DIRECTOR'S REPORT FOR 1917.

W. H. JORDAN.
BOARD OF CONTROL.
Governor Charles S. Whitman, Albany.
Commissioner Charles S. Wilson, Albany.
Parker Corning, Albany.
Frank M. Bradley, Barkers.
Charles C. Sackett, Canandaigua.
Alfred G. Lewis, Geneva.
John B. Mulford, Lodi.
Irving Rouse, Rochester.
C. Fred. Boshart, Lowville.

OFFICERS OF THE BOARD.
Commissioner Charles S. Wilson,
President.
William O'Hanlon,
Secretary and Treasurer.

STATION STAFF.

George W. Churchill,
Agriculturist and Superintendent of Labor.

†Reginald C. Collison, M.S.,
Agronomist.

James E. Mensching, M.S.,
Associate Chemist (Agronomy).

†William W. Baer, B.S.,
Assistant Chemist (Soils).

Everett P. Reed, B.S.A.,
Assistant Agronomist.

William P. Wheeler,
First Assistant (Animal Industry).

Robert S. Breed, Ph.D., Bacteriologist.
Harold J. Conn, Ph.D.,
Associate Bacteriologist.

Godefrey L. A. Ruehle, M.S.,
†James D. Brew, B.S.,
John Bright, M.S.,
Assistant Bacteriologists.

Fred C. Stewart, M.S.,
Botanist.
Walter O. Gloyer, M.A.,
Associate Botanist.

Mancel T. Munn, M.S.,
Assistant Botanist.

Lucius L. Van Slyke, Ph.D., Chemist.
†Rudolph J. Anderson, B.S.,
Arthur W. Clark, B.S.,
John C. Baker, Ph.D.,
Associate Chemists.

Morgan P. Sweeney, A.M.,
Otto McCrart, B.S.,
Richard F. Keefer, A.B.,
William F. Walsh, B.S.,
Walter L. Kulp, B.S.,
Assistant Chemists.

George A. Smith,
Dairy Expert.
Frank H. Hall, B.S.,
Vice-Director; Editor and Librarian.
Percival J. Parrott, M.A.,
Entomologist.
Hugh Glasgow, Ph.D.,
*Fred Z. Hartzell, M.A. (Fredonia),
Associate Entomologists.
Harold E. Hodgkiss, B.S.,
Bentley B. Fulton, M.S.,
Assistant Entomologists.

Ulysses P. Hedrick, Sc.D.,
Horticulturist.

Roy D. Anthony, M.S.A.,
*Fred E. Gladwin, B.S. (Fredonia),
Associate Horticulturists.

George H. Howe, B.S.A.,
Joseph W. Wellington, B.S.,
William C. Stone, M.S.,
Assistant Horticulturists.

Orrin M. Taylor,
Foreman in Horticulture.
F. Atwood Sirrine, M.S. (Riverhead),
Special Agent.

Jessie A. Sperry, Director's Secretary.
Frank E. Newton,
Willard F. Patchin,
Lena G. Curtis,
Mad M. Melvin,
Maude L. Hogan,
M. Loraine Horton,
Clerks and Stenographers.

Elizabeth Jones,
Computer and Mailing Clerk.

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.

*Connected with Grape Culture Investigations.
†On leave.
BULLETIN No. 445.

DIRECTOR’S REPORT FOR 1917.

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

Gentlemen.—I have the honor to present to you a report of the operations of this institution, for the calendar year 1917, together with a review of changes that have come to the Station during the year, and a statement of certain of its needs.

It cannot be said at the end of any short period of time that the general activities of the Station have materially changed. It is true that new problems arise and old ones are set aside. These problems always relate to agricultural production, and the use of crops in the form of cattle foods and human foods. Much of the effort of the Station is directed toward defense of farmers and fruit growers against the devastation of insect and fungus pests. It is also our duty to assist the Commissioner of Agriculture in the inspection of such commodities as fertilizers and cattle feeds, and fungicide and insecticide materials.

The institution has not escaped the effects of the war. Not only have members of the Station Staff been called into service, but throughout the entire institution there is felt the depressing influence of the gigantic and critical conditions in which this nation is engaged. All communities and institutions now are in the midst of an atmosphere unfavorable to the concentration of thought and effort on the usual activities of life.

ADMINISTRATION.

STATION STAFF.

No year passes without more or less change in the personnel of the Station Staff.

Joseph F. Barker, M.S., who was connected with the institution as Agronomist since 1911, resigned his position on September first. The occasion of his resignation was a call to a responsible position.
in the Ohio State University at an increased salary and to opportunities which he regarded as especially desirable. During the time Mr. Barker was connected with the Institution he gave to his work industry and zeal, his earnest effort being to accomplish for the agricultural interests of the State the greatest amount of good.

Lloyd A. Bosworth, M.S., who occupied the position of Assistant Chemist for the brief space of one month resigned his position to accept a position in the Philippine Islands.

Reginald C. Collison, M.S., Associate Chemist, because of the satisfactory services which he had rendered the Institution since his appointment in 1912, was promoted to the position vacated by Mr. Barker, his appointment taking effect on September 1, 1917.

James E. Mensching, M.S., was appointed Associate Chemist to fill the vacancy created by the promotion of Mr. Collison. His term of service began on September first. Mr. Mensching is a graduate of the Ohio State University and at the time of his appointment was associated with Dr. H. P. Armsby in Animal Nutrition work at the Pennsylvania Experiment Station.

Walter L. Kulp, M.S., was appointed in the position of Assistant Chemist to fill the place of Arthur J. Flume, his appointment taking effect on May 20, 1917.

Rudolph J. Anderson, B.S., Associate Chemist, having offered his services to the Federal Government, has been assigned to a position in the Surgeon General's Department with the rank of Captain. Mr. Anderson's work will be related to the feeding of the army, a service which he is admirably fitted to render.

