New York Agricultural Experiment Station.

GENEVA, N. Y.

DIRECTOR'S REPORT FOR 1920

W. H. JORDAN

PUBLISHED BY THE STATION
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ARTHUR W. CLARK, B.S., Associate Chemist.

MORGAN P. SWEENEY, A.M., WILLIAM F. WALSH, B.S., Assistant Chemists.

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 Cultivation Investigations.
† Members of the faculty of the New York State College of Agriculture affiliated with this Station.
BULLETIN NO. 483

DIRECTOR'S REPORT FOR 1920

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

Gentlemen: — The time has again arrived when it is my duty and privilege to report to you the year's operations of the institution under your charge. This report will include a statement of the financial relations and of the pressing needs of the institution. As this is the last report which I shall have the honor of preparing for you, I desire to record my profound appreciation of the considerate and helpful attitude which your Board has uniformly maintained toward me during my entire period of service. It is fitting, too, that I should express my deep sense of obligation to the members of the staff with whom I have been associated for their generous and hearty cooperation in maintaining the work of the institution. In the letter of resignation which I addressed to you, I stated that “the measure of success which the institution has attained and the confidence which the people of the State appear to repose in it are due to the fidelity of my associates to their appointed tasks, their adherence to a sound interpretation of the true function of an Experiment Station, and their conservative attitude in their conclusions and public statements.”

It is my most earnest wish that the institution shall continue to take its place among other Experiment Stations that adhere with a reasonable degree of faithfulness to the functions of a research institution. Before relinquishing the directorship it is my hope that I shall be able to prepare a resumé, in a somewhat popular form, of the results of Station work important to practical agriculture, which have been secured during the past 25 years.

ADMINISTRATION

STATION STAFF

Because of the re-adjustments following the disturbances in the staff due to the war, and because of the attraction offered by com-
mercial interests and by other institutions, there have been rather an unusual number of resignations from the staff, necessitating an equal or greater number of appointments. The resignations are as follows:

William C. Stone, M. S., Assistant Horticulturist, resigned May 1, 1920, to enter into practical agriculture.

John W. Bright, M. S., Assistant Bacteriologist, resigned June 15, 1920, to take a position with a commercial company.

Harold H. Winston, B. S., Assistant Chemist, resigned July 31, 1920, to enter the employ of a commercial company.


Otto McCreary, B. S., Assistant Chemist, resigned Sept. 15, 1920, to accept a position in the State Experiment Station, Pullman, Washington.

Rossiter D. Olmstead, B. S., Assistant Entomologist, resigned Sept. 30, 1920, to accept a position with a manufacturing concern.

Myron W. Finch, M. S., Assistant Bacteriologist, resigned Dec. 30, 1920, to accept a position as a member of the staff of the University of Buffalo Medical School.

The loss of useful men who have become actively associated with the work of the Station has always been a matter of regret, but it is to be expected that the younger men of the staff when fitted for advancement which it is not possible to give them at the Station shall seek other positions offering larger remuneration or larger opportunities. It is, however, unfortunate that so many of our young men who give promise of usefulness in research or teaching are attracted by larger salaries to commercial activities.

The appointments are as follows:

James D. Luckett, M.S.A., graduate of Purdue University, was appointed Editor and Librarian on March 1, 1920. At the time of his appointment he was a member of the staff of the Office of Experiment Stations, United States Department of Agriculture. He succeeds Mr. Hall, who was obliged to relinquish his work on account of ill health. He has entered enthusiastically and effectively into service.

Thomas O. Sprague, B.S., graduate of the University of California, was appointed Assistant Horticulturist, May 1, 1920.
Myron W. Finch, M.S., graduate of Rhode Island State College of Agriculture and a graduate student of Brown University, Providence, R. I., was appointed Assistant Bacteriologist, June 15, 1920. After remaining with us for a few months and having shown his ability, he was offered an attractive position at the Buffalo Medical School, which he accepted.

James S. Lawson, Phm. B., Museum Preparator, was appointed July 1, 1920. Part of the purpose of the new building recently erected at the Station was to house a museum which shall visualize the work which the Experiment Station has accomplished. Mr. Lawson entered upon this work July 1, 1920, and what he has already accomplished indicates not only the wisdom of his appointment but justifies the policy of developing a museum on the plan indicated.

Richard Wellington, M.S., graduate of Massachusetts Agricultural College and afterwards a graduate student of Harvard University where he was granted the degree of M.S., was appointed Associate Horticulturist, July 1, 1920. Mr. Wellington was formerly at this institution for five years, and later occupied positions in the Minnesota Experiment Station and Maryland University as Professor of Vegetable Gardening. He comes to the Station to meet the recognized need for taking up work in the field of genetics in an effort to make available the extensive results in plant breeding which have been secured during the past twenty-five years.

