

New York State Agricultural Experiment Station

# 115 Years of Service To New York Food and Agriculture



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**For 115 Years**

# Geneva Station Nourishes Food Industry In New York

by Linda McCandless

**Agriculture is a row-by-row, inch-by-inch endeavor that presents farmers and processors with a variety of complex problems in an environment that is ever-changing. With one eye on the weather, the stewards of our food supply juggle variables such as seed viability, land chemistry, and crop physiology in a complicated equation that equals a plentiful food supply.**

In timing crop-specific techniques for planting, cultivation, and harvest, they struggle with pests like insects, weeds, and disease-causing microorganisms. To move food from farm to consumer as fresh or packaged commodities, they weigh factors like quality, health, safety, and affordability.

A long-standing partnership between New York State taxpayers and scientists at Cornell University's New York State





**LAUNCH PAD:** Donald L. Downing, professor of food processing, directs the Food Venture Center, opened in 1988 to give guidance to state residents seeking to introduce new food products and processes. Here are just some of the many products the center has helped launch. Guidance includes expertise in food safety, government regulations, sensory evaluation, and product development; resource networking in such crucial areas as packaging, labeling, and marketing; analytical services; and scale-up facilities in the station's 10,000-square-foot Pilot Plant (seen in background).

Agricultural Experiment Station at Geneva helps sustain New York's number one industry—food and agriculture—valued at more than \$21 billion annually. For 115 years, this unique partnership has helped farmers provide fruits and vegetables to consumers, resulting in many improvements in the grand horticultural experiment we call production agriculture. It is an experiment that feeds 17 million people in New York alone and millions of others in the Boston-Washington corridor.

In response to increasingly complex environmental issues and consumer demand for new, value-added products, the mission of the Geneva Experiment Station over the last three decades has broadened beyond the scope of production agriculture, however.

Researchers continue to develop improved va-

rieties of fruits and vegetables and new methods of production, but technology has changed. Today, gene jockeys integrate molecular methods of genetic transformation with classical breeding techniques to develop insect- and disease-resistant varieties, thus decreasing our reliance on pesticides. In the last decade, entomologists, plant pathologists, and horticulturists at the station have been successful in ushering in a new era of pest control called Integrated Pest Management (IPM), which has reduced New York growers' and turf managers' reliance on chemicals.

Research and education programs conducted at Geneva in the last 10 years, in particular, have played a major role in the dramatic renaissance of the New York grape and wine industry. And to help satisfy changing consumer demand for "freshly packaged," "quick," nutraceutically en-



**HONEST TALK AND WHOLESOME WINE:** Robert M. Pool (left), professor of viticulture, discusses grape and wine quality with Dick and Cindy Peterson, owners of Swedish Hill Vineyard in Romulus, N.Y. The average value of all New York grape sales is \$41.8 million. More than 70,000 tons of grapes from more than 1,000 New York growers end up in the wine bottles of 97 state wineries; gross sales are over \$300 million.



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hanced, gourmet, and ethnic foods, food scientists at the station have helped fledgling and established entrepreneurs—both large and small—negotiate health, safety, and licensing regulations to develop hundreds of new food products.

#### **Farmers Rely on Station**

Dale Hemminger, a third-generation vegetable farmer of Seneca Castle, N.Y., farms 2,000 acres and runs a 300-cow dairy. Like thousands of farmers before him, he relies directly on agricultural information developed by researchers at the Geneva Experiment Station.

"We need the Ag Station and we need Cornell to help us keep our costs low; to develop good

management practices; to help us monitor and manage insects, diseases, and weeds; to monitor soil fertility; and to keep new varieties coming," he says. Projected yields at Hemdale Farms this year will be factored into a 1995 New York State vegetable processing equation that totals well over \$250 million. Despite the hot, dry weather of 1995, Hemminger was projecting yields of 1550 tons of snap beans, 6000 tons of cabbage, 3000 tons of beets, and 1600 tons of sweet corn—nearly 24 million pounds of vegetables.

Like most growers, Hemminger is both cautious and aggressive when it comes to trying out new farm technology. Before he invests his time and money, he wants to make sure a new variety,



a new control, a new technique, or a new sampling method works somewhere else first. He relies on trials conducted in labs, greenhouses, and fields at the 800-acre Geneva Experiment Station to do the research and prove its value to the Hemdale Farm operation.