William W. Baer, B.S., Assistant Chemist, enlisted in the United States Navy and was called into service in June. After the necessary training he has been given the rank of Ensign.

Donald B. Clayton, being a member of Company B, of the National Guard was called into service very soon after the declaration of war and is now serving as bugler in an officers' corps.

F. H. Hall, B.S., Vice-Director, Editor and Librarian, has been requisitioned by the Federal Food Administration to aid in preparing various publications and utterances sent out from that division of our Federal Government. His experience for nearly twenty years as Editor of the publications of this Institution, a service requiring a broad knowledge of the various phases of agricultural science, has admirably fitted Mr. Hall for the duties he is now fulfilling. It is
understood that he is rendering highly satisfactory services, while it is still possible for him to carry on most of the editorial work of the Station.

The Director of the Station very soon after the declaration of war began to interest himself in food conservation and has endeavored through public addresses and the instruction of classes in war dietetics to promote such economy in the use of food resources as is required by war conditions. Later he was asked by Mr. Hoover to serve on the Federal Milk Commission for the purpose of establishing milk prices for the City of New York. This service is not yet completed.

MAINTENANCE FUND.

The following appropriations were made available for the use of the Station during the fiscal year beginning July 1, 1917.

<table>
<thead>
<tr>
<th>General Fund</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Salaries</td>
<td></td>
</tr>
<tr>
<td>Administration</td>
<td>$13,260 00</td>
</tr>
<tr>
<td>Research</td>
<td>56,400 00</td>
</tr>
<tr>
<td></td>
<td>$69,660 00</td>
</tr>
<tr>
<td>Labor</td>
<td></td>
</tr>
<tr>
<td>Wages, regular</td>
<td>86,760 00</td>
</tr>
<tr>
<td>Wages, temporary</td>
<td>15,200 00</td>
</tr>
<tr>
<td></td>
<td>21,960 00</td>
</tr>
<tr>
<td>Maintenance and operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>31,830 00</td>
</tr>
<tr>
<td></td>
<td>$123,450 00</td>
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</table>

<table>
<thead>
<tr>
<th>Inspection Fund.</th>
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<tbody>
<tr>
<td>Salaries</td>
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<td>Labor, regular and temporary</td>
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<tr>
<td>Total for inspection</td>
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<tr>
<td>Total appropriation</td>
<td>$138,495 00</td>
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<tr>
<td>Salaries for all divisions</td>
<td>$83,190 00</td>
</tr>
<tr>
<td>Labor, regular</td>
<td>7,600 00</td>
</tr>
<tr>
<td>Labor, temporary</td>
<td>15,875 00</td>
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<tr>
<td>Maintenance and operation</td>
<td>31,830 00</td>
</tr>
<tr>
<td></td>
<td>$138,495 00</td>
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</tbody>
</table>

The amount appropriated was $6,379.80 less than the request of the Board of Control.

In accordance with the action of your Board the following budget for the fiscal year beginning July 1, 1918, has been presented to the
Governor's Budget Committee. It is not yet acted upon by the Legislative Budget Committee.

<table>
<thead>
<tr>
<th>General Fund</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Salaries</strong></td>
<td></td>
</tr>
<tr>
<td>Administration</td>
<td>$13,560 00</td>
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<tr>
<td>Research</td>
<td>59,250 00</td>
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<tr>
<td><strong>Total</strong></td>
<td>$72,810 00</td>
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<tr>
<td><strong>Labor</strong></td>
<td></td>
</tr>
<tr>
<td>Wages, regular</td>
<td>$7,020 00</td>
</tr>
<tr>
<td>Wages, temporary</td>
<td>20,000 00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>27,020 00</td>
</tr>
<tr>
<td>Maintenance and operation</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$99,830 00</td>
</tr>
<tr>
<td><strong>Total Appropriation</strong></td>
<td>$162,905 00</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Inspection Fund</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Salaries</strong></td>
<td></td>
</tr>
<tr>
<td>Labor, regular and temporary</td>
<td>$13,830 00</td>
</tr>
<tr>
<td><strong>Total for inspection</strong></td>
<td>$15,430 00</td>
</tr>
<tr>
<td><strong>Total Appropriation</strong></td>
<td>$178,335 00</td>
</tr>
<tr>
<td><strong>Salaries for all divisions</strong></td>
<td></td>
</tr>
<tr>
<td>Labor, regular</td>
<td>$86,640 00</td>
</tr>
<tr>
<td>Labor, temporary</td>
<td>7,920 00</td>
</tr>
<tr>
<td>Maintenance and operation</td>
<td>20,700 00</td>
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<tr>
<td><strong>Total</strong></td>
<td>63,075 00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$178,335 00</td>
</tr>
</tbody>
</table>

In addition to the above for salaries, labor, maintence and operation, the budget contains requests for the following:

- Repairs .................................. $3,150 00
- New construction* ........................ 70,000 00

**Total requested** ...................... $251,485 00

*Remainder of $100,000 appropriated, but not made immediately available for administration, demonstration and library building.

LABOR SITUATION.

It is to be noted that the amount asked for the maintenance of labor at the Station is considerably increased over that received during the present fiscal year. This increase is necessary because of the fact that it is not possible to obtain efficient labor at the wages now paid. The Institution is unfortunate in being located very near a munition plant where wages are rated at an abnormally high figure. It is, therefore, very difficult for the Station to secure labor at the wages that would ordinarily be paid. This fact, taken in
connection with the general scarcity of labor, makes the situation very difficult. During the past season it has not been possible to obtain desirable labor at any price which could be paid within the resources of the Institution.

SALARY CONDITIONS.

