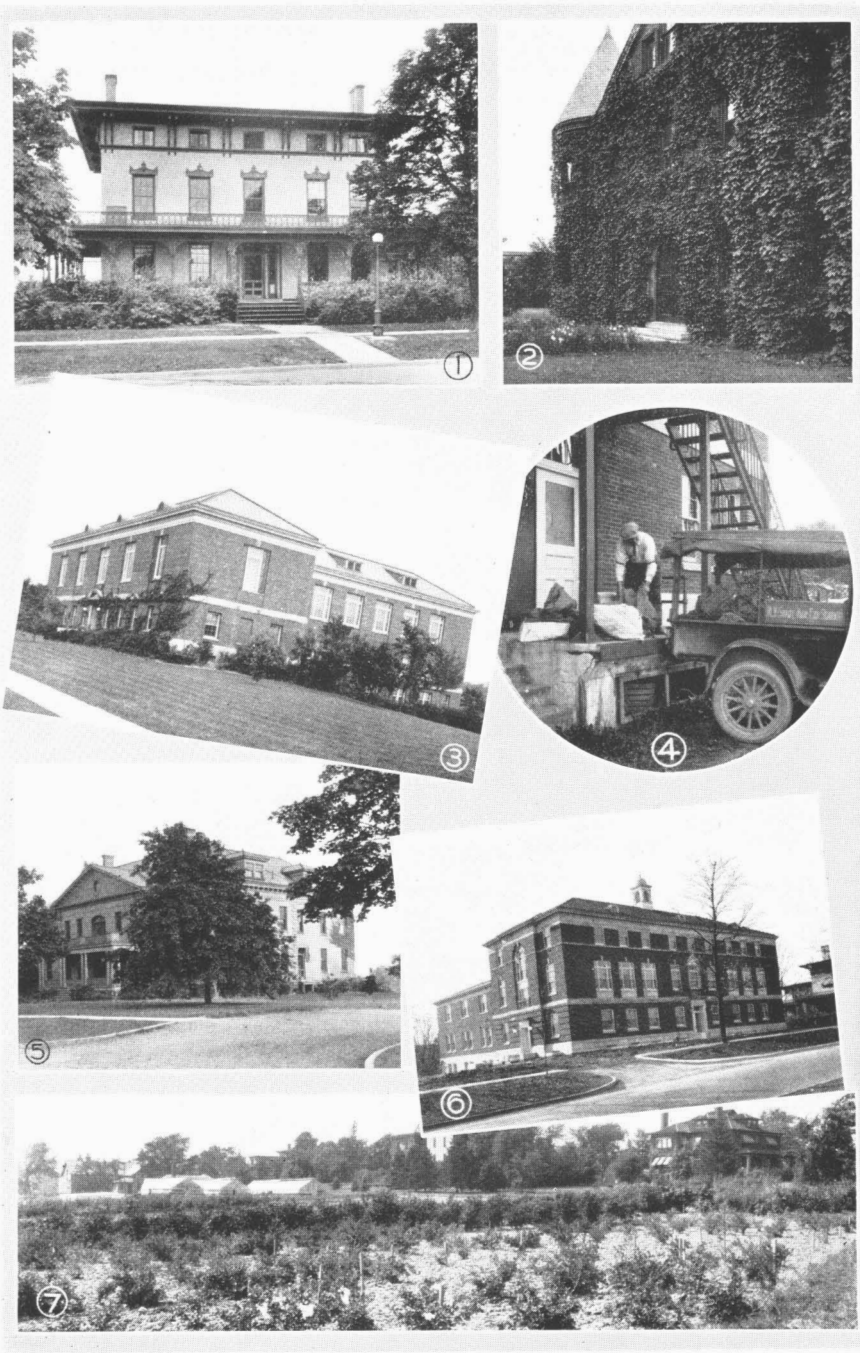
Welcome To Geneva

FACTS *about the* GENEVA STATION

July 1, 1935

GENEVA, NEW YORK

Circular No. 136



1. Entomology Building; 2. Chemistry Building; 3. Jordan Hall; 4. Bulletins Going to the Post Office; 5. The Dairy Building; 6. Hedrick Hall; 7. General View of Station Grounds.

ADMINISTRATION

DEDICATED TO RESEARCH

THE New York State Experiment Station celebrated its fiftieth anniversary in 1932. On March 1, 1882, Dr. E. Lewis Sturtevant, first Director, took possession of the farm of 130 acres with its farm house and the usual outbuildings which had been purchased by the State earlier in that year. Now the Station owns or rents 356 acres and has five laboratory and office buildings and eleven farm buildings.

In creating the Station, the Legislature stated that it was established "for the purpose of promoting agriculture in its various branches by scientific investigation and experiment." Consequently, the chief work of the Station has been to study, in a scientific way, problems confronting the farmers of the State and the problems of industries dependent upon agriculture for their raw materials, notably dairy manufactures, food preservation, by-product utilization, etc. To do this the Station employs a corps of 62 highly trained specialists, who are engaged on 150 or more main lines of research.

The Station does not attempt to run a "model" farm, nor does it necessarily demonstrate good farm management in its fields and orchards. Rather these are used as outdoor laboratories for carrying on experiments under more nearly natural conditions. In all of its work the Station is attempting to establish facts and principles that shall serve as safe guides in farm practice. Other agencies in the State take the facts developed in the Station researches and show how they can be applied on the farm.

The administration of the Station was first placed in the hands of a Board of Control appointed by the Governor. In 1923, following a general reorganization of the State government, the Station was placed under the jurisdiction of the Board of Trustees of Cornell University.

OUTLYING LABORATORIES

In order better to serve the diversified interest of New York agriculture, the Legislature has seen fit from time to time to set up field stations or laboratories in various parts of the State under the supervision of the Experiment Station. At these laboratories problems peculiar to the region receive special attention.

The oldest of these is the Vineyard Laboratory at Fredonia, in the heart of the Chautauqua grape belt. Here every phase of grape culture is under investigation, including methods of controlling the insect pests and diseases that afflict grapes. This laboratory is also used as a center from which to direct studies on other fruit problems in that territory.

The Hudson Valley Fruit Investigations are represented by two laboratories, one at Hudson where the Station maintains a pomologist to study fruit varieties for the Hudson Valley as well as fertilizer and cultural needs of eastern New York orchards, and one at Poughkeepsie where a plant disease specialist and an entomologist devote their time to solving insect and disease problems under Hudson Valley conditions.

At Riverhead is located the Long Island Vegetable Research Farm where the Station carries on extensive experiments with the numerous truck crops grown on Long Island.

A VARIED PROGRAM

Geneva is situated at the foot of Seneca Lake, about 30 miles south of Lake Ontario, in what is known as the "Finger Lakes" region of western New York. This section is famous for its fruits, orchards, vineyards, and small fruit plantations abounding on every side in the vicinity of the numerous lakes which temper the climate and make possible the production of an abundance of apples, pears, peaches, plums, cherries, grapes, and berries of all kinds. The Station's research program features many problems of importance to the fruit grower.

Also, in the immediate neighborhood of the Station, as well as in many other sections of the State, vegetable growing has become increasingly important in recent years. This has led to a rapid expansion of the Station's vegetable crop investigations, about which more will be said later.

New York's tremendous dairy interests naturally brought to the Station at its very beginning many problems of fundamental importance to the dairy industry. The Station has long enjoyed world-wide renown for its dairy researches, and is recognized today as one of the leaders in the field of dairy research.

In each of these great farm enterprises—fruit and vegetable growing and dairying—fields of research contribute to the solution of problems peculiar to each, such as the chemistry of dairy products, the control of insect pests and diseases of fruits and vegetables, agricultural bacteriology, soil fertility and plant nutrition—to mention only a few. So it will be seen that the research program of the Station presents a wide array of subjects demanding the attention of the investigator, some of which are discussed more fully in the pages that follow.

THE MUSEUM

In the administration building, or Jordan Hall, will be found a large collection of models illustrating new fruits created at the Station, major

insect injuries and diseases of fruits and vegetables, standard varieties of vegetables, and many other things, all designed to visualize results obtained in the several lines of research in progress here. Visitors to the Station find these exhibits not only interesting and instructive, but an unending source of delight because of their beauty and novelty.