Agricultural research that is developed and tested today becomes the practice in the fields of tomorrow, but it may take two to five or more years to produce reliable results and several more years before the practice, the variety, or the technology is adopted. In that respect, agricultural research is a lot like farming: a process where observations made daily contribute to weekly, monthly, and yearly gains resulting, ultimately, in decades of increasingly better yields and higher-quality and safer food.

During the past century, the experiment station has communicated research results to its audience in the form of bulletins, newsletters, field days, fruit and vegetable schools, and by one-on-one contact with extension agents and farmers. To generate and keep abreast of the latest information today, farmers and researchers also rely on technology unavailable 10 years ago: computers track production and crop records; scouts send insect monitoring reports via computer and fax; farmers, researchers, and extension agents talk shop over the Internet; and weather data and forecasts are available over Cornell Cooperative Extension's electronic network called CENET.

Hemminger is quick to point out what most consumers don't know: "There is a complete turnover in vegetable varieties every five years. Where would we be without the research of people like Mike Dickson at the Experiment Station?"

Dickson, a vegetable breeder who just retired, spent his career breeding vegetables for yield, pest resistance, quality, and adaptability. Since 1960, he worked to develop germplasm for snap beans resistant to white mold and brown spot. The station provides this germplasm free of charge to commercial seed companies who use it to produce new hybrids—another successful partnership.

"We used to think two tons per acre was a good yield," says Hemminger, who has grown snap beans for 30 years. "Now we are approaching yields of four tons per acre and are disappointed if we don't get it. Some say we have an oversupply problem, but if New York farmers

fall behind in our ability to improve yields and reduce our costs of combating insects and diseases, it's the consumer that loses."

Harold Teeple of Wolcott, N.Y., agrees. He and his family farm 250 acres of apples on the shores of Lake Ontario and have been involved in New York's apple industry since 1945. In 1995, the New York Agricultural Statistics Service projects production of 1,130 million pounds of apples in New York. Five varieties developed at the station—Cortland (1915), Empire (1966), Jonagold (1968), Jonamac (1972), and Macoun (1923)—will account for nearly 20 percent of the state's total production in 1995. Since 1914, the Geneva Experiment Station has released more than 224 new varieties of fruits including more than 60 varieties of apples.

The Teeple family cooperated closely with station apple breeders Roger Way and Susan Brown in the development of the Royal Empire, an apple that was first discovered as a limb sport on an Empire tree on Teeple Farms and released in 1990. "It comes on redder than Empire, improves the pack (to extra fancy grade), and is more appealing to consumers," Teeple says.

### **Vineyards and Wineries Benefit**

Production agriculture for fruit and vegetables is only part of the food infrastructure supported by research at Geneva. Part of the station's continued success and service over the past 115 years has been in its ability to develop and adapt research programs to meet new challenges posed by growers, industry, the environment, state regulatory agencies, the university, and consumers.

The wine and grape industry is a case in point. Since the New York legislature passed the Farm Winery Act in 1976, 77 new wineries have been established. Total production from all 97 New York wineries is 25 million gallons and gross sales are more than \$300 million. New York is now the second largest wine producer in the country.

Jim Trezise, president of the New York Wine & Grape Foundation, is a strong supporter of the station's Wine Research and Extension Program. "The numerous viticultural projects have in-

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**Developments in vineyard scouting for insect pests, new cultural and management practices, and the use of weather stations and monitoring programs to reduce pesticide applications have saved an estimated \$187 per acre. Applied to New York State's 33,000 acres of grapes, industry-wide savings could be as high as \$6 million.**

creased vineyard productivity, and the enology projects have improved wine quality and consistency, while the newsletters, seminars, and workshops have ensured that the information ultimately arrives where it belongs—in the vineyards and wineries,” he explains.

His assessments are seconded by Thomas G. Davenport, director of Viticultural Research and Regulatory Compliance for the 50-year-old National Grape Co-Operative Association, Inc. “National Grape Co-Operative and its wholly owned subsidiary Welch Foods have a long association with Cornell University’s New York State Agricultural Experiment Station,” he writes, and “this association has enabled National grape producers and Welch to maintain and expand our businesses not only in New York but in the entire United States as well as internationally.”

Davenport outlines developments in vineyard scouting for insect pests, new cultural and management practices that have increased yield, and the use of weather stations and monitoring programs to reduce pesticide applications to support his estimate that “overall savings from these and other cultural practices amount to \$187 per acre. Applied to New York State’s 33,000 acres of grapes, industry-wide savings could be as high as \$6 million.”

#### **Food Ventures Get Boost**

Other industries throughout the state have received valuable technical assistance from the Food Venture Center (FVC), a program initiated in fall 1988 by the station’s Food Science and Technology Department.