Harold B. Tukey, M.S., graduate of the University of Illinois, was appointed Assistant Horticulturist October 1, 1920.

Nathan F. True, A.B., graduate of the University of Maine, was appointed Assistant Chemist December 1, 1920.

Laura G. Collison, B.A., graduate of Ohio State University and afterwards a graduate student at Columbia University for one year, was appointed Assistant Editor and Librarian, July 1, 1920.

Elizabeth F. Hopkins, A.B., graduate of Vassar, was appointed Assistant Botanist, July 1, 1920, with specific reference to conducting seed investigations in the seed laboratory recently established at the Station.

Guy F. MacLeod, B.S., graduate of Massachusetts Agricultural College, was appointed Assistant Entomologist, July 1, 1920, under the special fund for Insecticides and Fungicides.
Mr. M. T. Munn, whose duties immediately relate to seed control was promoted from Assistant Botanist to Associate Botanist, July 1, 1920. This was done in recognition of efficient service for several years.

MAINTENANCE FUND

The expenditures of the Station during the fiscal year ended June 30, 1920, were as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal service</td>
<td>$117,270 23</td>
</tr>
<tr>
<td>Maintenance and operation (including repairs)</td>
<td>$37,535 83</td>
</tr>
<tr>
<td>Construction or permanent betterments</td>
<td>$5,346 01</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$160,152 07</strong></td>
</tr>
</tbody>
</table>

The Legislature of 1920 made the following appropriations for the use of the Station during the fiscal year beginning July 1, 1920:

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal service:</td>
<td></td>
</tr>
<tr>
<td>Salaries and wages</td>
<td>$148,150 00</td>
</tr>
<tr>
<td>Salary of geneticist (special)</td>
<td>2,750 00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$150,900 00</strong></td>
</tr>
</tbody>
</table>

| Maintenance and operation:                         |            |
| Fuel, light, power, and water                       | $7,000 00  |
| Printing                                            | 15,400 00  |
| Equipment and supplies                             | 16,600 00  |
| Hired horses and vehicles                           | 2,500 00   |
| Traveling expenses                                 | 3,000 00   |
| Communication                                       | 2,500 00   |
| General plant service                               | 1,000 00   |
| Repairs                                            | 4,000 00   |
| Rent                                               | 500 00     |
| **Total**                                          | **51,900 00** |

| Insecticide and fungicide investigations            | 5,000 00   |

| **Total**                                          | **$207,800 00** |

The budget proposal for 1921–22 carries the following sums for the various needs of the institution:

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal service</td>
<td>$176,975 50</td>
</tr>
<tr>
<td>Maintenance and operation</td>
<td>62,000 00</td>
</tr>
<tr>
<td>New construction and permanent betterments</td>
<td>85,000 00</td>
</tr>
<tr>
<td>Deficiency</td>
<td>700 00</td>
</tr>
<tr>
<td>Insecticide and fungicide investigations (re-appropriated)</td>
<td>3,008 33</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$327,683 83</strong></td>
</tr>
</tbody>
</table>

INCREASES IN SALARIES

The management of the Station is highly appreciative of the action of the Legislature of 1920 in materially increasing the salaries of the
members of the scientific staff. Until the beginning of the present fiscal year, these salaries had remained practically on a pre-war basis. With the increases that were allowed, the salaries are not yet on a par with those paid to men of no greater ability in similar lines of work in the State. This is a discrimination against the members of the Station staff — not an intentional one, but one that has come about in the course of legislation. The budget proposals of this year suggest the bringing of these salaries up to a parity with those enjoyed by men in positions no more important and requiring no larger scientific training and ability.

**NEEDED BUILDING EQUIPMENT**

For several years, it has been my duty to call your attention to the fact that the plant houses at the Station, constructed some 30 years ago, and the small cold storage building, erected nearly as long ago, are in such a state of decay as imperatively to require their replacement by new structures if some important lines of work at the institution are to be continued. The public may not be aware that the modest request of $50,000 for forcing houses and cold storage facilities at the Experiment Station, a need which has existed for several years, was denied last winter, at the same time that millions were allotted to the College of Agriculture. This is said with perfect good feeling and in a spirit of rejoicing that the College has such a splendid future before it. If, however, this policy is likely to continue, the result will handicap agricultural progress. It will result in a top-heavy educational structure. All the knowledge we have which promotes the welfare of man has been acquired in two ways — experience and scientific research, and to the trained scientist and the modern laboratory we owe a large part of the methods and appliances which have made possible modern progress in agricultural methods. The value of research reaches out beyond the benefit to the farmer. It is of extreme importance to all the people because out of it have proceeded a more abundant supply of food, food of higher quality, and, above all, those sanitary measures which are such a remarkable defense against physical ills.