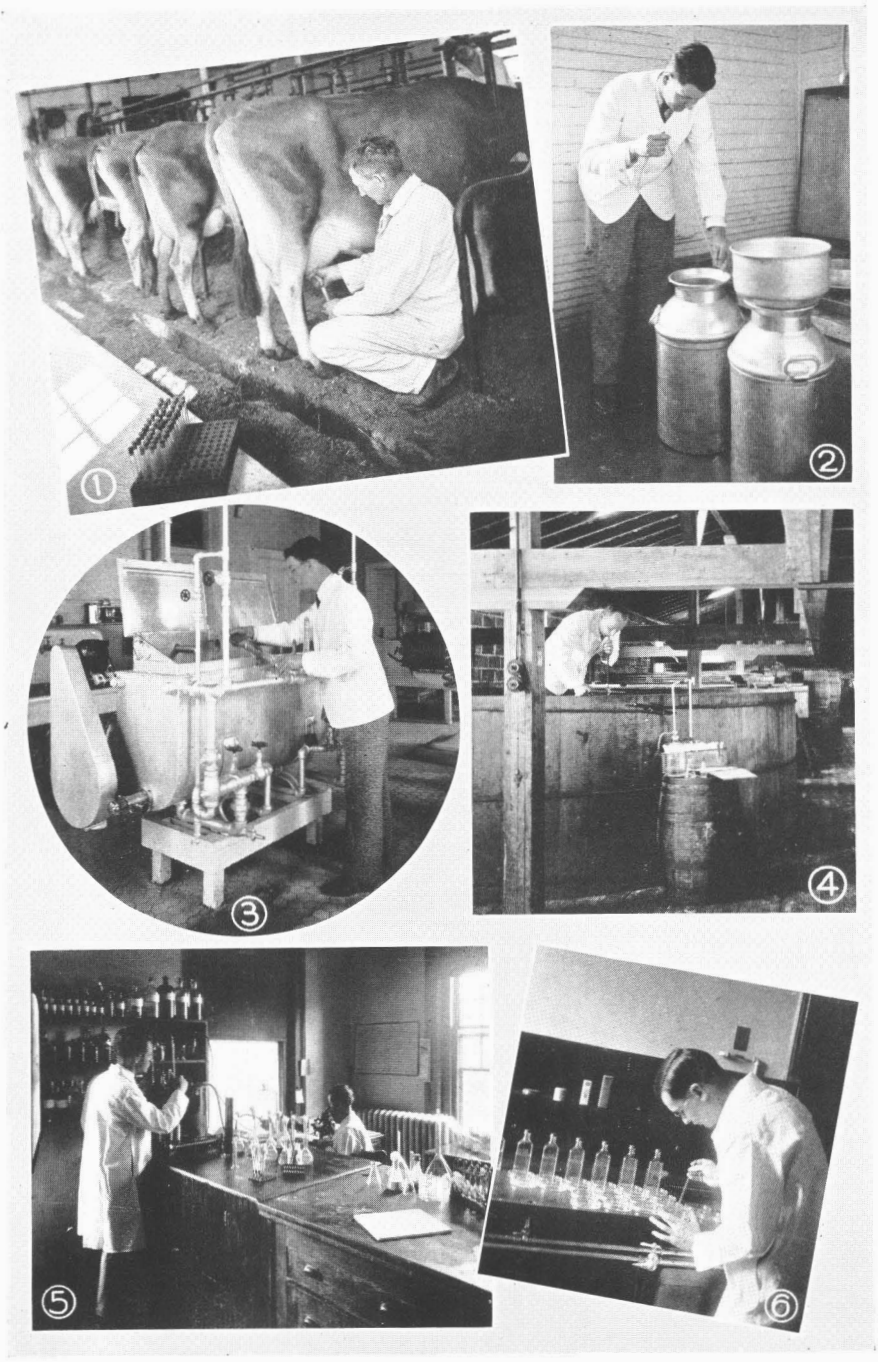
REPORTING RESULTS

Equally as important as solving farm problems is the reporting of the results so that those who can make the best use of the information will have it at the first opportunity. At the Experiment Station this is accomplished by means of bulletins and circulars, by brief accounts of new developments in newspapers and farm papers, by radio broadcasts of timely information, and by occasional exhibits.

The printed material issued by the Station in the form of its bulletins and circulars is distributed free of charge upon request to anyone who can make use of the information. Announcements of new bulletins appear in the newspapers of the State and are read over the radio as new publications become available.

Recently the Station has undertaken the publication of a quarterly magazine known as *Farm Research* in which are presented brief popular reviews of new developments in Station work. *Farm Research* is sent free of charge to anyone interested in following the work of the Station.

The circular in hand has been prepared to give the visitor to the Station and others interested in its work a brief résumé of the chief things that are going on in the several research divisions. It is by no means a complete review of the Station's activities, but it is hoped that it will serve, in a small way at least, to make farm research a little better understood.



1, Mastitis Studies; 2, Market Milk Control; 3, Testing Pasteurizing Equipment; 4, Studying Sauerkraut Fermentation; 5, A Bacteriological Laboratory; 6, Examining Legume Inoculants.

THE tiny forms of life that we call by the general name of bacteria play such an important and varied part in so many agricultural operations that it is impossible in a limited space to deal adequately with the researches under the supervision of the bacteriologists at the Station. To state it as briefly as possible, it may be said that they are concerned chiefly with bacteria in food, with bacteria in milk; cheese and other dairy products, with soil bacteria, and with legume bacteria.

Sources of bacteria in milk.—Farmers endeavoring to meet sanitary milk standards which necessitate low bacterial counts have for years consulted the Station's bacteriologists for aid. The bacteriologists have studied the sources of bacteria which find their way into milk and as a result of these studies are in a position to offer advice to the dairyman to help him in keeping his bacteria counts from milk at a minimum.

Bacterial counts.—The Station bacteriologists have long cooperated with milk distributors and public health authorities in standardizing and improving methods for making bacterial counts. In Grade A districts these counts serve as a basis for payment of premiums to New York dairy farmers for low-count milk. A continued effort is under way to refine these methods and make them as accurate as possible as an aid to milk inspection laboratories making official counts for New York State dairy farmers. It is estimated that more than a million samples of milk a year are examined by the direct microscopic method of counting bacteria perfected in the Station bacteriology laboratory.

Heat-loving bacteria.—Recent developments in pasteurizing equipment in milk plants in the State have introduced a new problem to the milk distributor in the control of so-called "heat-loving" bacteria that grow at pasteurizing temperatures. These bacteria are harmless so far as the health of the consumer is concerned, but they do affect the bacterial count as well as the flavor and keeping quality of the milk, hence are undesirable. Progress is being made in the control of these as well as the pasteurization resistant organisms by proper handling of the milk and the apparatus.

Ropy milk.—Outbreaks of so-called "ropy" milk cause considerable loss to milk dealers during certain periods of the year. The bacteria causing this condition are well known and methods for controlling or eliminating the offending bacteria are now available.

Milking machines.—The bacteriologists at the Station were among the first to realize the future of the milking machine. However, it was soon found that the success of the machine depended largely upon its care from a sanitary standpoint. Methods of washing and sterilizing machines have been perfected and they have been widely adopted thruout the State.

Cheese.—The Station has been interested for many years in the bacteria which are associated with the ripening and flavor production of cheese and was one of the pioneers in investigations on the making and ripening of cheddar cheese. In more recent years these studies have been confined to the organisms in the starters used for cheddar as well as certain of the fancy and foreign varieties.

Mastitis or "garget".—The sanitary milk control work under way at the Station has naturally led to a study of the significance of milk from cows suffering with mastitis as a source of contamination of the general milk supply. A study has been made of the methods for the detection of mastitis as well as possible methods of control to aid dairymen in meeting the regulations imposed by public health authorities. The bacteriologists are studying the organisms that cause this disease, its method of spread, effect upon milk production, and general sanitary significance.

Septic sore throat epidemics.—Attention is being given to the bacteria which are the cause of septic sore throat epidemics so that dairymen may be able to continue the production of safe milk. It has been found that bovine mastitis does not cause these epidemics and general advice is now available to farmers on the best methods of protecting the milk from the septic sore throat bacteria.

Food studies.—The spoilage of food products by bacteria, yeasts, and molds offers many problems, both to the housewife and to the canning industry, that the Station bacteriologists are attempting to solve. Many foods lose much of their fine, delicate flavors by the methods of preserving most of which involve the use of heat. Improved methods of preservation should bring about a greater utilization of fruit and vegetable products.

Flavors in dairy and vegetable products.—Bacteria are known to play an important part in the flavor of many food products. Studies are being made of the organisms affecting the flavor of milk, cheese, dairy starters, tomato products, sauerkraut, and the like. A better knowledge of these bacteria should eventually lead to a better control of such flavors.

Sauerkraut studies.—The Station is in the center of one of the largest sauerkraut-producing areas in the world which is an incentive to the study of this complex product. The bacteria that bring about the sauerkraut fermentation are receiving much attention as are the possibilities of controlling the fermentation as well as spoilage of this food.