It is universally true that when for any reason living costs materially increase, persons occupying salaried positions are placed at a disadvantage because increases in salaries, if realized at all, come very much later than the increased living expenses. It is for this reason that the members of the Station Staff receiving the smaller salaries are feeling very seriously the effect of the greater cost of rent, clothing and food supplies. It seems unfortunate that while the needs of organized labor in this particular are met quite promptly, teachers, scientific workers, clerks and similar employees receive at first scant consideration.

NEW BUILDING.

The Legislature of 1915 appropriated $100,000.00 for the construction and equipment of an Administration, Demonstration and Library building for this Institution. Of this appropriation $30,000 was made immediately available, under which construction began; and the building is now roofed in and is ready for interior construction. Varying conditions, including scarcity of labor and the slowness with which materials have been secured and transported have seriously delayed work on this structure. It now appears that it will probably be ready for occupancy some time during the summer of 1918.

FURTHER BUILDING NEEDS.

In previous reports attention has been called to the fact that new plant houses and a cold storage house must be soon erected at the Institution if it is to continue present lines of work. The report presented to you for 1916 contained the following statement:

"The time has come when in order to carry on its work with the desired efficiency new and greatly enlarged plant houses should be provided. The present plant houses of the Station were erected about twenty-five years ago. They have exceeded the usual life of such structures, and are now neither adequate nor efficient. There is a large amount of work in agricultural investigation which should be carried on in such houses, if carried on at all, including
plant breeding, plant nutrition and studies of plant diseases and injurious insects, to all of which lines the Station is obliged to give much attention.

"The small cold-storage house, established chiefly for the storing of fruits, was erected at the Station something more than twenty years ago. The preservation of fruits, of which the Station has several thousand varieties, requires cold storage facilities in order that such materials may be used for study and exhibition purposes. The present cold-storage plant is inadequate in size and construction and if retained will need enlargement and extensive repairs. A new building should be erected.

"It is not to be expected that an institution which has been in operation for thirty-four years should not find it necessary to replace buildings of a somewhat perishable character that have been in use during that time. The State must either provide the means for such replacement or allow the institution to deteriorate seriously in appliances and efficiency."

RELATION OF THE STATION TO WAR CONDITIONS.

It is an encouraging fact that the institutions established through Federal and State aid, without exception, have patriotically been held ready for such services as it has been possible for them to render in accomplishing the purpose for which this Nation entered the war. If there ever has been any serious question as to the wisdom of establishing the Colleges of Agriculture and the Agricultural Experiment Stations, all doubts of this kind should certainly now disappear. The war in which we are now engaged is one which is testing all the resources of the Nation, particularly our food supply. Because we must not only feed ourselves but the Allies who have been facing the enemy so long and whose productive capacity has been greatly diminished through the entering of forty or more million men into war service, it is incumbent upon us to increase the production of food stuffs if possible and to conserve to the fullest extent that which we produce. It is self-evident, therefore, that the knowledge which has been accumulated through agricultural research and which has been disseminated through the agricultural colleges and experiment stations is now of the highest importance. Our present knowledge of the means of increasing crop production and of defending farmers against the inroads of pests is serving us at
a critical time and without such knowledge our condition would be much more serious than it is. More than this, a large number of men trained in our colleges of agriculture are rendering war service of the highest importance. This Nation will sometime learn, as we trust it is now learning, that its efficiency depends, and always will depend, upon our understanding of how to develop and conserve our material resources as well as upon the expert service which trained men may render in agriculture and our industrial life.

The withdrawal of so many men from the faculties of the colleges of agriculture and the staffs of the experiment stations has more or less depressed the activities of these institutions. The situation has also caused men whose ordinary function is that of research or teaching to engage more largely in the efforts of popular education. No criticism should be offered concerning this condition, because the first duty of every man now is to aid the Nation at the most critical points in bringing the war to a successful conclusion.

There has been much inquiry and discussion concerning the activities of experiment stations as a means of rendering special services under war conditions. It does not seem that there are many new efforts which could be undertaken to advantage. The work of these institutions has been directly in the line of increasing our knowledge of the factors which enter into crop production and concerning the means for defending crops of various kinds against pests. It would seem, therefore, that the only course to pursue is to continue these investigations, with occasional deviations of effort to meet special war conditions. What we have been doing, however, would seem to be what we should continue to do in the most earnest and energetic manner possible.

STATION PUBLICATIONS.

The distribution of Station publications for the year has been in accordance with the following figures:

<table>
<thead>
<tr>
<th>Popular Bulletins</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Residents of New York</td>
<td>38,859</td>
</tr>
<tr>
<td>Residents of other States</td>
<td>2,526</td>
</tr>
<tr>
<td>Newspapers</td>
<td>778</td>
</tr>
<tr>
<td>Experiment Stations and their staffs</td>
<td>2,295</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>44,558</td>
</tr>
</tbody>
</table>

Complete Bulletins.

Experiment Stations and their staffs .................................. 2,526
Libraries, scientists, etc ............................................... 400
Foreign list .................................................................... 330
Individuals ................................................................... 4,086
Miscellaneous ................................................................ 100

Total ........................................................................... 7,442

To the list of bulletins as given on page 843 two other publications should be added as distributed during 1917 — the Thirty-fourth Annual Report for 1915, and Part II of the Annual Report for 1916. The usual delay in printing of the Annual Reports of the Station has been intensified during the past year so that distribution of the report for 1915 could not be made for a year and a half after the completion of the year. For the first time, also, printing and delivery of the bulletins of the Station have been so delayed as to be annoying and embarrassing. Many factors have combined to cause this delay, including failure of the Legislature to make the necessary appropriation for printing the bulletins, difficulty in securing paper of proper quality, and slow transmission of printed material from Albany to Geneva because of transportation troubles. That the bulletins have appeared at all during the last half of 1917 has been due to the public spirit of the State Printer, the J. B. Lyon Company, who bore the financial burden of their publication in advance of an appropriation to provide for them.

