Healthy Plants, Healthy Planet, Healthy Food, Healthy People

Our Vision

To advance a sustainable plant agriculture and food system through state-of-the-art research and extension programs that address local and worldwide needs.

Our Mission

Geneva supports New York's agricultural and food industries with research, extension and education programs.

- We use the best-suited scientific tools and systems to solve fundamental and applied scientific questions pertaining to plant agriculture and food science;
- We improve competitiveness and profitability of growers and processors of fruit and vegetable crops, turf, and other expanding horticultural industries;
- We develop biologically and environmentally sound practices to produce, protect, and process horticultural crops and commodities;
- We develop and implement technologies to ensure wholesome foods;
- We serve the diverse clientele of the state and support emerging opportunities to enhance and expand plant-based agriculture and food systems;
- We help create, attract, and retain agricultural, food, and biotechnology enterprises in New York State.

Vital Statistics

- Established in 1880
- Four academic units; five support units
- Outlying labs in Fredonia and Highland
- 271 employees (148 on state funds):
  49 professors and program leaders
  21 other Ph.D. level scientists
- 22 graduate students
- 30 visiting scientists in residence
- 900-acre campus, including:
  850 acres of farm land for research
  1 acre of greenhouse space
- 623,000 square feet of buildings
- Annual budget of $21.9M
  ($11.6M funded through SUNY)

Partnerships with Industry

Geneva technology can be licensed from the Cornell Research Foundation for commercial development.

Patent Activity: Jan. 1, '02 - Dec. 31, '03
16 Foreign patents filed
10 Foreign patents issued
10 US patents filed
9 US patents issued

NEW HIRES

Dr. Lance Cadle-Davidson, adjunct professor of plant pathology, works at the USDA's Plant Genetic Resources Unit, and researches disease development in grapes at the molecular level. (2003)

Dr. Juliet Carroll, plant pathologist, is the fruit IPM coordinator for the NYS Integrated Pest Management Program. (2002)

Dr. Chris Owens, adjunct assistant professor of horticultural sciences, works at the USDA-ARS Plant Genetics Resources Unit where his research aids the future development of new grape cultivars. (2002)

Dr. Dan Peck, assistant professor of entomology, leads the Soil Insect Ecology Group. (2002)

Dr. Christine Smart, assistant professor of plant pathology, studies the molecular and genetic basis of plant-disease interactions in vegetables and leads the vegetable extension program. (2003)

FACULTY AWARDS

Dr. Terry E. Acree, Food Science & Technology, the 41st Tanner Lecture Honoree for outstanding scientist. (2003)

Dr. Dennis Gonsalves, Plant Pathology, Alexander von Humboldt Foundation Award. (2002)

Dr. Thomas Henick-Kling and Dr. Chris Egli, Food Science & Technology, American Society for Enology and Viticulture Best Paper Award. Henick-Kling also awarded honorary membership in the International Assoc. for Enology, Management and Wine Marketing. (2002)

Dr. Harvey Hoch, Plant Pathology, Fellow of the American Phytopathological Society. (2002)

Dr. Geza Hrazdina, Food Science & Technology, elected to the Hungarian Academy of Sciences. (2002)

Dr. Wolfram Köller, Plant Pathology, American Phytopathological Society Lee Hutchins Award. (2002)

Dr. Alan N. Lakso, Horticultural Sciences, NY Wine & Grape Foundation's 2003 Research Award.

Dr. C.Y. Lee, Food Science & Technology, the Institute of Food Technology Babcock-Hart Award. (2002)

Dr. M.A. 'Andy' Rao, Food Science & Technology, IAFIS-FPEI Distinguished Food Engineering Award. (2003)

Dr. Alan G. Taylor, Horticultural Sciences, Seed Science Award from the Crops Science Society of America. (2003)

Perpetual Winegrape Productivity Award, received by the Experiment Station for exceptional contributions to the growth and development of the U.S. wine industry. (2002)

IN MEMORIAM

Dr. Emil Frederick Taschenberg, professor emeritus of grape entomology, served for 38 years as director of the Fredonia Research Lab, which was renamed the Taschenberg Lab in his honor in 1991. (2002)

Dr. Michael Szkolnik, professor emeritus of plant pathology, was internationally recognized for his work on the biology and control of fungal diseases of fruit trees. (2002)

Robert W. Kime, food scientist and manager of the Station's Processing Pilot Plant, helped many fruit and vegetable growers and entrepreneurs develop and refine value-added products, particularly mead, hard cider, and fruit wine. (2002)