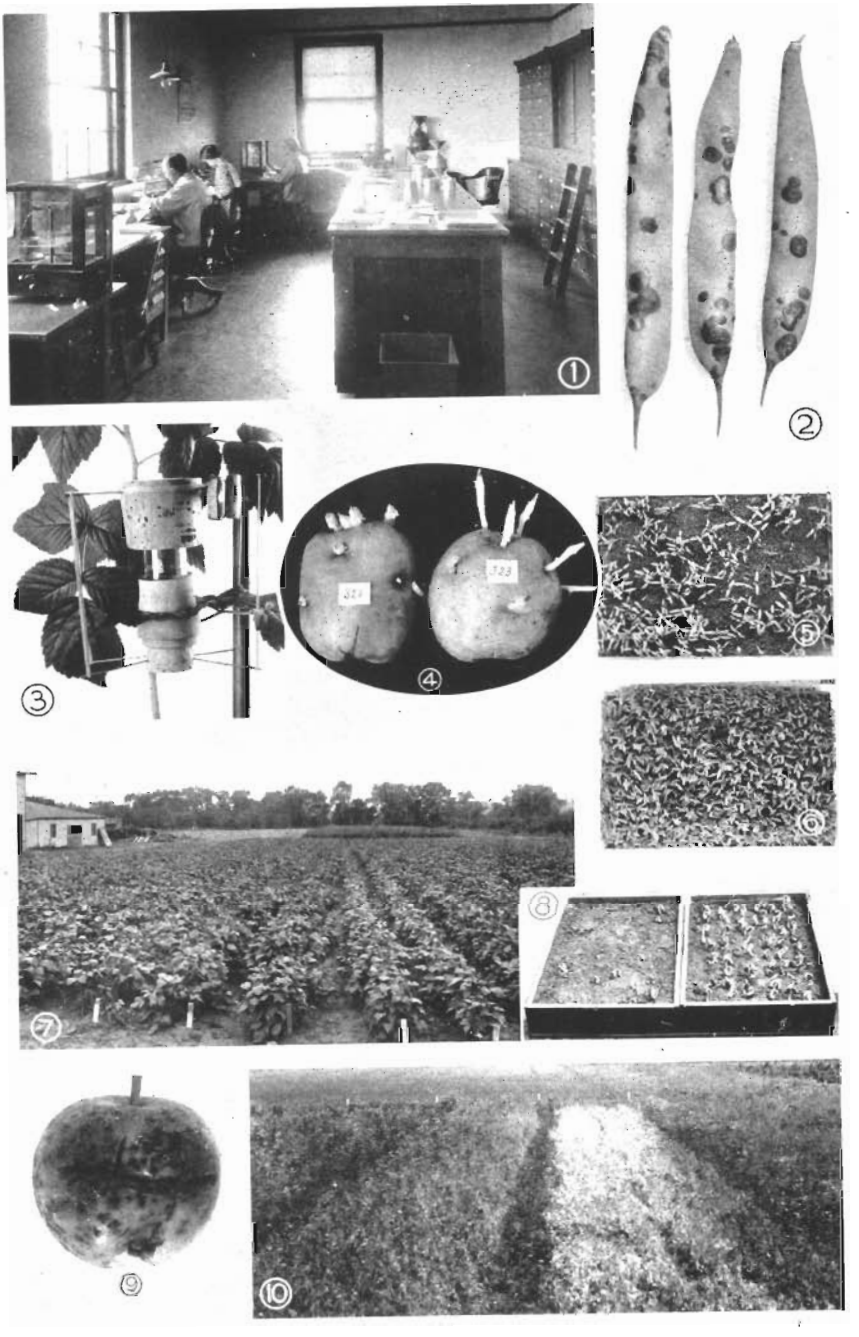
Tomato products.—The Station bacteriologists are studying the bacteria which cause spoilage of tomato products particularly catsup and have information available for canners as well as housewives on the best methods of preparing fine quality tomato juices, catsups, chili sauces, etc.

Fruit juice studies.—The best methods for the preservation of all types of fruit juices, particularly tomato, apple, grape, and cherry juices, are also being studied. The preservation of all of these juices has not only involved a study of the temperatures at which the organisms in such juices are killed without materially affecting the original fine flavor of the native juice but also methods of packing these juices. The results of these studies have shown that lower temperatures can be used than heretofore supposed for the preservation of these juices, and have indicated certain changes in bottling methods which has eliminated certain undesirable flavors. It is obvious that the use of these lower temperatures will allow New York State processors to produce a higher grade fruit juice for the consumer.

Soil bacteria.—Bacteria have many important functions to perform in the soil but the chief interest at present in these soil organisms in the bacteriology laboratory is the possibility of utilizing them instead of test farm crops as indicators of fertilizer requirements. This has been suggested by results obtained with bacterial cultures that fail to grow in certain types of soil without the addition of fertilizers, particularly nitrogen. It is a rather technical subject, but obviously if a fairly simple bacteriological test could be devised to determine the fertilizer needs of a soil, its practical application would save considerable time and expense.

Legume bacteria.—Recent legislation provides, among other things, that the Experiment Station test samples of commercial legume inoculants offered for sale in this State to determine whether or not they meet the claims of the manufacturer. These tests are made both in the laboratory and in the greenhouse to ascertain whether the culture will produce nodules on the legume for which it is recommended. When this inspection started (1931) over a third of the cultures inspected proved to be unsatisfactory. At present, due to the inspection and a policy of cooperation with manufacturers, the number of unsatisfactory cultures has been cut to about 10 per cent.

Bacteriological analyses of miscellaneous samples.—General information which may be based on a bacteriological analysis of milk, food or other samples is always gladly given. Help may be given to individuals submitting requests for bacterial counts from milk, altho it is rarely possible to send milk samples to the laboratory from long distances and have them arrive in satisfactory condition for examination. Bacteriological analysis of food spoilage samples for purposes of securing information on the control of the spoilage may be arranged in so far as time and facilities will permit.



1. Section of Seed Laboratory; 2, Bean Anthracnose; 3. Studying the Breathing of Leaves; 4. Leafroll in Potatoes; 5 and 6. Untreated and Treated Tomato Seed; 7, New Strains of Beans; 8. Hardshell in Beans; 9, Apple Scab; 10. Pea Root-rot Control.

THE work of the Division of Botany may be divided into two major enterprises—one, researches into the cause and control of diseases of fruits and vegetables; and two, the various services of the Seed Testing Laboratory. In addition, the Station botanists are often called upon to identify plants and for suggestions on controlling weeds, poisonous plants, etc.

Apple scab.—Without doubt the greatest menace to the New York apple grower is scab. The prevalence of this disease is influenced so much by seasonal conditions that the prudent fruit grower takes no chances but follows closely the recommendations of the Station specialists in making protective spray applications. Considerable work is being done in various parts of the State on perfecting spray treatments for scab and in trying out new fungicides as they come on the market.

Raspberry diseases.—Raspberry growing, both in western New York and in the Hudson Valley, was at one time a major industry, but a few years ago inroads of a baffling disease or group of diseases, known as virus diseases, practically destroyed commercial raspberry production in this State. Since then, extensive studies at the Station and in various other sections of the State have demonstrated the possibilities of circumventing these maladies by rigid selection of disease-free planting stock and careful isolation of plantings. Something has also been accomplished in developing resistant varieties. The industry is now reviving in all parts of the State and gives promise of once more assuming something of its former importance.

Pea diseases.—That pea production in the State is in the doldrums, is due in no small part to the ravages of fungi that cause pea seeds to decay in the ground and that cause root-rot. The new red copper oxide seed treatment promises to stop the former and alleviate the latter difficulty. Other researches designed to stop root-rot are under way.

Damping-off.—Climatic conditions in New York foster an intensive agriculture under glass, where even a single diseased plant assumes considerable importance. Damping-off of seedlings takes an amazingly large toll from this industry. It is of importance also to field crops like spinach, beets, and peas. The Division of Botany has contributed the red copper oxide seed treatment and spray, the zinc oxide seed and soil treatment, and low-temperature soil pasteurization to the control of this disease.

Other vegetable diseases.—The diseases of several other vegetables, including cabbage, cauliflower, brussel sprouts, cucumbers, lima beans, etc., have been studied, especially on Long Island, and effective control measures worked out. Also, in connection with those diseases of vegetable

crops which are carried by the seed or which live over in the soil, studies have been made of different methods of chemical and other seed treatments.

Potato leafroll and mosaic.—Studies of virus diseases of potatoes have been under way at the Station for many years and have led to extensive experiments at Geneva and elsewhere in the State on methods of combating these elusive maladies. Isolation of the seed plat and roguing infected plants have given some measure of control, while studies are under way on factors causing the spread of the diseases.