Part II of the report for 1916, mentioned above, is The Peaches of New York, the fifth of the series of fruit monographs prepared by the Horticultural Department of the Station. This volume has been more in demand than any of its predecessors except The Apples of New York, since it is one of the most satisfactory and pleasing of the series. The Commissioner of Agriculture very kindly placed at the disposal of the Station a portion of his allotment of 2000 copies, thus aiding in meeting the great demand, which our own allotment of 2000 copies could not possibly cover. The remaining 5000 copies of the monograph have been assigned to the members of the Legislature. Attention must again be called to this unsatisfactory method of distribution, whereby it is made impossible to place such valuable books in the hands of fruit growers who would make profitable use of them, while hundreds of copies go to ornament the libraries of those who have no connection with fruit production and
are not specially interested in it, but desire the books because of
their beautiful color plates and because they can be obtained without
expense.

RESULTS OF STATION WORK IN 1917.

During 1917, the published results of Station activities appeared
in seventeen bulletins, of which nine had popular editions also; in
seven technical bulletins; and in four circulars. The number of
persons reached by these Station publications increased somewhat
during the year, but there are evidently still thousands of farmers
in the State who might benefit by Station experience who secure
knowledge of its results only at second or third hand, if at all.

DIVISION OF AGRONOMY.

Ground limestone for New York State.— The need for lime in New
York agriculture has been shown in many ways and the production
of ground limestone in the State has developed very rapidly in five
years to meet this need, at least in part. From one plant grinding
limestone in 1912 and one producing marl, the number has increased
until there were 56 such plants in the State in 1917 and a dozen or
more outside the State shipping in large quantities of the ground
stone. To familiarize farmers with these local sources of supply
and the comparative value of the product of the different plants,
Bulletin No. 430 was prepared. This includes a map showing the
location of the different grinding plants and a table giving the analysis
of the ground product of each, the analyses being more detailed as
well as more numerous than those given in the fertilizer bulletin.
Discussions are also presented, in simple terms, of the comparative
value of ground limestone, of the degree of fineness required for best
results, of soils requiring lime, of field tests for need of lime, of the
response of crops to liming and of the nature of soil acidity.

Determination of carbonates.— Technical Bulletin No. 62 describes
and illustrates a simple piece of apparatus, devised by the Agron-
omist, for the determination of carbonates, particularly in lime-
stone and similar materials. It is based on the principle of the
hydrometer, requires no weighing and gives results without com-
putations. From its inexpensiveness, simplicity and accuracy it
should serve a useful purpose in a wide field.
Lysimeter and pot-culture work.— During 1914 the Station installed a battery of lysimeters for soil study, perhaps the most complete and expensive piece of apparatus of this type in the country. Believing that familiarity with this lysimeter installation would be of value to others engaged in similar work or contemplating it, plans, photographs and structural details of the apparatus have been collected in Technical Bulletin No. 61. Outlines of the problems to be studied and of the plan of work are also given. Adjacent to this battery of lysimeters on the Station grounds are sets of drain-tile cylinders for controlling conditions in certain lines of soil study, but without opportunity to study drainage water as given by the lysimeters. The two installations supplement each other.

FIELD WORK OUTSIDE STATION FARM.


Cherry orchard — Fertilization, cultivation and cover crop tests. .................... P. F. O'Neil (3 acres), Geneva.
Pear orchard — Fertilization, cultivation and cover crop tests. .................... Lawrence Howard (3 acres), Kinderhook.


Tobacco culture experiment .......... F. A. Tuerk (12 acres), Baldwinsville. Four year rotation and fertilizer tests .... P. R. Bennett (6 acres), Milford.

DIVISION OF ANIMAL INDUSTRY.

Goat's milk for infant feeding.— For several years the Station maintained a herd of milch goats, the original animals coming as a gift from Mr. H. S. Greims of New York City. The animals that reached Geneva early in 1910, forty-nine in number, were of several breeds, pure and crossed; several were in poor condition; and a few later developed the somewhat uncommon malady known as takosis. Owing to these conditions and the necessity of weeding out undesirable types and animals, no records of great value were secured in 1910 or 1911; but during 1912 data were obtained showing the approximate food cost of maintaining twenty-eight females, three males and nine kids of Long-haired and Short-haired Toggenburg, Schwartzenberg, and Saanen breeds, and crosses among these breeds and of some of them with Angora and American goats. The food cost of the milk for all of the goats during 1912 was 4 cents a quart. The
lowest cost for a year's production was with a Saanen doe, the estimated cost of whose milk during 1911 was 1.27 cents a quart. Even the best of these figures shows the food cost of milk from these goats to be far above that from the Station herd of Jersey cows, with which the average for three years was .92 cents a quart.

The milk of the goats was used with good success for feeding infants in a hospital. In eighteen cases where children in private homes were not thriving on other foods that had been used, a satisfactory state of nutrition was established thru the use of goat's milk, the beneficial results in some instances being very marked. With some of these children their condition was regarded as serious, and their restoration to a satisfactory state of health was good evidence that goat's milk is often a very desirable resort for infant feeding. The details of this work with milch goats appear in Bulletin No. 429.

BACTERIOLOGICAL AND DAIRY DIVISIONS.