It is suggested here for your further consideration that following a policy which now seems to be acceptable to the Legislature of the State the Board of Control should prepare a program for the future
development of the institution. This policy has been accepted for the New York State College of Agriculture and for the development of the good roads system of the State. The Station should have new forcing houses, new cold storage, additions to the chemical laboratory to permit of proper scientific study of problems in animal nutrition, and other lines of enlargement or improvement which must be brought about if the Station is to continue to progress and to meet the increasing needs of the agriculture of the State. If such a program is presented to the Legislature and adopted, then the various needs will individually be met as fast as the finances of the State will appear to permit.

PUBLICATIONS

The Legislature of 1919 authorized the printing of two volumes, namely, "The Pears of New York" and "Sturtevant's Edible Plants of the World." The latter has been received from the printer. Under the terms of the law "any surplus copies over and above the number necessary for distribution to the members of the Legislature, educational institutions, libraries, and for exchange, shall be placed on sale by said Station to the public at cost, as determined by the State Printing Board." The Printing Committee has set the price of this volume at $2.75, which is about one-fourth or less than such a publication would cost if printed as a private enterprise. On receipt of this sum, payable to the New York Agricultural Experiment Station, volumes will be sent to individuals up to the limit of the supply.

The manuscript for "The Pears of New York" is not yet ready for the printer, and will not be for some months. This volume will not be distributed under a year, at least.

The mailing list, on the basis of which Station publications are now issued, is as follows:

<table>
<thead>
<tr>
<th>Popular Bulletins</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents of New York</td>
<td>37,000</td>
</tr>
<tr>
<td>Residents of other states</td>
<td>2,558</td>
</tr>
<tr>
<td>Newspapers</td>
<td>735</td>
</tr>
<tr>
<td>Experiment stations and their staffs</td>
<td>2,284</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>350</td>
</tr>
<tr>
<td>Total</td>
<td>42,927</td>
</tr>
</tbody>
</table>
Complete Bulletins

Experiment stations and their staffs ............................................. 2,284
Libraries, scientists, etc. ............................................................. 400
Foreign list .................................................................................... 465
Individuals ................................................................................... 4,150
Miscellaneous ............................................................................... 350

Total ............................................................................................. 7,649

RESULTS OF STATION WORK IN 1920
DIVISION OF AGRONOMY

Soil fertility studies.—Bulletin No. 473 describes investigations made under greenhouse conditions in an effort to determine the effect of fertilizers upon the productiveness of soils from different parts of the State, and the influence of fertilizers and crop production on the soluble material of the soil.

Varying amounts of peat, stable manure, and commercial fertilizers were applied to nine different soils, each soil receiving the same treatment. Commercial fertilizers increased production to a much greater extent than did manure supplying the same amount of important plant food elements. The application of different combinations and amounts of commercial fertilizers to a highly productive soil and to a poor soil resulted in larger crop production on the latter than on the fertile soil.

When commercial fertilizers were added to an uncropped soil it was found that the proportion of soluble plant food elements was greatly increased, and was maintained at a high level for several months. However, soils which were producing crops showed a marked diminution of water soluble material even in the early stages of the growth of the crop. Before the plants had completed their growth, the water soluble ingredients of the soil were reduced to a level which was maintained during further growth. It was concluded, therefore, than an adequate supply of immediately available plant food is essential to successful crop production.

Commercial fertilizers in the orchard and vineyard.—Work on the fertility question in the orchard and vineyard has now been in progress for six to seven years and the results for this period have been published in a progress report as Bulletin No. 477. The investigation was originally planned as an extension of work already done on this question by the Horticultural Department. The
character of the results secured by this Department in the Station Rome Beauty Orchard made it very desirable to duplicate the work on other soils of New York fruit-growing sections.

The orchards reported on in the bulletin are as follows: Baldwin apple orchards near Albion and Rochester, a Northern Spy apple orchard near Fulton, a pear orchard near Kinderhook, and a cherry orchard near Geneva. The experiment also included a Concord grape vineyard near Fredonia in the Chautauqua grape belt and an apple nursery near Geneva.

In general, the results in the apple orchards have been very similar to the 15- to 20-year results with the Station Rome Beauty orchard. So far as yield of fruit is concerned, it has not paid to use commercial fertilizers on the Baldwin orchards under the system of management which these orchards have received. The Spy orchard is young and has shown some increase in trunk diameter due to fertilizers but what it will do as to yield remains to be seen. The cherry crop has been increased by fertilizers, especially by nitrogen but the increase has not paid for the cost of fertilization. In the vineyard, the indications are that nitrogen may be a limiting factor in this vineyard. In the nursery experiment, altho some interesting questions arose, fertilizers apparently did not make any better trees on the soil used.