Potato blight.—Many years ago the Station demonstrated that potato blight could be profitably controlled by spraying year after year, regardless of the prevalence of the disease—a discovery that marked a new era in potato growing in New York because of the severe losses generally sustained from blight. This and other experiments with potatoes have made the Station a much-sought-after source of information on potato growing.

Beans.—A common trouble with shell beans and peas, aptly described by the term "hardshell", has received much attention for the past several years. It is not a disease but a physiological condition that renders the seed coat impermeable to water. This makes the beans or peas slow in germinating, and of even more importance, reduces very materially the quality of the cooked product. An effort is being made to develop new varieties of kidney beans for the canning trade that possess a high degree of freedom from hardshell. Much work is also being done on the control of hardshell by proper storage of the seed. The mosaic disease of the canning variety, Refugee, reduces yield to the grower and quality to the canner. Breeding work now under way promises to build resistance or immunity to mosaic into the Refugee type.

Aster diseases.—The production of aster seed was at one time a thriving business in this State; but with the rising cost of labor and cheap sources of seed abroad, it has gradually disappeared. One consequence of this is that many of the seed-borne diseases are being brought into the State on imported seed. To meet this situation, an effective method of treating aster seed to destroy disease organisms has been devised. In the course of this work better methods of storing aster seed have also been developed which have materially improved the viability of the stored seed. An extended study of the relation of cultural methods to aster diseases indicates that the ravages of certain diseases may be materially lessened simply by employing proper methods of culture.

Mushrooms.—Certain problems encountered in the propagation of mushrooms have been under study at the Station in years past, particularly with regard to the preparation of the compost for mushroom beds. Con-

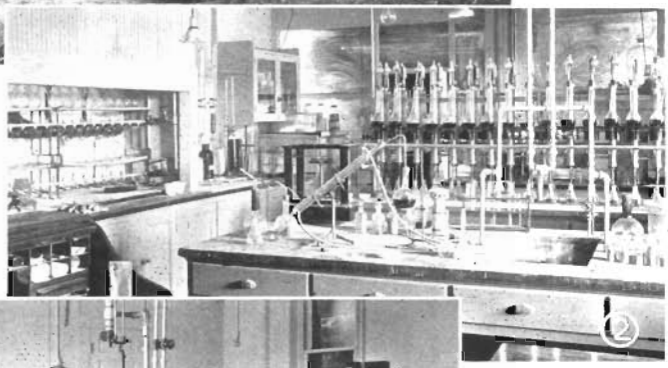
siderable information is also to be had on wild mushrooms to be found in the State and their use for food. The Station botanist is ready at all times to identify mushrooms and toadstools sent to him.

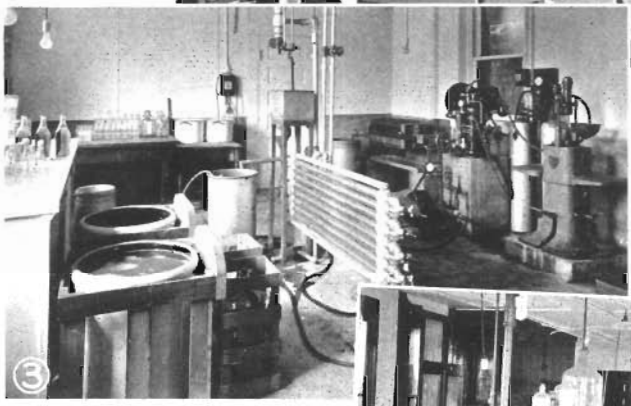
Seed testing.—Each year thousands of samples of field crop seeds, vegetable seeds, flower seeds, and lawn grass mixtures are tested for purity, germination, and planting value. While some of this work is done as part of the official inspection of seed stocks carried on by the State under the seed law, many tests are made for farmers of seed stocks grown on their own farms and to be used for planting purposes. Weight for weight, seeds are the most expensive and at the same time the most uncertain commodity that the farmer has to deal with. It is important to know the quality and planting value of seeds *before buying* and most especially *before sowing*. The tests made in the Station Seed Laboratory aid tremendously in arriving at a fairly accurate estimate of this value. The Seed Laboratory is operated as a service and protection to the seed buyer, whether he consciously utilizes its facilities by having seeds tested or unconsciously benefits from its protection by buying only tested and fully labeled seeds. It is providing a type of service of inestimable value to all residents of the State who have occasion to buy or sell seeds.

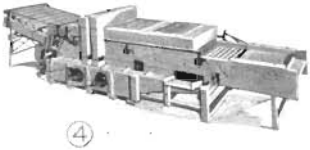
Control fields conducted in connection with the seed testing laboratory, in which any lot of seed offered for sale is planted and grown to maturity to check its varietal purity or other qualities claimed for it, are proving to be most useful and effective in connection with seed control. Each year several hundred plantings are made as circumstances warrant and these are serving as a great deterrent to misrepresentations.

When making germination tests of many kinds of seeds it is often possible to make a useful and accurate estimate of their health or of the extent of infection with seed-borne diseases, and, upon the basis of such observations to suggest useful control measures or effective seed treatments.

The identification of weed seeds in seed samples, particularly from the many lots of seed shipped into the State, gives a great amount of information as to the introduction of weed seeds into the State. The appearance of certain weeds can often be traced to their introduction thru contaminated seeds purchased from without the State. The presence of typical weed seeds or other characteristic inert material in seeds often serves as an effective aid in determining the origin or possible place of growth of certain kinds of seeds in cases where origin or adaptability is very important.







1. Unloading Fertilizer Samples; 2, Section of Inspection Laboratory; 3, Fruit Juice Laboratory; 4. Fruit Washer; 5, One of the Research Laboratories.

THE work of the Station chemists covers a wide range of agricultural interests. They are studying the utilization of fruit and vegetable products, the clarification and carbonation of fruit juices, the factors that affect the quality of canned vegetables, chemical changes occurring in soils, the chemical behavior of insecticides and fungicides, and many other things as well. In addition, several chemists devote their entire time to analyzing the samples of fertilizers, feeding stuffs, insecticides, and fungicides offered for sale in this State.

Fruit juices.—A demand for new commercial outlets for the surplus supply of certain fruits has been responsible for the investigations on fruit juices recently started at the Station. Along this line, the Station chemists have experimented with various ways of clarifying fruit juices, particularly apple juice and grape juice, with a view of making them more attractive and salable to the public. Exceedingly attractive products have been obtained, and now attention is being given to the carbonation of clarified fruit juices in an attempt to develop year-around natural fruit beverages that will compare favorably with ginger-ale, coca-cola, and other popular soda fountain drinks.

Champagne cider and wine.—In cooperation with chemists of the Bureau of Chemistry and Soils, United States Department of Agriculture, methods of making still and sparkling wines and champagne cider are being studied. Both the method of making champagne cider requiring the secondary fermentation in the bottle followed by disgorging and the recently introduced closed tank method are being tried. Wines prepared from the new varieties of grapes recently developed at this Station are being studied in order to determine the wine-making qualities of these grapes. Other investigations on the making of wine being undertaken include the study of the quality of wine obtained by the use of various strains of yeasts, and the improvement in the quality of wine made from Concord grapes.

Improvements in spray materials.—Heretofore, the use of calcium arsenate as a substitute for lead arsenate in fruit tree spraying has been more or less avoided because of its greater tendency to produce foliage injury. Field and laboratory studies of calcium arsenates have resulted in chemical methods for distinguishing between relatively safe and unsafe brands of calcium arsenates and as an indirect result, relatively safe calcium arsenates are now available to the grower. Further improvements may be expected through these researches.

Spray and other deposits on fruit.—Demands from the public for higher standards in all commodities and discrimination abroad against fruit

showing an undue amount of spray residue or other deposits have caused New York fruit growers to give serious consideration to the washing and polishing of apples and pears, especially where they are to go into the export trade. Spray residues on cherries for canning also present a problem in some seasons. The Station chemists have been studying the merits of various methods of removing deposits of all kinds from fruit.

Quality in vegetables.—Canned vegetables, particularly peas, corn, pumpkin, and squash, have been under investigation in the chemical laboratory in order to determine to what extent fertilizer treatments, cultural operations, time of harvesting, or variety of vegetable affected the quality of the canned product. The effect on peas of a diseased condition, such as root-rot, has been studied. An effort also has been made to study the chemical changes occurring in peas during processing at the cannery.

Pectin studies.—Pectin is manufactured from apple pomace on a large scale in the State and is an important by-product of the apple industry. For a number of years, Station chemists have been studying the properties of pectin to determine the conditions under which it is formed in fruits and to find out how to prevent its decomposition in apple pomace.