GIFTS

John F. Schadt, left $.5M to the Entomology Department at the Hudson Valley Laboratory where he was employed as a technician for 38 years. (2002)

For More Information

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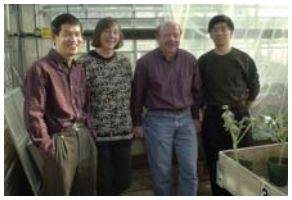
DISCOVERING FUNDAMENTAL KNOWLEDGE FOR FUTURE APPLICATIONS

Gene Pyramiding for Resistance Management

Provided the first experimental evidence that breeding plants to produce two different proteins by a process called "gene pyramiding" delays the development of resistance in targeted insect pests. The research has important implications for the long-term protection of agricultural crops produced through biotechnology, particularly Bt corn and Bt cotton. The entomologists performed the research using Bt broccoli and the diamondback moth, one of the world's major insect pests.



Entomologists and plant breeders in Ithaca and Geneva helped identify "gene pyramiding" as a means of delaying insect resistance in Bt corn and Bt cotton.

Redefining Sexual Chemistry

Unlocked a 320-million-year mystery about species evolution. Researchers proved the existence of a non-functioning gene in the female sex glands of the European corn borer moth that can be suddenly turned on to change the pheromone components that females use to attract a mate. Only rare males in the male corn borer population—roughly 1 in 200—are capable of responding to the chemicals produced by the new gene. In this new model, the entomologists demonstrate that insects can evolve chemical systems in leaps and bounds rather than by slow evolutionary stages, as had been previously assumed. Manipulation of insect chemistry is an effective behavioral tool used to monitor insect populations and disrupt mating behavior in agriculture and turf.

The pesky European corn borer helped scientists at Geneva unlock a 320-million year mystery about evolution.

Cracking the Code

Identified processes by which plants and bacteria "communicate." A team of researchers from China, Hobart and William Smith Colleges, and the Experiment Station are studying a type of bacteria called *Agrobacterium vitis* that attacks grapes. They are working on methods that use signal molecules called auto- inducers to control interactions with plants by enhancing or inhibiting "quorum sensing" communication. In addition to being able to affect how plants defend themselves against bacterial diseases, scientists and growers hope to use quorum-sensing to inhibit the growth of detrimental bacteria and encourage biological control.

Healthy Plants, Healthy Planet, Healthy Food, Healthy People

New York State
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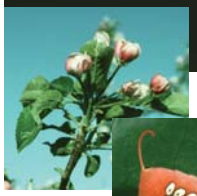
Geneva, NY 14456-0462



Two Years in Review 2002-03

From Molecules to Markets... the Geneva Experiment Station Means Business for New York

CORNELL

FROM THE Director...

Since 1882, scientists at the New York State Agricultural Experiment Station have helped build the most highly efficient and productive agricultural and food production system in the world. We have achieved this result through research, and by extending the results of that research to other scientists, growers, and producers.

In the early 1900s, there was very little scientific knowledge and few technologies to improve agriculture through applied research. As basic knowledge in science developed, it proved critical in achieving the practical improvements we see in modern agriculture. In assessing the relevance of some of the more basic research being done at agricultural experiment stations across the country today, we do not want to lose this historical perspective.

At Geneva, research is almost entirely focused on practical applications that benefit producers and consumers. This will be apparent as you read about some of our accomplishments in this document. Our scientists conduct basic or fundamental studies to develop new knowledge and technologies with the expectation that these studies will lead to practical applications.

We need to keep this balance between applied and fundamental research. We cannot solve all the problems the world faces today with current knowledge. We need to develop new information and technologies to advance agriculture and food processing in the future.

Although we invest a small amount to generate fundamental knowledge, most of the investment at Geneva is for research conducted using well-established methodologies to solve specific problems. For instance, we continue to develop new varieties of crops using traditional breeding approaches; evaluate new pest control materials and IPM strategies using proven methods; use conventional approaches to test new rootstocks and cultivation systems; and use well-established principles and procedures to help food and beverage manufacturers produce new food products.

Funds to support our applied and fundamental research programs come from many sources: the state and federal government, granting agencies, grower organizations, companies that manufacture equipment used to grow and process food, food processing companies, and endowments established by private companies and individuals. We are grateful for the support of so many in industry and government who appreciate that investments in agricultural research have historically paid huge dividends.

In many ways, Geneva's investment in fundamental and applied research reflects our philosophy: use existing scientific information and technologies to advance agriculture and develop new approaches when necessary.