Summing up the results to date, the indications are that on the better fruit soils of New York (and our orchards are on our better soils) commercial fertilizers will not pay financially in the best recognized system of orchard management, namely, that of clean cultivation and the use of cover crops. We must recognize, however, that there may be local conditions under which this statement would have to be modified, especially in the case of orchards in sod or on less fertile soil.

These experiments are being continued, and an endeavor will be made to render them still more comprehensive.

The perennial question of agricultural lime.—Considerable work has been done on this question in the past. The subject matter in Bulletin No. 478 comprises a brief summary of the main points to be remembered in the use of liming materials. Former bulletins can be consulted for more detailed information. The main object of the present bulletin is to make it easier for the farmer to secure these materials at the least cost. The bulletin contains an exten-
sive and quite exhaustive list of the manufacturers of agricultural lime in the State and also near the borders.

The extensive and increasing use of lime on land, together with the fact that transportation is a large factor in lime cost, make it very desirable that the farmer keep in touch with all sources of supply.

DIVISION OF ANIMAL INDUSTRY

*Some studies relating to calcium metabolism.*—Of the mineral elements serving in the bodies of all farm animals (as well as of man) calcium is found in largest amount. From the feeder’s standpoint, also, it is one of the most important to consider because, under modern conditions, many rations fail to supply enough of this element. Most grain foods and some other foods, including many by-products, are deficient in calcium and contain much more magnesium than calcium, altho more calcium is required by the body.

Much calcium is required by the animal while its bones are hardening and by those mammals giving milk. During extended egg production by birds a large amount is needed. The obvious and somewhat exceptional demands for calcium by domesticated fowls while laying make them good subjects for certain studies relating to its metabolism.

The special physiological activities observed for one class of animals cannot be attributable in all particulars without qualifications to another class, but in a general way a knowledge of the influence of certain factors profoundly affecting the life of one warm blooded vertebrate may be used to help in an understanding of the needs of certain others.

Besides the special duties of the base-forming elements in the body, they all serve their part in maintaining neutrality wherever necessary. In this direction, magnesium, which is nearest to calcium chemically of any recognized element of the body or its food, works with calcium to a certain extent, altho in some important functions their action is antagonistic. But in the bony framework, in so far as it serves for mechanical support, and in the shells of birds' eggs, both structures having the two elements as normal constituents, it would seem that magnesium, much more abundantly supplied by many foods, might serve to a limited degree in place of lacking calcium. That it does this to an extent that can be
considered important or more than incidental or accidental we have failed to find.

On the other hand strontium was found capable of replacing calcium to a considerable extent in the egg shell and in bones as well as of accompanying or replacing calcium elsewhere in the body, altho it is not a recognized normal constituent of the body nor of ordinary foods.

Whenever rations deficient in calcium but carrying abundant supplies of magnesium were fed to the common fowl and the duck, there soon followed a noticeable shortage of calcium and of total mineral matter in the bones. With mature birds, whenever calcium was withdrawn from the skeleton it was usually taken in larger proportion from the softer bones.

With the duck, young and old, a fowl which seems better able to adapt itself to an excess of magnesium when only a very low indispensible minimum of calcium is present, the relations between the two classes of bones in respect to changes in composition did not hold always as with the common fowl. Where strontium replaced calcium in the bones, however, in every instance with both representative species, except in the earlier stages of feeding with immature birds, the ratio of strontium replacement was higher in the softer bones.

When strontium salts were fed for several weeks or several months with low calcium rations, mature hens or nearly mature chicks always had heavier bones with more mineral matter in them, actually and in relation to body weight, than did similar birds fed corresponding calcium or magnesium salts. There was a similar result when mature ducks were fed such rations for a limited time, but not with immature ducks or young ducklings or very immature chicks.

Under the unusual rations, of necessity largely used in such a study, the common fowl, on the whole, was much better able to endure the feeding of strontium salts than was the duck. On the other hand, the duck in these feeding trials showed greater tolerance for the excess of magnesium in rations of low calcium content than did the common fowl. The ability to save or to increase the stores of fat in the body under the unusual rations appeared to be considerably different for the two representative species.

Under the rations fed, the larger part of the calcium and of the total mineral matter used for egg production came sometimes from
the bones and sometimes directly and indirectly from the mineral salts fed.

The experiments which supplied the data above summarized were made at different times during a number of years as opportunity permitted, and have been reported in Bulletin No. 468 of this Station.