Enzyme studies.—Enzymes are responsible for most changes occurring in fruits and vegetables during growth, harvest and storage. The reactions caused by them affect the quality of a great variety of fruit products including frozen fruits. The nature of these reactions is being studied in order to determine means of preventing deterioration of dehydrated and frozen fruits and vegetables.

What happens to soil?—The effect upon soil of cropping and fertilization is being studied by chemical work on soils having a definite history as to fertilization and crops harvested over a long period of years. Another angle of approach is the analysis of drainage water from lysimeters, for here may be measured the nutrients being carried off in solution.

Wetting properties of insecticides and fungicides.—The effectiveness of agricultural sprays depends largely upon how well the liquid wets the surface on which it is sprayed and upon how long the toxic materials stick to the surface. Studies of spreaders and stickers carried out by Station chemists should be of benefit to all fruit and vegetable growers in combating insect pests.

Vitamin studies.—A survey of the antiscorbutic vitamin content of vegetables is being undertaken in order to indicate the relative nutritive values of the fruits and vegetables grown in New York. Other points

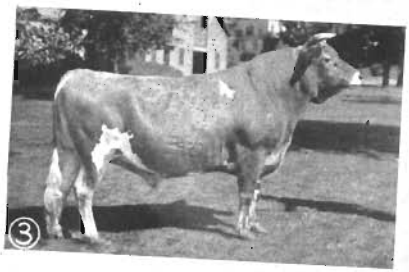
considered in this investigation are the losses of vitamins during transportation, storage, preparation, and cooking of these products.

Fertilizer inspection.—Early in its history the Station was charged with the duty of making chemical analyses of samples of the different brands of fertilizers placed on sale in the State. Manufacturers are required to state certain facts about the chemical composition of their products, and it was the duty of the Station chemists to verify these claims by chemical analysis. Failure to live up to his claims brings the manufacturer into conflict with the State Department of Agriculture and Markets which administers the various agricultural laws in New York. Each year 750 to 800 samples of fertilizers are sent in by State inspectors for analysis. On the whole, the commercial fertilizers offered for sale in this State are high grade and come up to the representations made for them by the manufacturer.

Feeding stuffs inspection.—In a similar way, the chemists examine samples of concentrated feeding stuffs found on New York markets. The last year for which figures are available more than 2,600 samples of feeds were analyzed. In general, the quality of the feeding stuffs sold in New York compares favorably with that of materials sold in other states. About 5 per cent of the samples examined are materially deficient in protein and fat, and about 5 per cent of them are misbranded or unlicensed.

Insecticide and fungicide inspection.—From 300 to 350 samples of insecticides and fungicides are analyzed each year, some of these materials requiring several chemical determinations to arrive at an estimate of their composition. Of the samples analyzed during 1934, 20 per cent were found to be deficient in active ingredients or improperly labeled as to content. Upon completion of the chemical analyses, the results are published by the State Department of Agriculture and Markets.

Private testing limited.—As with other divisions of the Station, it is natural that many persons should look to the chemical laboratory for the testing and analysis of various things in which they are interested. However, if all such materials submitted to them were analyzed by the Station chemists, there would be little time or money left for the authorized work of the Chemistry Division. In most cases, therefore, the suggestion is made that the material be taken to a commercial laboratory, unless there is some other State agency that is specifically delegated to analyze the particular material in question. This is especially true of drinking water, foods and drugs, for the analysis of which the Department of Health maintains several laboratories scattered about the State.



1. Section of Dairy Laboratory; 2. Milk Cooler; 3. The Head of the Herd; 4. A Silver Medal Cow; 5. Testing Experimental Ice Cream; 6. The Station Herd.

NEW YORK State has a population of over 11,000,000 persons, with more than 9,000,000 living in cities and large towns. This enormous market creates a tremendous demand for all kinds of dairy products, especially for fluid milk and ice cream. It is not to be wondered at, therefore, that New York has long been a leading dairy state and that the Experiment Station has almost from the first found an exceedingly fertile field of research in dairy herd management, sanitary milk production, milk plant operations, and dairy manufactures.

Dairy herd management.—Since 1900, the Station has maintained a herd of purebred Jerseys to furnish milk for the numerous researches by the dairy specialists, the bacteriologists, and the chemists, and also to serve for certain studies on dairy herd management. By careful selection, breeding, and feeding, the herd has been brought up to the remarkable level of 425 pounds of fat per cow per year for all cows in the barn irrespective of the lactation period. Furthermore, the herd has been developed from two heifers purchased in 1900 to its present size (26 milking cows and 2 bulls) at a cost within the reach of any progressive dairyman. In recent years a small herd of Holstein-Friesian cows has been started for the primary purpose of producing milk more typical of that used in New York State. Such milk is needed for research on milk and its products as the milk by different breeds does not always give uniform results.

Other herd problems.—Many other interesting problems are under study in the Station dairy barn besides the improvement of the production record by breeding. For example, attention is being given to means of keeping the herd free from tuberculosis, from contagious abortion, and from mastitis by practical methods. Comparisons are being made of two and three milkings and of two and three feedings per day. For many years, hand versus machine milking has been under observation. The entire herd is also entered in the Herd Improvement Registry Test conducted by the American Jersey Cattle Club. Last year's record was 7,643 pounds of milk, testing 5.58 per cent and containing 427 pounds of fat.

Creaming studies.—How the cream layer forms in the milk bottle and the effect of various methods of handling milk, including pasteurization, on its creaming ability are topics of interest to the dairy farmer, the milk distributor, and the consumer alike that have received considerable attention in the Station dairy laboratory. The comparative creaming ability of Holstein and Jersey milk has also been studied. Many practical applications have come out of the creaming studies, particularly as to more efficient operation of the milk plant, and still other applications are under investigation.

Ice cream.—Improvements in the commercial production of ice cream and economies in the preparation of ice cream mixes have been made possible by researches on a number of factory problems. Several lines of work are under way at present which, if successfully concluded, will still further aid an industry which consumes vast quantities of milk and cream from New York dairy farms.

Uses of dry milk.—Few realize the large amount of skimmilk that is going into skimmilk powder and the place that this by-product of the dairy industry occupies in dairy manufactures. It is estimated that in 1930, over 30 million 10-gallon cans of skimmilk were made into skimmilk powder in this country. These powders differ widely in their physical properties, due largely to methods of manufacture, and the Station dairy specialists have been studying the effect of these differences when the powders are used in ice cream and in cream cheese. These studies are opening up new uses for dry skimmilk, thus expanding the market for this product.

New cheese.—Development of a new formula for the making of cream cheese of the Neufchatel type which not only makes possible a cheese infinitely superior to the old product in texture, quality, and flavor, but which also reduces the length of time of manufacture from a matter of days to a period of a few hours and removes much uncertainty as to the quality of the cheese from each batch of milk, has been protected by a public patent for the use of any one interested in this type of cheese. This is yet another instance whereby researches in the Station dairy laboratory aid the dairy farmer by creating a better end-product for the consumer, thus stimulating demand. The adaptation of certain foreign varieties of cheese to New York conditions of manufacture and the development of entirely new cheese varieties is a fertile field for study to increase the market for milk. Many countries have a per capita consumption of cheese several times that of the United States.

Cooling milk on the farm.—A highly practical study from the point of view of the dairy farmer has to do with a comparison of ice and electric refrigeration for the cooling of milk in insulated tanks on the farm. This study has also shed light on the cooling of milk in general, showing for one thing that milk will cool in the can without stirring if the cooling tank is properly refrigerated, is of adequate size, and is well constructed.

Milk strainers.—Rather exhaustive tests have been made to discover the best type of strainer for use on the dairy farm. This has included a comparison of strainer cloths and cotton pads, as well as variously designed strainers. The Station receives a large number and variety of strainers for test and for suggestions on improvement in design.