Joel Frank, program director for the Argus Community’s New Leaf Program, helps provide job training for 170 formerly homeless men and women in the South Bronx. In the spring of 1995, they received a license to market the vinegar they make flavored with the herbs they grow to help support their own program. “The

Food Venture Center is an incredible resource,” Frank says. “Don Downing was extraordinarily helpful in guiding us in the proper notation of our vinegar process so we could gain licensed approval from Ag & Markets. When the FDA came in to inspect a week after we were licensed, they told us we exceeded all requirements for commercial production.”

David Moore, corporate quality assurance manager at Indian Summer, a fruit juice company with operations in Lyndonville, Sodus, and Medina, N.Y., notes, “As a result of the advice I have received, I have been able to redirect my efforts to prevent a quality defect from reoccurring, at a potential savings of \$40,000 per year.”

The federal government has posed its own challenges to the experiment station: within seven years, integrated pest management is to be practiced on 75 percent of the nation’s agricultural acreage. Since the inception of the statewide program at the station in 1986, New York has emerged as one of the nation’s leaders in this initiative. Nearly 500 IPM projects have been funded in research, development, and implementation, decreasing pesticide use and increasing profitability for New York farmers, nursery operators, and turf managers. Research-backed methods of pest forecasting and monitoring, action thresholds, and biological control have helped most New York apple growers reduce their pesticide use by as much as 50 percent, while turf managers at golf courses—traditionally some of the heaviest pesticide users—have been able to cut pesticide use by 54 percent.

Does station outreach stop with vintners, growers, processors, and entrepreneurs? No. Today, station researchers are more heavily involved in educating the next generation of scientists than ever before. A widely diverse group of visiting scientists and graduate students from around the world work in the laboratories and field trials



at the station, assisting faculty and infusing programs with new energy, ideas, and concerns. Scientists at the station also support education at the elementary level, too, taking hands-on projects into schools around Geneva to give students a greater understanding and appreciation of fruit culture, pollination, honey bees, hornworms, nematodes, cabbage loopers, and science and math.

### Support for the Future

Research conducted at the Geneva Experiment Station ensures the viability of a multitude of enterprises across the state and the future of New York's food supply. Outreach programs educate consumers, growers, processors, entrepreneurs, industry, and future scientists. In 1882, the budget was \$10,000 a year; in 1995, it is \$19 million. Some of the station's budget



**CATCHING THE PUBLIC'S EAR:** IPM-grown corn was introduced to consumers in test markets in Henrietta, N.Y., this past summer as a collaborative pilot project among sweet corn producers Alan and Jeff Werner, Cornell Cooperative Extension, the state Department of Agriculture and Markets, the Geneva Experiment Station's integrated pest management team, and Wegman's supermarket. Shown here discussing expanding the effort to include other fresh and processed products are (left to right) Abby Seaman, area specialist in sustainable agriculture/vegetable production; Curt Petzoldt, senior IPM extension associate; and Bill Pool, manager of food safety and regulation for Wegman's Food Markets.

KEVIN COLTON, NYS AGRICULTURAL EXPERIMENT STATION



comes from state and federal sources, some from grants, contracts, gifts, and other places. New York taxpayers fund slightly more than half of the total budget and it is a remarkable bargain: for roughly 50 cents per person per year, New Yorkers guarantee the future of the food chain that sustains them, the stewardship of at least 25 percent of the land in New York State, and the economic viability of industries that contribute \$21 billion to the state's economy.

Generating support for the station's research programs has not always been easy. Every director has grappled with the problem. But the partnership between taxpayers and scientists that was first established in 1880 has continued to prosper and bring positive results. Today, it is complemented by increased support from growers, processors, and industries that benefit from station research.

Hemminger and Teeple, Trezise and Davenport, and Frank and Moore represent the many New Yorkers who support the Geneva Experiment Station. They are adamant that research affecting all sectors of agriculture is good for growers, good for the economy, and good for consumers. They are concerned about a lack of

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K. COLTON AND J. OGRODNICK, NYS AGRICULTURAL EXPERIMENT STATION

support for research at all levels: by farmers, by industry, by the public, and by legislators.

"We have a good thing going between Cornell, extension, and farmers," Hemminger says. Despite urban land-use pressures in New York that are almost negligible in competing states, the state ranks third nationally in apple production, second in wine production, first in sweet corn for processing, and fourth in snap beans for processing.