Dairy investigations.—Definite progress has been made during the year on the studies of the accuracy of the analytical methods used for counting bacteria in milk. This has resulted in the preliminary publication in the Journal of Dairy Science of the results of the cooperative analytical work done with the Department of Dairy Industry of the State College of Agriculture. The chief conclusion reached in this work was that when samples of milk were prepared in such a way that all of the well known and commonly understood difficulties which prevent accurate counting of bacteria in milk were eliminated, different analysts could secure reasonably close duplicate counts. Two methods of analysis were used: one, the generally used agar plate method and the other, the direct microscopic examination of the milk previously described in bulletins from the Station. The counts secured by both methods agreed so closely that there is good reason to believe that the figures obtained really represented a very close approximation to the actual number of bacteria present.

Unfortunately, however, for the accuracy of the counts used in the milk control work in the State, the results of a long series of comparative analyses in which both the agar plate and the direct microscopic examination were used have shown that the ordinary conditions prevailing in market milk samples are such that the officially recognized counts are not counts of the individual bacteria but are counts of groups of bacteria. The results of these studies
have been published as Bulletin No. 439. Since the clumps of bacteria in ordinary market milk are of variable sizes in different samples of milk, the counts secured are not only much smaller than they should be but the errors in count are so variable that it makes it uncertain whether a milk sample stated to contain 10,000 bacteria per c.c. actually contains less bacteria than does another sample stated to contain 20,000 bacteria per c.c.

These findings would leave the matter of milk control on the basis of the bacteria count in a very unfortunate condition if it were not for the fact that while these studies have been in progress still another line of experimental work has been carried out at Hobart, N. Y., and at Geneva in cooperation with dairymen and certain milk distributing companies. The report on this work published as Bulletin No. 443 shows that it is not necessary to make accurate and detailed counts of the bacteria in milk in order to control its bacterial quality; and that either the microscopic method or the officially recognized agar-plating method can be used to divide unpasteurized milk on the basis of the bacterial count into as many as three classes with an agreement in results as high as 91 per ct. Strong presumptive evidence was secured for believing that milk delivered to the milk stations by dairymen was graded more accurately by microscopic examination than by the plating method.

The results of the studies on sanitary milk problems carried out at this Station and at the Illinois, Cornell, and Wisconsin Stations have led to the publication of a joint bulletin, No. 438, which discusses the fundamental problems underlying the grading of milk according to its quality. During the year the studies upon milking machines as factors in the production of sanitary milk have been completed and the results of the investigation are being prepared for publication.

Soil flora studies.—A series of technical bulletins has been issued dealing with the general bacteriological flora of the soil. The general characteristics of the soil flora and the methods best adapted to studying it are discussed in Technical Bulletin No. 57, the first of this series. The other three bulletins of this series deal with the three groups of soil bacteria already mentioned in the Director's Report for 1916. Technical Bulletin No. 58 takes up the spore-forming bacteria, giving descriptions of four different species, three of which have been found in all the soils studied. It is shown that
these are not the most abundant nor apparently the most important bacteria in soil. Technical Bulletin No. 59 deals with the non-spore-forming bacteria, showing that they are the most numerous and apparently the most active bacteria in soil, but that they are so difficult to study that it is almost impossible to identify any of them with previously described species. These organisms are considered to be so important in soil that a more intensive study of some of them and of their activity in the decomposition of organic matter in soil is now being made. The other large group of soil microorganisms, the Actinomycetes, is treated in the last paper of this series, Technical Bulletin No. 60. These organisms appear to be numerically quite important; but certain technical difficulties make it hard to tell whether or not they are very active in soil. Identification of the forms found in the soils studied has proved impossible as yet. Some of them are closely related to, if not identical with, the organism causing potato scab. The chief point emphasized by these soil flora studies is the meagerness of present-day knowledge in regard to the microorganisms of soil. One of the first steps which appears to be necessary in order to put the knowledge of soil bacteria on a scientific basis is a classification of them. The study reported in this series of bulletins is a preliminary step toward such a classification; but much work remains to be done.

*Potato scab investigation.*— The similarity between certain soil Actinomycetes and the organism causing potato scab has led some soil investigators to believe the cause of this disease to be widespread in soil. If it is a very common soil organism the control of the disease must be based upon different principles from those in general practice. To test out this matter an investigation has been begun this year in cooperation with the Botanical Department of the University of Illinois, but results are not yet ready for publication.

*The direct microscopic examination of bacteria in soil.*— A method has been worked out for examining the bacteria of soil directly under the microscope. This is quite similar to the method already used for studying milk bacteria microscopically, but the development of a satisfactory technic has proved more difficult. The method used and a few of the most interesting results obtained with it are shortly to be published as a technical bulletin.
Coöperative Studies.

Potato scab investigations
Stable and milk sanitation
Methods of counting bacteria in milk
Methods of controlling the sanitary quality of market milk

Department Botany, University of Illinois.
Illinois Agricultural Experiment Station.
State College of Agriculture, Ithaca, N. Y.
White Springs Farm Dairy Company.
Geneva Milk Company.
Geneva Board of Health, and about 40 dairymen in the vicinity of Geneva.

BOTANICAL DIVISION.

Blackheart and the aeration of potatoes in storage.—The peculiar behavior of some potato tubers in an air-tight jar led to an investigation of the effect of scant aeration upon potatoes in storage. The results of this work are given in Bulletin No. 436.

It was learned that potatoes cannot long endure close confinement. Within a certain length of time, which varies with the temperature and quantity of air available, tubers confined in hermetically sealed jars become moist over a part or the whole of their surface. If the tubers are then exposed to the air the moist surface areas turn brown and the color of the flesh at the center changes from white to pink then to black, producing a condition known as blackheart.

With a volume of air equal to the volume of the tubers a confinement of ten or twelve days is sufficient to produce the symptoms described provided the temperature is around 70° F. At 50–60° F. about twenty days are required; and at 40° F. a still longer time—somewhere between twenty-three and forty days.