DIVISION OF BACTERIOLOGY AND DAIRYING

Physiological studies on milk secretion.— Technical Bulletin No. 80, on The Reaction of Milk in Relation to the Presence of Blood Cells and of Specific Bacterial Infections of the Udder, was published during the year in cooperation with the Division of Chemistry. In this bulletin the biological and histological data have been examined that have a bearing on the theory that the reduced H-ion concentration observed in fresh milk drawn from udders infected with long chain streptococci is caused by the entrance of blood serum into the milk during secretion. From the new data it appears that a more exact statement of the case would be that the bacterial infection causes the entrance of a serous exudate derived indirectly from the blood. This serous exudate is neither exactly like blood serum nor milk, but has a reduced H-ion concentration due to the predominance in it of the alkaline substances of the blood. With this serous exudate, there enter increased numbers of leucocytes and there is evidence also of increased wastage from the epithelial lining of the alveoli of the udder.

Laboratory methods for determining the sanitary quality of milk.— The final report of the cooperative analytical studies made with the Department of Dairy Industry of the College of Agriculture at Cornell has appeared during the year as Technical Bulletin No. 75 entitled The Accuracy of Bacterial Counts from Milk Samples. Aid has also been given in the preparation of the third edition of the Standard Methods for the Sanitary Analysis of Milk which was adopted by the American Public Health Association during the year. The year has seen a rapidly increasing use of the microscopic examination of milk as a means of determining the sanitary quality of fresh milk as delivered at the milk shipping and pasteurizing plants of the State.

Milking machine studies.— A report on results obtained by dairy farmers in producing sanitary milk where milking machines have been used, has been published as Bulletin No. 472 on The Produc-
tion of High Grade Milk with Milking Machines Under Farm Conditions. In this it is concluded that, altho the average dairy farmer is at the present time failing to keep his milking machines bacteriologically clean, methods are now known whereby it is easily possible for him to do so regardless of the type of machine in use. In comparing the bacterial count of over 16,000 samples of hand-drawn milk as brought into the Geneva city markets with the bacterial count of over 5,000 samples of machine-drawn milk it was found that the machine-drawn milk was received in much poorer condition. However, when two of the farms using machines were visited and the cleaning and operation of the milking machines done by a member of the Station staff, no difficulty was experienced in producing milk with a sufficiently low count to meet the standards for a grade A raw milk, i. e. official count less than 60,000 bacteria per cc.

Quality of milk received at cheese factories.— Studies have been made during the summer on the relation between the quality of patrons' milk at cheese factories and the quality of the cheese produced. A preliminary report discussing the relation or lack of relation between the number of bacteria in cheese factory milk and the quality and yield of the cheese is in preparation. Other studies on the influence of specific types of bacteria on the quality of cheese are in progress.

Control of city milk supplies.— Cooperation with the city of Geneva in the control of the city milk supply has been continued during the year. The object of the work is to find methods of controlling the quality of milk brought to the city that are effective and yet fair and just to the dairymen. Six years of records are now available from which to estimate the value of the work. A report on these is in preparation.

Pure culture studies of bacteria.— In many lines of bacteriological investigation it is necessary to make detailed studies of the individual kinds of bacteria in pure culture. This is necessarily laborious work which must often be continued for years before yielding results of value, and the difficulties are greatly increased by the lack of uniformity in the methods used by different bacteriologists. The Society of American Bacteriologists has for some time been working to obtain uniform methods of pure culture study and of descriptions of the bacteria, and for several years the Station has been cooperating in this work. One of the methods adopted to secure uniformity has
been thru the use of a printed chart for recording the characteristics of the organisms. During the past year this descriptive chart of the Society has been materially revised, largely on the basis of work done at this Station. It will soon be available and its use is expected to simplify certain investigations now under way. A further result of the cooperation with the Society has been a paper on Methods of Pure Culture Study, a revised report of the Committee on Bacteriological Technic, drawn up under the chairmanship of a member of the department.

Decomposition of manure.—The work previously reported on the ammonification of manure in soil (Technical Bulletin No. 67) is being followed up by a study of the decomposition of manure under conditions similar to those which occur in the manure pile. Different litters such as peat and straw and preservatives such as acid phosphate and gypsum are being studied as to their effects on the rate of decomposition, loss of nitrogen, and fertilizing value of the manure as judged by vegetation tests. This work is being done in cooperation with the Division of Agronomy.

Testing glassware.—The total number of bottles examined and marked under the law requiring Babcock glass graduation to be tested is given below.