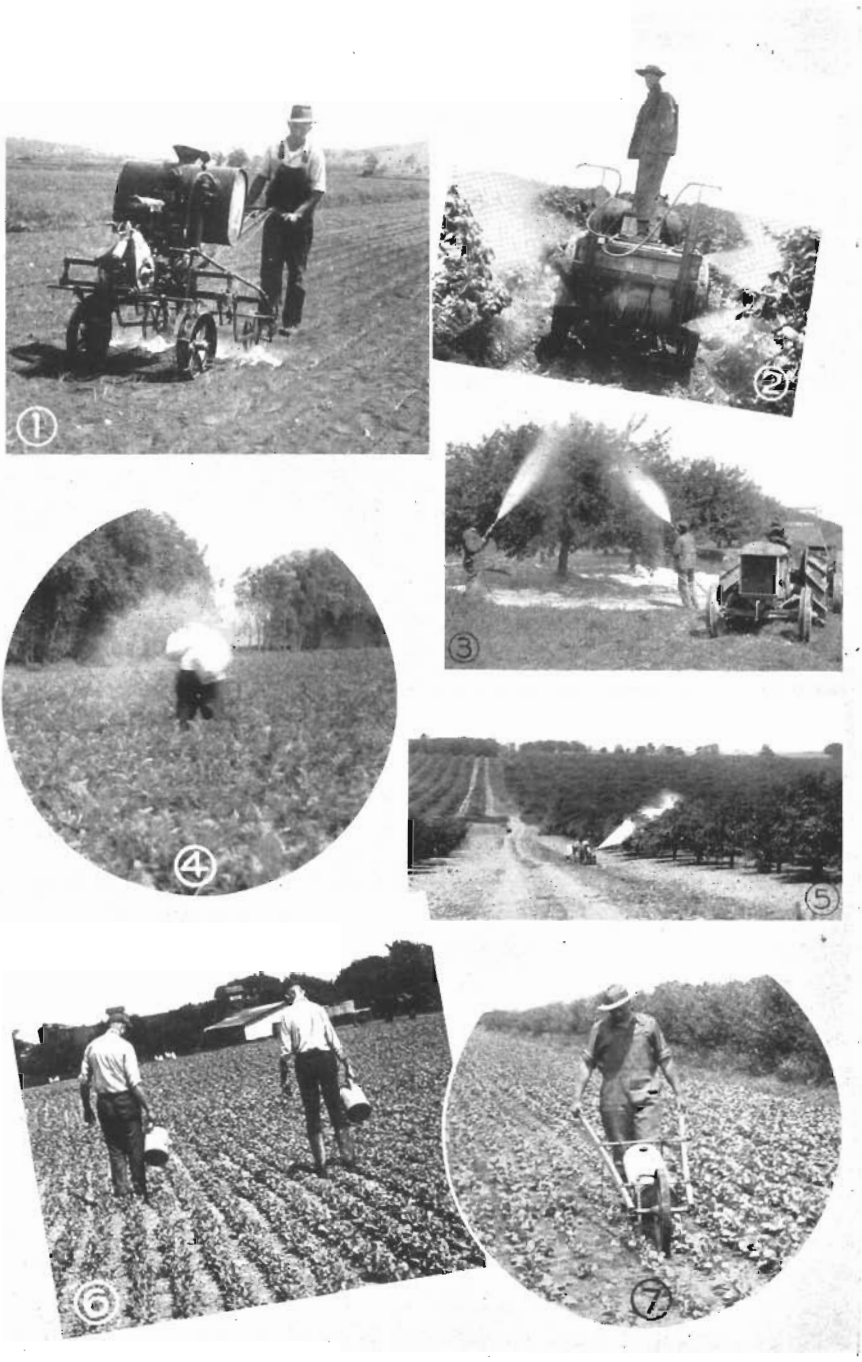
Milk fat tests.—Variations in milk fat tests are a constant source of annoyance, both to the dairy farmer and to the milk plant operator. Much work has been done in the dairy laboratory at the Station to show that the Babcock test for fat in milk and cream cannot be blamed for these differences, nor can the method of sampling at the milk plant in most cases. Normal factors affect the fat content of milk to a much greater degree than do differences in methods of handling or in the testing.

Babcock and bacteriological glassware.—One important reason why the Babcock test for milk fat is as accurate as it is lies in the supervision that is given the glassware used in making the test. Every piece of Babcock glassware used in New York State must first be tested for accuracy in the Station dairy laboratory. All inaccurate pieces are destroyed. During the fiscal year of 1930–31, a total of 36,057 pieces of Babcock glassware was examined and only 264 inaccurate pieces discovered. A similar test is made of the pipettes used in bacteriological examinations of milk, and out of a total of 23,059 pipettes examined during the year only 16 were rejected.

Cream viscosity.—When pasteurization was introduced to protect public health, the dairy industry immediately recognized that the process produced cream of very low viscosity which appeared to lack richness. Repeated attempts have been made to correct this difficulty. The Station dairy laboratory has developed a heat treatment of cream applicable to plant practice by which it is possible to increase materially the apparent thickness of cream without affecting its other properties. The procedure or some modification is of practical value in meeting the problem of cream viscosity.

Casein studies.—For many years the Station chemists have been studying the composition and properties of this important constituent of milk. Recently, they have found that casein is, in fact, a mixture of three different proteins and not one single substance as was formerly supposed. This discovery has made possible a much more thoro analysis of each of these proteins and the determination of their properties. These studies have many practical applications in the dairy industry and elsewhere.

Gelatin.—As a sequel to the work done several years ago by Station chemists on the use of gelatin in ice cream, additional fundamental studies have since been made on gelatin, particularly as to the effects of various salts on certain properties. These studies have led to a better and more complete understanding of the chemistry and behavior of protein substances.



1, Bordeaux-oil Spraying for Onion Maggot; 2, A Vineyard Sprayer; 3, Experimental Spraying for Apple Red Bug; 4, Naphthalene Dusting for Carrot Rust Fly; 5, Spraying a Cherry Orchard; 6 and 7, Cabbage Maggot Control with Corrosive Sublimate.

THE growing of fruits and vegetables is becoming increasingly specialized with constantly advancing standards and with modern methods of transportation which bring all sections of the country into close competition for a discriminating market. The work of the Division of Entomology reflects this trend in the type of problems with which it deals and in the unremitting search for cheaper and more efficient sprays and dusts with which to combat insect pests. These problems may be grouped roughly under three general headings, namely, orchard insects, pests of vegetable crops, and insects attacking nursery and ornamental plants.

Apple insects.—The spraying of apple orchards in this State is fairly well standardized, thanks to the experiments and observations on the major insect pests of the apple carried on for years by the Station entomologists. Occasionally, however, a new pest will appear in the State, as for example the cranberry root-worm which was recently found working on apples in western New York. But more often, an old and well-known pest will suddenly assume major importance and necessitate a modification of the spray schedule to combat it effectively. The bud-moth, leafroller, and apple maggot are recent examples of this. Then, too, new insecticides must be tried out for the control of such persistent enemies of the fruit grower as the codling moth, the San Jose scale, and the rosy aphid.

Pear insects.—The chief work with pears at present has to do with the development of efficient methods of combating the pear psylla, the pear midge, and the quince curculio which, fortunately, is rather erratic in its attack on pears. Here again, the Station entomologists are seeking to discover new materials that will give greater protection at less cost than those now in use and to perfect the timing and technic of pear spraying and dusting so that the maximum of protection may be realized against these destructive enemies of the pear orchard.

The oriental peach moth.—Peach growers find adequate protection against the usual insect pests of the peach in the standard spray schedule used generally thruout the State, except for the oriental peach moth, a pest that has but recently invaded New York peach orchards. Due to peculiarities in the feeding habits and life history of this insect, it cannot be reached with sprays or dusts. The chief hope of the peach grower lies in the introduction of parasites, and the Station workers are carrying on an intensive campaign of rearing and liberating tremendous numbers of parasites in the peach-growing sections of the State. Encouraging results are being obtained.

Special studies in eastern New York.—The extensive fruit plantings of the Hudson Valley and the Lake Champlain district offer many problems

in insect pest control peculiar to those regions. The Station has found it necessary, therefore, to conduct rather widespread orchard experiments in these sections in order to deal intelligently with the difficulties encountered by fruit growers in eastern New York.

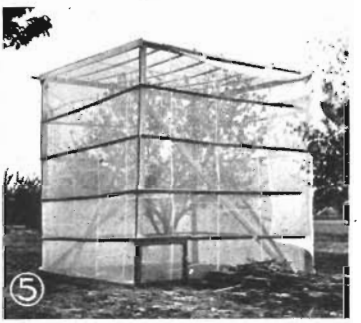
Phototropism of the codling moth.—The reactions to light of the codling moth and other orchard insects are being studied with a view to determining the possible value of light traps in the control program. It has been found that the use of light traps is one of the most reliable methods for determining codling moth flight, thus contributing to greater accuracy in forecasting spray dates. Tests show that light traps reduce the amount of codling moth injury, and efforts are being made to determine the feasibility of omitting late spray applications, thereby diminishing the residue problem.

Insect pests of ornamentals.—The nursery industry has long felt the need for reliable information on the identity, habits, and control of destructive insects that attack evergreens and ornamental plants, such as is available for fruits and vegetables. In order to meet this need, the Station has assembled an impressive planting of evergreens and other ornamentals on its own grounds where major pests of these plants can be studied, while other experiments and observations are also being carried on in commercial nurseries.