Tubers confined in sealed jars with less than about ten times their volume of air are unable to do more than barely start sprouts. For normal sprouting about nineteen volumes of air per volume of tubers are required. Blackheart may be expected to appear whenever the volume of air available to the tubers is less than that required for normal sprouting.

Tubers suffering from insufficient aeration thru deep piling behave, in a general way, like tubers in sealed jars. They sprout feebly or not at all, become moist on the surface, discolor externally upon exposure to the air and are often affected with blackheart internally. While the data obtained from the experiments are insufficient for the formulation of definite rules, it appears that six feet should be the maximum depth of piling when potatoes are to be stored for
several months at temperatures below 45° F. At temperatures above 50° F. the depth limit should be three feet if the potatoes are to be stored longer than three or four weeks.

Insufficient aeration during storage does not cause spindling sprout. It may retard sprouting temporarily, but when, subsequently, the tubers are supplied with air they sprout normally if at all.

Blackheart sometimes occurs in potatoes stored out-of-doors in piles and is due, undoubtedly, to insufficient aeration. It may be produced, also, by exposure to a temperature of 100–113° F. for fourteen to eighteen hours and often results from the overheating of potatoes during shipment in stove-heated cars.

The facts brought out in this investigation emphasize the importance of providing ventilation for potatoes in storage.

*Neck-rot disease of onions.*—During the past four years an exhaustive study has been made of a destructive rot of onions occurring in storage houses. Of the several common names by which this disease is known, neck-rot appears to be the most appropriate. Affected bulbs bear irregular, black, compact masses of fungus material (sclerotia) and a growth of smoke gray mold. These sclerotia and the mold are two different forms of the causal fungus which, tho long known, appears to be an undescribed species. Accordingly, it has been described and named *Botrytis allii*.

It has been determined that infection of the tubers takes place in the field and that the source of infection may be either wind-borne spores or fungus in the soil. A few of the infected bulbs show the disease while still in the field; but in the great majority of cases the disease does not develop until after the bulbs have been placed in storage. Also, flowers of onions grown for seed may become infected by the fungus and blast.

Factors favorable to infection and the occurrence of neck-rot are: (1) Immaturity and imperfect curing of the bulbs; (2) the application of commercial fertilizers late in the season or in incorrect proportions; (3) the application of large quantities of stable manure before planting; (4) poor air drainage on the fields; (5) high humidity, high temperature and poor ventilation in the storage house.

Methods of control appear to lie mainly along the line of field sanitation, care of the curing crop and storage in houses which are properly constructed and regulated. Diseased bulbs should not be
used as "mother bulbs" for producing the seed crop, since they are an important source of infection to the seed heads and, later, to growing crop onion: in nearby fields. Refuse onions should not be piled near onion fields or used for fertilizer thereon. Care should be taken to avoid unnecessary bruising, on the topping machine and while handling, of stock to be stored. The crop should mature and die early. All refuse tops, soil and screenings should be removed. The bulbs should be thoroly cured in the field or drying sheds and stored in slatted crates in well constructed houses having ample facilities for ventilation and the maintenance of low temperature.

Fumigation of the stock with formaldehyde gas either before or during storage has proven ineffective. While spraying the growing crop with bordeaux mixture has given some promising results it has not been tested sufficiently to warrant definite recommendations. Apparently, spraying is unpopular with onion growers because of certain difficulties encountered. Bulletin No. 437 gives a detailed account of these onion neck-rot studies.

ENTOMOLOGICAL DIVISION.

Plant lice injurious to apple orchards.— Bulletin No. 431 is the second report of life-history studies and experiments with the apple aphides (Aphis sorbi, avenae and pomi), which have for their object the establishment of efficient spraying practices for the protection of bearing apple orchards. In experiments with the insects all species attacked succulent tissues, as blossom and fruit stems, tender leaves and young apples. As a result of their activities various distortions of apples developed which were, as a rule, much more conspicuous with the fruits attacked by the rosy aphis (A. sorbi). In an experiment on the Station grounds, that is discussed with considerable detail, an application of lime-sulphur and nicotine solution at recommended strengths afforded efficient protection from the oat aphis and the rosy aphis. Of twelve auxiliary experiments, nine gave appreciable benefits from spraying. As losses by aphides vary according to locality and season, growers who are not certain as to the necessity of systematic spraying are advised to conduct a test for a period of years, for which brief directions are given.

The radish maggot.— In Bulletin No. 442 attention is directed to the injurious work of the maggot (Phorbia brassicae Bouché) on radishes and to experiments with screening as a means of protecting
radish beds. Radishes produced in the spring months in this latitude are subject to attack by one brood of maggots which, in normal seasons, injure roots during the latter part of May or early June. As this vegetable is grown in most home gardens these dates closely coincide with the period when radishes are making their most succulent root growth. The results of experiments over a period of four years have shown plainly that a practical means of avoiding losses is to practice early sowing. During some seasons little leeway may be given as to choice of time for planting because of weather and soil conditions; however, it should be the rule to plant seed as soon as the physical condition of the soil permits. For the protection of radishes that are to be harvested during the period of the prevalence of the insects, growing of plants in frames covered with cheesecloth of 20 or 30 mesh has given excellent results. The roots grown by this method have in most seasons given larger yields and have been more succulent and tender than those produced in open beds.

The cherry leaf-beetle (*Galerucella cavicollis* Le Conte) is the subject of Bulletin No. 444. This is a study of the life history, habits and control of a native species which normally feeds on the bird cherry (*Prunus pennsylvanica*). Both insect and plant have the same geographical distribution. The history of the beetle records intermittent attacks on cultivated cherries. The most extensive outbreak of the insect occurred in 1915, and in New York was most serious in the territory west of Cayuga Lake and principally in the Lake Erie Valley, where considerable damage was done in orchards of cultivated cherries.