Testing of Babcock Glassware from December 1, 1919 to December 1, 1920

<table>
<thead>
<tr>
<th>Type of Bottle</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 per cent milk bottles</td>
<td>10,946</td>
</tr>
<tr>
<td>8 per cent milk bottles</td>
<td>15,955</td>
</tr>
<tr>
<td>30 per cent 6-inch, 18-gram cream</td>
<td>514</td>
</tr>
<tr>
<td>30 per cent 9-inch, 18-gram cream</td>
<td>744</td>
</tr>
<tr>
<td>40 per cent 9-inch, 18-gram cream</td>
<td>136</td>
</tr>
<tr>
<td>50 per cent 9-inch, 18-gram cream</td>
<td>1,107</td>
</tr>
<tr>
<td>50 per cent 6-inch, 9-gram cream</td>
<td>2,970</td>
</tr>
<tr>
<td>60 per cent 9-inch, 9-gram cream</td>
<td>324</td>
</tr>
<tr>
<td>70 per cent 6-inch, 9-gram cream</td>
<td>718</td>
</tr>
<tr>
<td>17.6 cc. pipettes</td>
<td>4,483</td>
</tr>
<tr>
<td>18 cc. pipettes</td>
<td>99</td>
</tr>
<tr>
<td>17.6 cc. up-to-date pipettes</td>
<td>95</td>
</tr>
<tr>
<td>17.6 cc. and 18 cc. pipettes</td>
<td>31</td>
</tr>
<tr>
<td>8.8 cc. pipettes</td>
<td>25</td>
</tr>
<tr>
<td>9 cc. pipettes</td>
<td>494</td>
</tr>
<tr>
<td>25 cc. pipettes</td>
<td>12</td>
</tr>
<tr>
<td>Acid measures</td>
<td>302</td>
</tr>
<tr>
<td>Acid bottles</td>
<td>4</td>
</tr>
<tr>
<td>Skim-milk bottles</td>
<td>290</td>
</tr>
<tr>
<td></td>
<td>39,249</td>
</tr>
</tbody>
</table>

Rejections .................................. 452
Express packages .......................... 579
DIVISION OF BIOCHEMISTRY

A study of inosite phosphoric acids.—In Technical Bulletin No. 79 are described experiments which were made in efforts to synthesize phytic acid or inosite hexaphosphoric acid. Inosite hexaphosphoric acid could not be obtained but a new inosite phosphoric acid compound corresponding to the formula $C_6H_{12}O_{16}P_4$ was produced. The organic phosphorus compound of wheat bran was again investigated. After carefully purifying the substance crystalline barium salts were obtained corresponding to the formula $C_6H_{12}O_{24}P_6Ba_3$. A neutral silver salt having the composition represented by the formula $C_6H_2O_{24}P_6Ag_{12}$ was also prepared. It is evident, therefore, that the composition of the natural phytic acid is best represented by the formula of inosite hexaphosphoric acid, $C_6H_{18}O_{24}P_6$.

DIVISION OF BOTANY

The spacing of potato plants.—The experiments on the spacing of potato plants, which have been conducted at Geneva during five seasons, have been brought to a close and the results published in Bulletin No. 474. The chief purpose of these experiments was to determine the feasibility of employing close planting in the production of seed potatoes as a means of improving the quality of the crop thru a reduction in the average size of the tubers.

The experiments consisted chiefly of a comparison of 6- by 36-inch planting with 15- by 36-inch planting. Rows of thick and thin planting were alternated. The varieties used were Sir Walter Raleigh and Enormous No. 9. The soil was heavy clay loam of medium fertility. At harvest time the product of each row was sorted, according to weight, into four grades and the tubers of each grade weighed and counted.

The difference in net yield (total yield minus seed) of tubers over 1 ounce in weight varied, in different seasons, from 24.9 to 46.6 bushels per acre, and averaged 34.7 bushels per acre, in favor of thick planting. Over one-half of this difference (18.7 bushels) consisted of tubers over 2 ounces in weight. The average weight of tubers over 2 ounces in weight was reduced from 10.5 to 22.8 per cent by thick planting. For table use, the size of the tubers of the crop from thick planting was superior to that from thin planting.
in two seasons, but in the other three seasons the tubers from thin planting were the better in this respect.

The results of the experiments appear to warrant the following conclusions: In the production of seed potatoes of varieties of the Rural group, New York growers may well consider planting considerably closer than 15 by 36 inches, since, thereby, the net yield is likely to be increased and the quality of the crop improved, particularly on rich soil. In the home seed-plat the spacing in the row should be as close as is consistent with roguing; but if the crop is to be sold the difficulty in disposing of the small tubers may necessitate somewhat thinner planting, except on rich soil. Potatoes grown in rich garden soil, for table use, may be planted as close as 6 by 30 inches with advantage.

Seed testing.— During the first half of the year the Seed Analyst of the Station made purity tests of 642 samples of seeds of which 267 were official and 375 unofficial.