Canning crop pests.—The production and quality of fruit and vegetables grown for the canning factory may be materially affected by various insect pests. Among the more important of these receiving special attention at this time are the carrot rust fly, the cabbage maggot, the seed corn maggot, the cherry fruit fly, and the raspberry fruit worm. Each of these presents some perplexing problem to the entomologist, such as finding an insecticide with killing properties for the particular pest concerned, keeping the cost of control within practical limits, avoiding the use of materials that might prove deleterious to the canned product, and the like.

The corn borer.—Since most of the field corn grown in New York goes into the silo, the general farmer has not found the European corn borer the serious pest that it has proved to be in other parts of the country. Sweet corn growers, however, especially in western New York, have sustained serious losses from this insect in some instances. This is true both where the crop has been grown for the green corn market and for the canning factory. The Station experiments deal chiefly with control of the pest by clean-up measures, variety resistance, and delayed planting. Community effort and constant attention to good farm practices that have given a large degree of control of the borer are especially recommended.

Vegetable pests on Long Island.—The highly developed truck crop interests on Long Island have made necessary special attention to the important insect pests attacking vegetables in that region. Efforts are being directed to the control of insects on potatoes, cauliflower, cucumbers, and beans. In connection with the last-named crop, mention should be made especially of the Mexican bean beetle. This is a striking example of invasion of new territory by an insect wholly unknown to the section a few years ago. With the Mexican bean beetle definitely established both in western New York and on Long Island, the bean growers of the State are confronted with a radical change in the production of beans, for it is apparent that the crop cannot be grown without protective sprays once the bean beetle gains in numbers as now seems inevitable.



1. Harvesting Grapes at Vineyard Laboratory; 2. Lysimeters; 3. Tunnel under Lysimeters; 4. Bagged Blossoms in Breeding New Varieties; 5. Tent for Pollination Studies; 6. Cortland Apple; 7. Nursery Stock Experiments.

NEW YORK is one of the three leading states in the Union in the area devoted to fruit growing and in the yield of fruit. In 1930, over 9,000,000 quarts of strawberries were harvested; more than 27,000,000 bushels of apples; better than 25,000 tons of cherries; over 76,000 tons of grapes; over 2,000,000 bushels of peaches; and something over 3,000,000 bushels of pears. The Experiment Station has played a prominent part in the development of the fruit industry in the State.

Testing fruit varieties.—At one time or another there have been under test in the Station orchards all of the named varieties of apples, pears, peaches, cherries, and plums that could be obtained. In a similar way, tests have been made of the named varieties of grapes and of the small fruits. The information obtained in this way has served as the basis for a series of exhaustive monographs on the hardy fruits that are accepted universally as standard treatises on the subject. A comparison and study of the characteristics of these fruits have also served to aid the Station fruit specialists in the breeding of new varieties, discussed in more detail below. Hundreds of varieties of all of the hardy fruits are under test at the present time, and new varieties are being added to the collection from all parts of the world. It is not expected that many of these new sorts will be suited to New York conditions, altho sometimes they are, but occasionally they display qualities that make them valuable as parent stocks in the breeding of new varieties.

Fruit breeding.—Working on the assumption that only by the introduction of superior varieties can any permanent progress be made in fruit growing, the Station pomologists have for years given their chief attention to the breeding of new fruits. That this is a painstaking and time-consuming job is apparent when one considers that it requires 30 years or more to establish a new variety of apple and from 10 to 12 years to prove the worth of a new kind of strawberry or raspberry or other small fruit. It is not surprising, therefore, that the offerings of the Station in the way of proved new varieties is no larger than it is. During the past 25 years more than 80,000 seedlings have been grown on the Station grounds from crosses between various fruits. Of this number a little better than half have fruited, and out of this 40,000 or more less than 100 seedlings have been given names and sent out as new varieties deserving further testing by fruit growers. Some of the outstanding new varieties are Cortland, Macoun, Milton, and Early McIntosh among the apples; Cayuga, Gorham, Phelps, and Pulteney for the pears; the Seneca sweet cherry; Hall and Stanley for the plums; Portland, Ontario, Sheridan, Fredonia, and Golden Muscat for the grapes; the Fredonia gooseberry; June and Newburgh

raspberries; and Clermont, Culver, Camden, and Cato among the strawberries.

The Fruit Testing Association.—The first question that naturally occurs to the fruit grower, either amateur or professional, is "Where can I obtain stocks of these new varieties?" To meet this demand there was created a few years ago a corporation known as the New York Fruit Testing Cooperative Association. The Manager of this Association makes his headquarters at the Station, and the chief purpose of the organization is to propagate the new fruits developed by the Station fruit breeders and distribute the stocks to the members of the Association and others at about cost of production. Membership in the Association is open to anyone interested in new and better fruit varieties upon the payment of a nominal fee.

Pollination experiments.—The importance of pollination in the production of fruit has come to be much better understood within recent years, and the Station is carrying on intensive studies on some of the more profound aspects of the pollination problem. Much information has been obtained on the compatability of the different varieties of the several hardy fruits so that fruit growers can now be advised as to the best combination of varieties to set in the fruit planting to insure an adequate supply of suitable pollen.

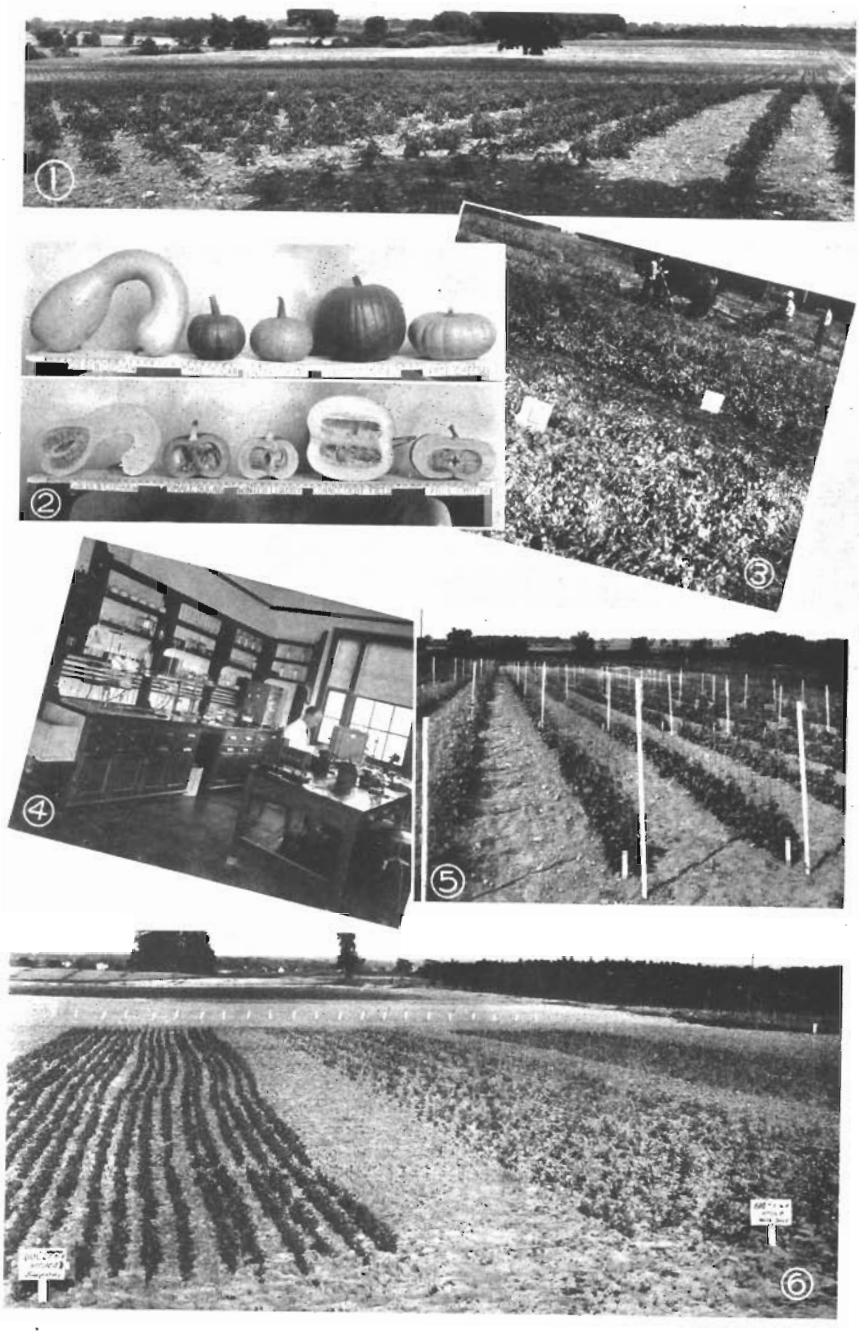
Identification service.—The rapid growth of the Station herbarium and greatly improved laboratory facilities now make it possible for the Station to aid nurserymen and growers in the identification of trees, shrubs, and fruits. The botanical relationships of the fruits and vegetables are also being studied in the botanical laboratory of the Pomology Division.

