on the trees a week or ten days later than on the sodded trees. The average annual growth of branches for the sodded trees was 1.9 inches; for the tilled trees 4.4 inches. The average number of laterals per branch on the sodded trees was 3.4; on the tilled trees 6.7. The new wood on the tilled trees was plumper and brighter in color, indicating better health. The amount of dead wood in the sod-mulch trees was much greater than in the tilled trees. The roots of the trees in the sod-mulch plat came to the very surface of the ground. In the tilled land the roots were found in greatest abundance at a depth of from three to ten inches. The circumference of the root systems in the tilled trees is approximately circular, but the circumference of the roots of the trees in sod is very irregular, indicating a reaching out of a part of the roots in response to a demand for more moisture, food, or air. The average cost per acre for the two methods of management, not including harvesting, was $17.92 for the sod; and $24.47 for tillage, giving a difference of $6.55 in favor of the sod. The average net income per acre for the sod plat was $71.52; for the tilled plat $110.43, a differ-
ence of $38.91 in favor of tillage, an increase of 54 per ct. for tillage over the sod-mulch method of management.

Tillage seems to be better than sod for the apple for the following reasons: The results of 120 moisture determinations in the Auchter orchard show that the differences in tree growth and crop in the two plats of this experiment are mainly due to differences in moisture, the tilled plat having most moisture. As a consequence of the reduced water supply in the sod plat, there is a reduced food supply; for it is only through the medium of free water that plants can take in food. Analyses show that the differences between the actual amounts of plant food in the two plats are very small. Analyses show that there is more humus in the tilled plat than in the sod plat, contradicting the oft-made assertion that the tillage method of managing an orchard "burns out the humus." At a depth of six inches, the tilled soil is 1.1 degrees warmer in the morning and 1.7 degrees at night, than the sod land; at twelve inches the tilled soil is 2.3 degrees warmer in the morning and 1.8 degrees in the evening. We are justified, without the presentation of specific data, in saying that a tilled soil is better aerated than sodden land. Soil investigators are well agreed that beneficial micro-organisms are found in greater numbers in a cultivated soil than in other soils.

The following application of the results of this experiment may be made: Nearly all the plants which minister to the needs of men are improved by tillage; the apple does not seem to be an exception. Results as positive as in this experiment can be made very comprehensive; they should apply to all varieties of apples and to nearly all soils and locations. The experiment does not show that apples cannot be grown in sod; it suggests, however, that apples thrive in sod, not because of the sod but in spite of it. While moisture is by no means the only factor to be considered in the controversy over the sod and tillage methods of managements, it appears to be the chief one. There is nothing in this experiment to indicate that trees will become adapted to grass.
The grape districts of New York and table of varieties.—The basis of Bulletin 315 is "The Grapes of New York," prepared by this Station and published by the State Department of Agriculture. In collecting the material for the grape book, much valuable information was contributed by the grape-growers of New York in co-operation with the Station. The edition of the larger work was necessarily limited. It was the purpose of this bulletin to place before the grape-growers an accurate summary of the information contained in the grape book. The bulletin contains: First, a discussion of the natural factors influencing grape culture. Second, an account of the location, soil, climate, history and present status of the four great grape districts of New York. Third, a brief description of the most important species of Vitis, giving their natural habitat, botanical differences and horticultural importance, with the object of showing their significance in varieties. Fourth, a table of 161 of the most important varieties, giving the species, fruit and vine characters, date and place of origin or introduction, and a brief statement of their value for the grower.

INSPECTION WORK.

Fertilizers.—During the year 1909, 722 samples of fertilizers were received from the Commissioner for analysis, and results of their examination are given in Bulletin 318. The chemical staff of the Station has also furnished evidence in several suits that have been brought by the Commissioner of Agriculture for violation of the fertilizer law.

Feeding stuffs.—The number of samples of feeding stuffs analyzed at the request of the Commissioner of Agriculture during the past year has been 403. Bulletin 316 contains the results of these analyses. It is shown, as has been the case for several years, that many brands of feeding stuffs, especially those that are compounded from two or more ingredients, contain materials of very inferior quality, such as ground corn cobs, oat hulls, ground peanut shells, mill screenings and elevator sweepings. It is hoped that the amendment to the feeding stuff law, requiring
manufacturers to state the ingredients that enter into a mixed feed, will greatly aid consumers in avoiding feeds that are inferior in quality.

PUBLICATIONS ISSUED DURING 1909.

BULLETINS.


No. 316. August. Inspection of feeding stuffs. Pages 89.


TECHNICAL BULLETINS.


No. 11. November. Bacterial soft rots of certain vegetables. I. Studies of the causal organisms. H. A. Harding and W. J. Morse. II. Pectinase, the cytolytic enzyme produced by Bacillus carotovorus and certain other soft rot organisms. L. R. Jones. Pages 120, figs. 10.


CIRCULARS.


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