The new State seed law which went into effect July 1 requires that all agricultural seeds sold within the State shall be labeled in such manner as to show their purity and viability. The law applies to all of the common farm-crop seeds when sold in quantities of 10 pounds or more for seeding purposes whether in bulk, packages, bags, or other containers. In the case of special mixtures, such as lawn mixtures, quantities 8 ounces or over in weight must be labeled. The Station will continue to make free seed tests, under certain conditions, for the information of farmers; but for all tests the results of which are to be used for declarations of sale, a fee will be charged. Persons desiring information concerning the provisions of the new seed law and the rules governing the testing of seeds should apply for Bulletin No. 476.

Under the new law 144 purity tests and 480 germination tests were made between July 1, 1920, and January 1, 1921.

DIVISION OF CHEMISTRY

The carbon dioxide content as a basis for distinguishing heated from unheated milk.— A study of the CO₂ content under conditions to which milk is subjected in the usual methods of handling shows that the CO₂ content is not appreciably affected by the method of milking, hand or machine; that the CO₂ content of milk rarely drops below 3 per cent by volume, when milk stands under ordinary
conditions, even for periods of from 20 to 40 hours; that the CO₂ content is not appreciably changed by passing thru a separator, and that only extreme and prolonged stirring reduces the CO₂ content below 3 per cent; that heating milk under the conditions required for pasteurization reduces the CO₂ content to, and usually below, 2.5 per cent by volume. Therefore, it is believed that when the percentage of CO₂ by volume is not more than 2.5 per cent, it is safe, in general, to assume that the milk has been heated to the temperature of pasteurization. The studies are described in Technical Bulletin No. 78.

*Inspection of commercial fertilizers, 1920.*—The total number of commercial fertilizers analyzed was 677, distributed as follows: 351 samples of complete fertilizers; 119 samples containing nitrogen and phosphoric acid; 58 samples containing phosphoric acid and potash; 72 samples of acid phosphate; 19 samples of bone; 8 samples of tankage; 15 samples of nitrate of soda; 7 samples of potash salts; 7 lime compounds; 15 samples of dried animal manures, mostly sheep; and 6 miscellaneous samples. The results of the analyses are reported in Bulletin No. 480.

*Inspection of insecticides and fungicides, 1920.*—The total number of samples analyzed was 195, distributed as follows: 19 samples of paris green; 46 samples of lead arsenate; 9 samples of calcium arsenate; 18 samples of bordeaux mixture; 5 samples of bordeaux-paris green mixtures; 18 samples of bordeaux-lead arsenate mixtures; 13 samples of lime-sulphur solution; 6 samples of dry lime-sulphur preparations; 9 samples of nicotine preparations; 7 samples of soap; 6 samples of hellebore; and 39 miscellaneous samples. The results of the analyses are reported in Bulletin No. 481.

*Inspection of feeding stuffs, 1919.*—The total number of samples of feeding stuffs analyzed was 1610, distributed as follows: 27 samples of alfalfa meal; 76 samples of animal products; 42 samples of barley by-products; 11 samples of brewers’ dried grains; 22 samples of buckwheat by-products; 33 samples of calf meal and pig meal; 6 samples of cocoanut meal; 376 samples of compounded feeds; 262 samples of compounded feeds containing molasses; 23 samples of corn gluten feed and meal; 48 samples of corn meal and corn feed meal; 12 samples of corn, oats, and oat by-products; 100 samples of cottonseed feed and meal; 7 samples of distillers’ dried grains; 5 samples of dried beet pulp; 58 samples of hominy feed and meal; 28 samples
of linseed meal; 4 samples of malt sprouts; 16 miscellaneous samples; 7 samples of feeding molasses; 15 samples of oats and oat by-products; 4 samples of peanut feed; 174 samples of poultry feeds; 17 samples of rye products; 11 samples of wheat and corn products; 6 samples of wheat and rye products; 88 samples of wheat bran; 35 samples of wheat bran and middlings; 3 samples of wheat bran and low-grade wheat flour; 85 samples of wheat middlings; 5 samples of wheat middlings and low-grade flour; 4 samples of dried yeast grains. The results of the analyses are reported in Bulletin No. 469.

*Inspection of feeding stuffs, 1920.*—The total number of samples of feeding stuffs analyzed was 871, distributed as follows: 13 samples of alfalfa meals; 53 samples of animal products; 7 samples of buckwheat by-products; 21 samples of calf meal and pig meal; 5 samples of cocoanut meals; 203 samples of compounded feeds; 104 samples of compounded feeds containing molasses; 28 samples of corn gluten feeds and meals; 17 samples of corn meal and corn feed meal; 5 samples of corn, oats, and oat by-products; 42 samples of cottonseed feeds and meals; 5 samples of dried beet pulp; 30 samples of hominy feeds and meals; 23 samples of linseed meals; 20 samples of miscellaneous materials; 5 samples of oats and oat by-products; 114 samples of poultry feeds; 7 samples of rye products; 7 samples of wheat and rye products; 51 samples of wheat bran; 27 samples of wheat bran and middlings; 2 samples of wheat bran and low-grade wheat flour; 9 samples of wheat bran, wheat middlings, and low-grade flour; 64 samples of wheat middlings; and 9 samples of wheat middlings and low-grade flour. The results of the analyses are reported in Bulletin No. 482.