In the brave new world of 21st century food and agriculture, positive cash flow on the farm and in food manufacturing facilities means more than keeping one step ahead of the competition. It also means staying one step ahead of the weather, the technology, the tools, the insects, the diseases, the weeds, the waste, the market, and the spoilage microorganisms. It also means being environmentally responsible. "Research helps us do that," Hemminger says. "If we let it slip, we'll never get back the advantage we now have."

Linda McCandless is director of Communications Services at the Geneva Agricultural Experiment Station.

**GRUBBY WORK:** Jennifer Grant, IPM area specialist in environmental stewardship, is involved in turf management projects that help golf course managers cut pesticide applications in half. A little darkroom and computer wizardry lets us see from a grub's vantage point how Grant looks using a cup cutter to scout for turf pests.



## It All Began with Seven People and a Few Buildings

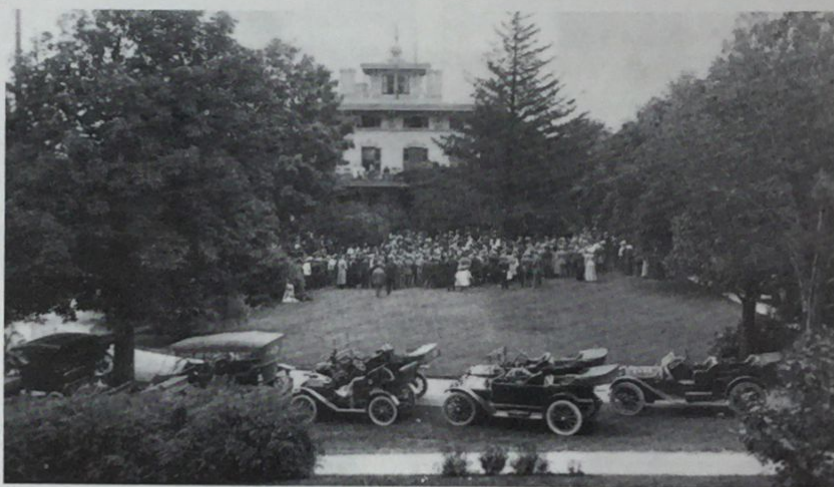
The New York State Agricultural Experiment Station at Geneva was established by an act of the state legislature in 1880 with the mandate "to promote agriculture in New York through scientific investigations." Under Director E. Lewis Sturtevant, the doors were officially opened on March 1, 1882. At the time, the station consisted of 125 acres of land, a large brick building that doubled as laboratory and living quarters, and several farm buildings. Orchards comprised 643 apple trees, 97 peach trees, 77 pear trees, 37 cherries, and 28 plums. Four Jersey cows and several horses made up the stable. The staff consisted of Sturtevant, assistant H. H. Wing, horticulturist E. S. Goff, chemist S. M. Babcock, and stenographer Robert Watson. An unnamed janitor functioned as yardman, stable boy, receptionist, and maintenance man. Entomologist J. H. Comstock of Cornell was hired part-time. Work started the next day and has never ceased.

Geneva is the sixth oldest experiment station in the country and the second for New York (the first was at Cornell, the state's land-grant university). There were some who thought the station should be run as a model farm but that was not Sturtevant's intent. "The province of an agricultural experiment station is not so much the discovery of new facts as it is the testing of applications and the theory of relations," he wrote in his 1882 annual report to the New York State Legislature. "The field of agricultural study is very extensive. There is room in it for pure science; and there is also abundant room for the science that applies to practical affairs."

In this, he was in agreement with A. C. True, the director of the U.S. Department of Agriculture's Office of Experiment Stations, who was charged with overseeing station expenditures nationally. "An agricultural experiment station is an institution in which

scientific and practical investigations are made with a view to improving the methods of agriculture and introducing new crops or industries," he wrote to J. Sterling Morton, secretary of agriculture, in 1889. At the time, experiment stations existed in 14 states and in 320 countries around the world. (Germany, which established the very first agricultural experiment station in Möckern in

broadened to include work on beef cattle, swine, and evaluation of fruit varieties. Still later, activities were added in the fields of bacteriology, dairy science, fruit horticulture, and chemistry. In 1923 the station became part of Cornell University's College of Agriculture. At the end of World War II, all research on animals was moved to Ithaca, and the Geneva station became essentially a horticultural and food



**Around the turn of the century, growers came in buggies and early-model cars to a meeting outside Parrott Hall.**

1851, had 68 stations. The first station established in the United States was in Connecticut in 1877.)