Seasonal conditions largely govern the life cycle of the insect, especially the development of the pupal stage. Oviposition begins in June and hatching of the eggs occurs during the latter part of July. After hatching the larvae feed on the foliage, preferably of bird cherry. When compelled to feed on other trees they invariably succumb. Upon completing their growth the larvae burrow into leaf mold or a short distance into the soil and form cells in which to pupate. The adults begin to emerge during the latter part of August.

Artificial control is affected by arsenicals used in combination with bordeaux mixture and nicotine sulphate, for the use of which directions are given.
The rose leaf-hopper.—Circular No. 55 is a popular treatise, illustrated with two plates and a number of text figures, on the rose leaf-hopper, which is regarded as one of the most destructive insects of roses. The ornamental value of rose plantings is frequently distinctly curtailed, if not actually destroyed, through the activities of this pest. The different life stages are briefly described and figured and seasonal history discussed. It is pointed out that when treated in time the leaf-hopper is not difficult to hold in check. Attention is directed to the selection of safe and efficient spraying mixtures and to the conditions under which plants should be treated in order to obtain satisfactory results. The spray is effective only while the insect is in the immature stages, and the application should be made as soon after hatching as possible.

HORTICULTURAL DIVISION.

Vitis vinifera grapes in New York.—For fifteen years this Station has been experimenting in the culture of Vitis vinifera grapes. Bulletin 432 is a brief account of the experiment. The following is a summary of the work done:

Experimental culture of the European grape was undertaken at this Station in 1902 when cuttings or plants of 19 varieties were received. In 1911 cuttings of more than 70 varieties were received and grafted upon a miscellaneous collection of Station seedlings ranging from 6 to 10 years old. The results were very satisfactory, most of the plants fruiting in 1913.

By giving the vines winter protection and the usual grape sprays they have been kept in a healthy condition.

As a result of the work certain cultural recommendations can be made for New York. One of the most serious difficulties is to secure plants of the desired kinds. Few can be had from eastern nurseries and not a great number from those in California and then not always on resistant roots. For this reason it will frequently be desirable for the eastern grower to know how to graft cuttings on phylloxera-resistant roots such as Vitis riparia. This can be done in the nursery row or in the vineyard.

In planting Vitis vinifera less space need be given the vines than with native sorts. Rows six feet apart and plants six feet in the row is a satisfactory distance. Care should be taken that grafted vines do not form roots from the cion.
In the east it is probably best to support the vines with the regular two-wire trellis.

Because of the necessity of bending the trunk to the ground for winter protection, a replacing spur should be left at the base of the trunk to use in forming a new trunk when the old one becomes too stiff. The main trunk should be carried to the lower wire and two fruit canes and two renewal spurs provided for. The young shoots which spring from these canes and spurs grow upright to the second wire when they are pinched off and tied. This gives stockier and more mature canes for the following season.

Cheap winter protection is secured by bending the vines to the ground and covering with a few inches of dirt.

The chief value of the Vinifera grape at present in this State is as a home-garden grape for the amateur, for the commercial grower supplying local markets demanding high quality, and for the plant-breeder seeking to improve the quality of our present varieties.

Most of the Vinifera varieties have originated in regions with a longer season and a much warmer climate than that of New York and many kinds included in the test at Geneva have been discarded because, even in the most favorable seasons, they have not reached maturity.

The varieties are discussed in four groups: (1) Desirable varieties for the grape regions of the State for (a) the table and (b) wine; (2) sorts worthy of testing in the more favorable parts of the State for (a) table and (b) wine; (3) kinds still on probation; (4) varieties of little or no value in the State.

*Winter injury of grapes.*—Bulletin No. 433 is an account of winter injury of grapes in the winters of 1909–1916 at Fredonia, N. Y., where this Station has been carrying on experiments in vine-growing for the past eight years. The observations and conclusions set forth in the bulletin are as follows:

The data show that approximately half the fruit buds in Concord vineyards about Fredonia were killed during the winter of 1909–10. The injury can be traced to a lack of maturity of the tissues as a result of the sudden termination of the maturing period on October 12, 1909, by unseasonably low temperature. Immaturity is favored by high temperatures and abundant rainfall during late summer and early fall.
The embryo flower clusters may succumb to low temperatures if they enter the dormant period immature and yet the foliage of the bud expand normally. Light crops in years following heavy yields are probably due in part to injury to the floral parts by cold; but unless the extent of the injury be considerable, winter killing is overlooked in explaining the light yield.

The low temperatures of December, 1909, probably killed the buds that were to bear the crop of 1910; but freezing temperatures after April 6, 1910, may also have caused injury or increased it. Following an abnormally warm period in late March and early April came freezing temperatures, and injury may have resulted therefrom to the prematurely stimulated buds.

Winter bud-injury during 1915–16 ranged from 10 to 100 per ct. among the varieties growing on the Station grounds at Fredonia. Injury to Concord varied from 19 to 45 per ct. at the same place. The killing was general through the “Grape Belt.” This great loss may have been due to unfavorable climatic conditions during the maturing months of August, September and October, 1915, as indicated by the poor ripening of the fruit of 1915, which was shown by the low sugar and high acid content. During the week of January 22–29, 1916, however, the average hourly temperature for 96 consecutive hours was 52.6 degrees, which no doubt awakened growth activity at this time; while the minimum temperature of the winter, —16 degrees, occurred in March. The winter killing of 1915–16 may have taken place, therefore, either shortly after the high temperatures of January, or not until the low ones of March.

The fertilizer elements, nitrogen, phosphorus and potassium, did not affect maturity and hence did not, apparently, influence the degree of killing. Extensive injury is closely correlated with poorly drained soils, altho bud killing occurred where the drainage conditions were satisfactory. Severe pruning after late frost injury of spring has apparently indirectly favored bud killing thru inducing rank wood growth.