**DIVISION OF ENTOMOLOGY**

*The leafhopper as a potato pest.*—The leafhopper (*Empoasca mali* Le Baron) has derived its reputation as a destructive agent chiefly from its injurious activities on young apple trees. Recently it has been the subject of special study with regard to its economy as a potato pest. The facts reported in Technical Bulletin No. 77 have established an important injurious relationship to potato culture in New York.

Migration of over-wintering leafhoppers to potato plantings began during early June, and the vines were sought for purposes of oviposition as soon as they appeared above the ground. Eggs were
deposited largely in the young tender leaves near the growing tips of the plants and oviposition continued until the plants were killed by frosts during early October. With the hatching of the nymphs all stages of the pest were present on the vines during the growing period.

In cage and field experiments feeding by the insects produced small, brownish areas of one-fourth inch or more in width at the tips and occasionally on the margins of the leaflets. The injury became more conspicuous as the season advanced, the brownish or burned areas increasing both in extent and numbers. As tissues became desiccated the margins rolled over the upper surface, leaving a small narrow green area in the central portion of the leaflet.

The disorder attained its greatest intensity during August. At this period nymphs and adults of the second generation of the leafhopper became increasingly abundant and intermingled with them were individuals of the different stages of the first generation. Feeding by both nymphs and adults was attended with injuries to leaf structures.

*Insect injuries in relation to apple grading.*—In the practice of grading fruit according to the provisions of the New York Apple Grading Law the attention of the fruitgrower has quite naturally been called to the great variety and diverse character of the insect injuries appearing on the fruit at picking time. This has led to an unusual number of demands on the Station for information in regard to the agents responsible for blemishes on the mature apples. The orchardist can readily see the value of greater knowledge on his part concerning the distinguishing marks of the various insect injuries which are, in many cases, quite characteristic and often more conspicuous than the insect itself. When he has once learned to recognize the various defects he can easily tell which insects are least under control in his orchard and can modify his spraying practices accordingly.

In Bulletin No. 475 the species of insects that attack apple fruits are described and grouped according to the injuries they produce.

A key for the identification of the different species is included and permits ready recognition of both insects and typical malformations.

Certain aspects of the subject which have received special consideration are activities of insects on fruit after harvest, effect of
insect injuries on yield, and defects of apples which may be confused with insect injuries.

Methods for combating the individual insects are indicated. In the main, the destructive agents are efficiently and economically treated by a routine system of spraying for which directions are given.

DIVISION OF HORTICULTURE

Studies on the cost of producing grapes.—Information has been accumulated in Bulletin No. 479 regarding the cost of producing grapes in three widely separated vineyards of the Chautauqua and Lake Erie fruit belt for the period of 1915 to 1919, inclusive.

Data are presented which show the amounts expended for maintenance, labor, and harvesting for each vineyard as well as for each acre cultivated and for each ton of grapes produced. The net return per acre and per ton is estimated for each year of the investigation.

The average cost of production for the three vineyards during the five years was $74.13 per acre, and the average cost per ton of grapes was $40.58.

The average net profit per acre was found to be $66.64, and the average profit per ton $26.31.

It is concluded that under intensive management the growing of grapes in this region can be made profitable, in spite of the high cost of labor and supplies, providing the selling price of the crop is maintained at or near the level of the 1918 and 1919 seasons.

Asexual inheritance in the violet.—In the improvement of fruit varieties the question of fixity of type in asexual propagation is of very considerable importance. The use of any of the tree fruits in a study of this problem would obviously extend the experiment far past the activity of a single investigator. In order to hasten work on this question the double violet, Marie Louise, which is propagated asexually, was used in a study of the effect of selection upon the length of blossom stem. Observations were also made of the inheritance of high and low yield. The investigation is described in Technical Bulletin No. 76.

At the end of five years it was found that: The process of selection has really been one of isolation whereby certain clonal lines have been selected out of a miscellaneous population. We seemingly
have proved only the existence of asexually inherited differences which probably were present before the experiment was begun. No attempt has been made to find when or how such differences arose.

Tho the existence of such differences in the violet makes it seem more probable that there may be differences within a single variety of any fruit, the labor and the technical difficulties involved render it inadvisable for a nurseryman to attempt to find beneficial variations among fruits by bud selection.

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