In addition to studies of plant physiology, chemical composition of natural and artificial fertilizers, rotational cropping systems, acclimation, and soil and water analysis, researchers worked on the development of practical and safe methods in the production and processing of food, particularly milk. Bacteriology and chemistry as they related to food safety were infant sciences. Research endeavors were undertaken in laboratories, plant houses, fields, orchards, stables, and dairies.

In its earliest days, the station's research efforts concentrated on dairy, horticulture, and the evaluation of varieties of vegetables and field crops. In 1887 the program was

science research institute.

Today the station is recognized around the world for horticultural research and the contributions it has made over the past 115 years. There are two outlying laboratories: Highland, N.Y., which concentrates on tree fruits and sweet corn, and Fredonia, N.Y., which specializes in grapes. Overall, research and extension activities are conducted on more than 100 different projects on 800 acres of land by 50 faculty members, 90 graduate students, and 230 staff.

—Linda McCandless  
*Director of Communications Services,  
Geneva Agricultural Experiment  
Station*



## Patrolling Pests, Nuzzling Nozzles, Jockeying Genes, and Factoring Food Station Research from 1880 to 1995

### 1960–1995

- Gene gun developed. This technique has revolutionized genetic engineering in many fields and has streamlined traditional plant breeding by injecting genes into plant tissues; accelerates development of superior apple and grape varieties (Sanford). Now used also in medical sciences.
- Fundamental discoveries about the identification and synthesis of sex attractants from more than 100 insect pests and use of these attractants in integrated pest management programs (Roelofs, et al.). For his work, Roelofs has been awarded the Wolfe Prize and the National Medal of Science, and has been inducted into the National Academy of Sciences.
- Development and release of the cultivars Jonagold (Way, Labelle, and Einset), Jonamac (Way), and Empire (Way and Einset). Jonagold and Empire received the prestigious Outstanding Fruit Cultivar Award from the American Society for Horticulture Sciences. Introduction of Liberty apple which is resistant or tolerant to four major diseases affecting apple (Lamb, Aldwinckle, Way, and Terry).
- Development of the Geneva Double Curtain system for trellising grapes; increases yields by at least 50 percent (Shaulis). Mechanized pruning, shoot positioning, and crop load control has major influence on grape industry yields (Pool and Shaulis). Mechanical harvester for grapes helps keep New York competitive with other grape-producing regions (Shaulis, Shepherdson, Millier, and Moyer).
- Since 1973, the development of the Integrated Pest Management (IPM) program has resulted in a 30–80 percent reduction in pesticides on crops in New York. Pest forecasting, insect monitoring, action thresholds, and biological controls lead to a more effective and economical control of diseases, weeds, insects, and mites of fruit and vegetables. New York's IPM program is a national leader in the IPM movement (IPM programs and the Departments of Entomology and Plant Pathology).
- Genetically modified squash Freedom II introduced which is resistant to zucchini yellow mosaic virus and watermelon mosaic virus, major diseases throughout the world (Gonsalves, et al.).
- Use of dwarfing rootstocks in the establishment of high-density apple orchards, which helps growers increase profits (Rootstock Apple Breeding Program).
- Release of Cayuga White, the first grape bred specifically for the wine industry (Einset and Robinson).
- Two natural products discovered in *ageratum* that provide anti-juvenile activity in insects and can be used in biorational programs for insect control (Bowers).
- Development and utilization of beneficial fungi in the genus *Trichoderma* as biological control agents for a wide range of plant diseases (Harman et al.).



In today's molecular biology labs, insect DNA is visualized by autoradiography.





In early labs, desiccators (foreground) were used to help keep fruit dry and at constant humidity.

- First large-scale field release of a genetically engineered virus for insect control; aids in the development of biorational pesticides (Shelton, Wood, and Hughes).
- Bred Hi-Dri cabbage for sauerkraut (Dickson and Stamer), multiple virus resistance in beans (Dickson), and virus resistance into crucifers and lettuce (Robinson and Providenti).
- Established Food Venture Center to help entrepreneurs wanting to bring new food products to market (Downing).
- Used molds to ferment and create new foods, including tempeh and onjom, which are important on the international market (Steinkraus).
- Demonstrated that the sweetness of compounds can be related to stereochemistry of the molecule which aided the synthesis of new sweetening agents (Shallenbarger and Acree) and developed the CHARManalysis for identification of compounds responsible for the odor of foods (Acree and Barnard).