Orchard soil studies.—The management of orchard soils presents a complicated problem to the New York fruit grower, for the economics of fruit growing of necessity play an important part in planning the procedure to be followed with respect to the cultural treatment of the orchard. For example, at present there is a pronounced trend from clean cultivation to sod which in turn raises the question as to what fertilizers will best maintain production in sod orchards. It is evident in many parts of the State, too, that even clean-cultivated orchards may need some fertilizer treatment where cover crops are not being turned under regularly to maintain a humus supply. Soil specialists, therefore, are carrying on a wide range of experiments in orchards, in the greenhouse, and in lysimeters to study the fertilizer needs of orchards, together with the nutrition of the fruit tree.

Nursery stocks.—A federal embargo on the importation of nursery stocks from abroad necessitated radical changes in the nursery industry in

New York State, which had looked to Europe for its seedling stocks. To meet this situation, the Station began a series of investigations on the propagation of nursery stocks which has now developed into a comprehensive program covering many phases of the nursery industry. While a great deal of this work is of interest chiefly to the professional nurseryman, much is being learned about the handling of fruit and ornamental stocks of a highly practical character that will eventually aid the fruit grower as well as the home gardener.

Outlying laboratories.—Two highly specialized fruit regions in the State have presented so many problems peculiar to themselves that for several years the Station has maintained special laboratories with horticulturists assigned to the study of local problems. One of these is the Vineyard Laboratory at Fredonia in Chautauqua County, where many phases of grape growing are receiving attention. Work with other fruits, particularly some of the small fruits, is also being carried on at Fredonia. Then in the Hudson Valley, with headquarters at Hudson, the Station is conducting what is known as the Hudson Valley Fruit Investigations. These include variety, cultural, and fertilizer experiments with fruits at various points in the Hudson Valley.



1. View of Canning Crops Farm; 2. Squash and Pumpkin Varieties; 3. Harvesting Pea Plats; 4. Research Laboratory; 5. Pole Beans Under Test; 6. Right and Wrong Way to Fertilize Peas.

EXAMINATION of the early reports issued by the first Director of the Station, Dr. E. Lewis Sturtevant, reveals a wide interest in vegetable crops. In fact, Dr. Sturtevant's work with sweet corn varieties, at this Station and elsewhere, was long the most authoritative treatise on the subject. For a period after Dr. Sturtevant's retirement, comparatively little was done with vegetables at this Station until the beginning of the last decade. In the meantime a profound change had been taking place in the agriculture of the State, one of the manifestations of which was an increasing interest in the production of vegetable crops. Since 1922, therefore, the Station has expanded its work with vegetables until it now operates a farm of 60 acres devoted exclusively to the study of various problems bearing on the growing of canning crops, and in addition utilizes extensive acreages in the testing of varieties of vegetable crops.

Rotation and fertilizer experiments.—A large part of the canning crops farm is given over to fertilizer and rotation tests with the leading canning crops including tomatoes, stringless beans, beets, peas, sweet corn, and cabbage, with 14 different kinds and amounts of fertilizers replicated three times. These tests are now in their tenth year.

There are two series of rotations in this experiment which clearly illustrate the value of crop rotation in a permanent system of canning crops production. A 4-year rotation of sweet corn, cabbage, peas with red clover seeded in the peas, and clover hay the fourth year has produced satisfactory crops each year, but peas grown continuously on the same land were a failure after the second year. Another 4-year rotation of tomatoes, stringless beans, beets, and peas with sweet clover seeded in the peas has also proved satisfactory for all crops. Tomatoes grown continuously on the same land produced as well as those grown in rotation for 3 years after which the yield rapidly declined until after 6 years of continuous cropping the yield was only about one-fourth as great as the yield of tomatoes fertilized the same way but grown in rotation. Visitors find many valuable object lessons in these experiments, which also supply data upon which the Station specialists base recommendations on cropping and fertilizer practices with canning crops.

The fertilizer experiments show what proportion of the different fertilizer ingredients gives the best result with each crop and what amount of fertilizer per acre will give the most economical increase in yield. Striking differences in growth of these vegetables as a result of the response from the different fertilizers can be seen in these field experiments. It is interesting to note that with cabbage and tomatoes heavy fertilization pays, but with peas and beets, the net returns are greater when moderate quantities

of fertilizer are used. With sweet corn there was very little increase in yield from fertilizer application. With sweet corn a very small amount of fertilizer placed to the side of the row or hill will give the most economical returns.

Fertilizer placement.—Equally as important as using the right kind and amount of fertilizers is the placing of the material at a point in the soil in relation to the roots of the plant to make possible the quickest and most economical use of the plant food supplied. Greater economy and efficiency in the use of fertilizer can be obtained by advantageous placement. The most comprehensive fertilizer placement experiments in the United States with peas can be seen on the Canning Crops Farm. In addition there are also extensive fertilizer placement experiments with tomatoes, beans, cabbage, and beets. With each crop broadcast fertilizing is compared with row placement and the crops are grown in a rotation. It is interesting to note the effect on the fertility level and productiveness of the soil over a period of years resulting from fertilizing the soil (broadcasting) as compared with fertilizing the crop (row placement).

Movement of fertilizers in the soil.—Studies are being made of solution rates of different kinds of fertilizers and their effect on the germination, root growth, time of maturity, and yields of peas, beans, beets, sweet corn, and tomatoes. Some fertilizers are very toxic and inhibit root growth; others stimulate root development. Some fertilizers are quite inert, some are slow acting, and others dissolve rapidly and give quick response. There are considerable differences in the prices per unit of the different kinds of nitrogen fertilizers and of phosphorus fertilizers, but the crop response is not in proportion to the price. A study of these experiments enables a grower to buy fertilizers more economically.

Strain tests of corn for canning.—Remarkable increases in yield have been obtained by growers and plant breeders from the use of what are called hybrid inbred and top-crossed strains of sweet corn. One of the special investigations with corn for the canning factory is a comparison of commercial strains of both yellow and white corn with hybrid inbred strains of the same varieties. New hybrids and top crosses are being rapidly introduced. Many of these are superior to older types. A few lack merit. Tests are made each year to determine the particularly outstanding strains. Altho the cost of the seed of these special strains is slightly higher as compared with seed of a good commercial strain, the net gain to the grower in the increased yield from the hybrid strain will more than justify the extra cost.

Canning quality and yields of pumpkin and squash.—Field and canning tests of many varieties of pumpkin and squash, aided by chemical analyses made by the Division of Chemistry, are showing what varieties will yield the most and produce a canned product of superior consistency. The results of these studies have demonstrated to growers and canners of this State how to produce a superior product and thus regain a market that had been seriously threatened by competition from the Pacific Northwest.

Preserving vegetables by quick freezing.—Thru a cooperative arrangement with a commercial concern, a large number of varieties of peas, beans, rhubarb, asparagus, tomatoes, and sweet corn are being preserved by the quick-freezing process to determine which sorts are most suitable for handling in this way. It is interesting to note that there are very marked differences in the quality of different varieties of a given vegetable and that varieties best suited for quick freezing are often entirely different from the varieties particularly adapted for canning. This may prove to be a very valuable method of expanding the markets for New York State vegetables.

Vegetable variety studies.—Quite apart from the work with vegetables for canning is a large-scale project for testing and describing all of the varieties of the different vegetables obtainable in a series of monographs entitled "The Vegetables of New York". Thus far, exhaustive tests have been made of the peas, beans, and sweet corn, and monographs on these three vegetables have been published. Work is under way at present on growing and describing cucumbers, muskmelons, pumpkins, squash, onions, shallots, chives, and leeks.

Vegetable breeding.—Improved varieties and strains of tomatoes, peas, sweet corn, greenhouse cucumbers, muskmelons, and squashes are being developed by hybridizing and selection. Extensive field tests of these new varieties can be seen and compared with standard varieties.

Vegetables for vitamins.—In cooperation with the Division of Chemistry studies are being made of the vitamin C content of different vegetables, and of different varieties of each vegetable to determine which kinds are richest in vitamins, which are so essential to good health. Studies are also being made of the stage of maturity and especially the freshness of vegetables on the vitamin content. This may prove to be an important factor in favor of local grown vegetables.