Resistance to low temperatures is probably a species character and is possibly correlated with the hardness of wood.

Culture of the globe artichoke.— For several years the globe artichoke has been successfully cultivated on the Station grounds.
Bulletin 435 gives an account of the methods practiced with some general observations regarding the plant. The chief facts set forth are as follows:

The plant is not fully hardy in our latitude and requires covering to endure winter. Coal ashes proved to be a satisfactory material with which to cover the artichoke, affording sufficient protection without causing decay of the crowns.

From records taken, it is evident that marked variations exist in the producing capacity of individual plants of a variety. Consequently, the separation of the offshoots from the old main root of the plant is the most reliable method of propagation and should materially assist in the establishment of uniform and meritorious strains.

The edible portion of the artichoke is the flower bud.

The plant itself is remarkably thrifty in growth and is practically free from fungus and insect pests. One insect, a black aphid or louse, becomes troublesome at times but is satisfactorily controlled by spraying with a properly prepared dilution of Black Leaf 40 and whale-oil soap.

Orchards: Location and care.—Circular 52 gives instructions for the care of orchards of tree fruits. The circular is a brief treatise on the culture of all tree fruits. The following are the chief topics discussed: Location, orchard plans, planting, cultivation, cover-crops, inter-crops, fertilizers, pruning, pests, spraying outfits, spraying formulas, spraying schedules, grafting and thinning.

INSPECTION WORK.

The Station examines samples of several classes of material subject to inspection by the Commissioner of Agriculture, among which are agricultural seeds, insecticides and fungicides, commercial fertilizers and concentrated feeding stuffs. All glassware used where milk and cream are paid for by the Babcock test must also be examined and marked at the Station.

This inspection work is extensive and time-consuming as it receives a large share of the attention of six chemists, an assistant botanist and his laboratory assistant, and one man in the Dairy Division.
The figures given below give an idea of the scope of these lines of Station activity during 1917:

**Babcock Glassware Tested.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten per ct. bottles</td>
<td>12,585</td>
</tr>
<tr>
<td>Eight per ct. bottles</td>
<td>10,928</td>
</tr>
<tr>
<td>Thirty per ct. 9-gram</td>
<td>72</td>
</tr>
<tr>
<td>Thirty per ct. 18-gram</td>
<td>581</td>
</tr>
<tr>
<td>Forty per ct. 18-gram</td>
<td>301</td>
</tr>
<tr>
<td>Fifty per ct. 18-gram</td>
<td>1,104</td>
</tr>
<tr>
<td>Fifty per ct. 9-gram</td>
<td>2,569</td>
</tr>
<tr>
<td>Fifty per ct. 9-inch 9-gram.</td>
<td>182</td>
</tr>
<tr>
<td>Sixty per ct. 6-inch 9-gram.</td>
<td>432</td>
</tr>
<tr>
<td>Thirty per ct. 9-inch 9-gram.</td>
<td>378</td>
</tr>
<tr>
<td>17.6 pipettes</td>
<td>3,069</td>
</tr>
<tr>
<td>9 cc. pipettes</td>
<td>143</td>
</tr>
<tr>
<td>8.8 cc. pipettes</td>
<td>12</td>
</tr>
<tr>
<td>6 cc. pipettes</td>
<td>12</td>
</tr>
<tr>
<td>18 cc. pipettes</td>
<td>83</td>
</tr>
<tr>
<td>Skimmilk bottles</td>
<td>179</td>
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<tr>
<td>Acid measures</td>
<td>562</td>
</tr>
<tr>
<td>Total</td>
<td>33,192</td>
</tr>
</tbody>
</table>

**Samples of Seed Examined.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Official samples</td>
<td>340</td>
</tr>
<tr>
<td>Samples sent by farmers and other correspondents</td>
<td>476</td>
</tr>
</tbody>
</table>

**Fertilizer Samples Analyzed.**

During the year 705 samples of fertilizers were analyzed. There were 265 samples of complete fertilizers; 249 samples of mixed fertilizers, containing nitrogen and phosphoric acid; 69 samples of acid phosphate; 29 samples of calcium or lime compounds; 37 samples of bone; 16 samples of tankage; 13 samples of nitrate of soda; 8 samples of dried animal manures; and a small number of samples each of blood, dissolved bone, mixtures of phosphoric acid and potash, insoluble phosphoric acid materials, ashes, garbage tankage, ground fish, soot, mixtures of nitrogen and insoluble phosphoric acid; and mixtures of calcium compounds and phosphoric acid.

**Feeding-stuffs Samples Analyzed.**

During the year 1917, 703 samples of feeding-stuffs were analyzed. There were 38 samples of cottonseed meal, 13 of linseed meal, 8 of malt sprouts, 18 of distillers’ dried grains, 2 of yeast or vinegar dried grains, 10 of brewers’ dried grains, 14 of corn gluten feed and meal, 22 of hominy feed, 107 of compounded feeds, 113 of molasses compounded feeds, 92 of compounded poultry foods, 1 of calf meals, 51 of animal products, 26 of alfalfa meal, 44 of wheat bran, 52 of wheat middlings, 21 of wheat bran and wheat middlings, 1 of wheat bran and low-grade wheat flour, 3 of ground corn and oats, 5 of wheat bran and corn by-products, screenings, 19 of corn meal and of corn feed meal, 7 of rye by-products, 2 of ground screenings, and 10 of miscellaneous mixtures.
PUBLICATIONS ISSUED DURING 1917.

BULLETINS.


TECHNICAL BULLETINS.


CIRCULARS.


W. H. JORDAN.

NEW YORK AGRICULTURAL EXPERIMENT STATION,
GENEVA, N. Y., January 15, 1918