- Improved methods of developing highly nutritious soybean milk and eliminating much of the objectional off flavors (Hand, Steinkraus, and Bourne).
- Wine Research and Extension Program, and Wine Analysis Lab established which helped 77 New York wineries get established after passage of the 1976 Farm Winery Act (Food Science and Technology Dept.).
- Liposome immunomigration assay developed as a field assay for rapid screening of samples for small molecules such as drugs and pesticide residues (Food Science and Technology Dept.).
- Studies on the degradation and synthesis of polypeptides eventually led to a breakthrough in understanding DNA and RNA. This work eventually resulted in a Nobel Prize for its author (Holley).

- Food scientists developed technology that allows canned vegetables to have substantially firmer texture (Bourne) and uses ultrafiltration to stabilize honey to make mead (Lee, McLellan, and Kime).
- Developed the leading pea breeding program which provided germplasm for useful characteristics such as leafless pea varieties and virus resistance (Marx).

## 1940-1960

- Four station scientists were among the founding members of the Institute of Food Technologists, the professional organization for food scientists (Hucker, Pederson, Kertesz, and Tressler). The IFT is the principal organization of food scientists with a present membership of more than 28,000.
- Relation between chemical constitution and insecticidal efficiency of oil sprays established (Chapman, Avens, and Pearce) and horticultural spray oils developed to control insects and mites (Chapman and Avens), a technology still used today.
- New process developed for dehydration of peas involving slitting of skin (Moyer et al.).
- Developed Red Top tomato, the first tomato variety that could be machine harvested, and pioneered work on verticillium resistance in tomato (Tapley).
- Developed a pea grading system which is still in practice today and documented the need for crop rotation for peas and tomatoes (Sayre).
- Pioneered laboratory/greenhouse facilities and techniques for research on modes of action in relation to disease control (Hamilton and Szkolnik).





Horse-drawn spray equipment is tested in the early 1900s.

## 1900–1940

- Utilized Bordeaux mixture for controlling fungal diseases of potatoes (Stewart).
- Lime sulfur discovered as a control for San Jose scale, an insect affecting fruit trees (Parrott).
- Developed first biological control program for (oriental fruit moth) insect control in New York (Daniel).
- Pioneered use of organic chemicals for control of plant diseases; researcher later became a member of the National Academy of Sciences (Horsfall).
- Seed Testing Laboratory established; as Station Director Sturtevant said, "Without good seeds, there can be no good crops"
- Published seven volumes of *Fruits of New York* from 1905 to 1928 (Beach and Hedrick).
- Published four volumes of *Vegetables of New York* from 1928 to 1937 (Hedrick and others).
- Developed and introduced (1914) the Cortland apple, a variety still widely used today.

- Conducted basic research on the structure of plant pectins and on the enzymes that degrade them. This work led to the use of pectinases to clarify fruit juices, a practice still used today (Kertesz).
- Studies on the microorganisms that spoil catsup and similar tomato products led to changes in formulations, involving salt, sugar, and vinegar that improved shelf stability of food (Pederson).
- Served as the international center for the taxonomy of bacteria and aided in the development of *Bergey's Manual of Determinative Bacteriology* (Breed, Pederson, Hucker, and Conn).
- Initiated the Bacterial Stain Commission which has played a major role in the standardization and improvement of dyes that are used in biology and medicine (Conn).
- Demonstrated the need for blanching frozen foods and documented their nutritive value which led to the development of the frozen fruit and vegetable industry (Tressler).

- Developed improved process for cream cheese production which doubled the production of cream cheese in New York the following year (Dahlberg).
- Developed and patented a rapid process for making sherry wine from Concord grapes (Tressler).

## Prior to 1900

- Investigated the chemical composition of milk and butter and developed the Babcock method as a rapid test for fat in milk, a process still used today (Babcock).
- Developed test to determine the bacterial count in milk (Breed).
- Evaluated more than 1,000 varieties of vegetable and field crops over the years 1883, 1884, and 1885 to make sound recommendations to New York growers (Sturtevant).
- The objectives of the station defined as "discover, verify, and disseminate" (Sturtevant).
- To ensure the quality of agricultural products for New York growers, developed regulatory analyses of feeds and fertilizers (Van Slyke), conducted the nation's first seed testing lab (Sturtevant), and established the chemical analysis laboratory for evaluating the quality of fertilizers, feeds, soils, milk, and water.
- Paris Green used to combat the Colorado potato beetle after it became established in 1872 in western New York potato fields; first chemical treatment used in New York (Goff).

—Linda McCandless, Pat Krauss, Paul Chapman, Edward Glass, and Anthony Shelton  
*Geneva Agricultural Experiment Station*