As the Experiment Station's Mission Statement indicates, research and extension activities at Geneva involve more than increasing production capacity. They also include improving food quality and safety, ensuring compatibility between production practices and a healthy environment, improving producers' profitability and competitive advantages, and helping agricultural, food and bio-based industries grow.

Research at Geneva has clearly evolved since our founding. Regardless of the nature of our research programs—whether short- or long-term, fundamental or applied—we are committed to serving the people of New York and strengthening New York's economy.

And we will continue to contribute to the Experiment Station's extremely important long-term goals: "Healthy Plants, Healthy Planet, Healthy Food, Healthy People."

James E. Hunter, Director
New York State Agricultural Experiment Station
Geneva, NY

NEW STATE-OF-THE-ART GREENHOUSES: Eight new greenhouses were built at the Station in 2002 to replace some that dated back to the 1930s. Cooling units and computer-controlled shade cloth enable scientists to conduct greenhouse research in the heat of the summer. Approximately $1.6M in construction funding and $169,000 for equipment came through the State University Construction Fund Five-Year Capital Plan.

Healthy Plants, Healthy Planet, Healthy Food, Healthy People

ON THE COVER: (clockwise from the top) The sun sets over the Station greenhouses; of more than 850 acres of land, there is over 1 acre in greenhouse space. In 2003, plant breeders at the Station released GR7, a new red wine grape, and the Clancy strawberry. Plant pathologists at Geneva study plant diseases, like ones caused by the fungus *Sclerotinia sclerotiorum*, shown here discharging ascospores. Entomologists at Geneva study the biology, ecology and control of insects; pictured here is a Pandora sphinx larva *(Eumorpha pandorus)*. Since its inception in 1880, research on apples "from molecules to markets" has been a major focus of Station researchers.
CREDITS: Larva, fungus, strawberry and apple buds by Joe Ogrodnick/NYSAES/Cornell. Greenhouses by Rob Way/NYSAES/Cornell.

ACCOMPLISHMENTS WITH IMPACT: 2002-2003

Healthy Plants, Healthy Planet, Healthy Food, Healthy People

DEVELOPING AND SELECTING NEW CROP VARIETIES

L'Amour and Clancy Strawberries

Developed and released two new strawberry varieties, L'Amour and Clancy. L'Amour is a bright red, early-June berry with good winter-hardiness, vigor, and flavor. Clancy bears in late June, is less susceptible to diseases that can trouble late-season strawberries, and has good eating quality. Since the Station's founding in 1880, berry breeders have released 38 strawberries.

Small fruit breeder Courtney Weber helps growers stay on top of insects, disease, weather, competition, and the flavor curve. He released L'Amour and Clancy strawberries in 2003.

BlackGold™ and WhiteGold® Cherries

Released two new varieties of sweet cherries adapted to growing conditions in the Northeast. BlackGold™ is dark red, heart-shaped, and good for fresh market and out-of-hand eating. WhiteGold® is yellow-red and excellent for fresh market or processed use. In 2002, the sweet cherry crop in New York was 900 tons and valued at $1.23 million. New York ranks fourth in U.S. tart cherry production, and eighth in sweet cherry.

Better Buckwheat

Station scientists developed new physiological predictors of buckwheat yield that helped identify the Canadian variety Manisoba as well-adapted for New York. Those predictions were borne out in a 10% yield advantage for Manisoba. Most growers adopted the variety immediately after it was recommended by Cornell and made commercially available. Despite harsh conditions in the first year of production, the new variety resulted in better yields across the state.

ASSURING HIGH QUALITY FOODS & BEVERAGES

Microwave those Apples

Found two benefits of the microwave heating of apple products. 1) Microwave heating of apple mash as a pre-press operation for making apple cider increases the yield and quality of the cider. 2) Using microwave heating to pasteurize apple cider improves the quality. A multi-functional microwave unit could heat the mash and pasteurize cider as well as thaw and blanch—two common operations in fruit processing plants.

Healthy Grapes Makes Better Wine

Determined that inconspicuous levels of grape powdery mildew are a precursor to a number of defects that degrade wine. Infections invisible to the eye predispose the grapes to spoilage microorganisms and Botrytis bunch rot that negatively impact wine quality. Plant pathologists at Geneva precisely defined the period of berry susceptibility to infection, demonstrating that diligent management of powdery mildew during this period enhances fruit and wine quality, and prevents losses.

Sniff, Swirl, Taste, and DNA Test

Used advanced DNA typing techniques to analyze 40 different strains of *Oenococcus oeni*, a lactic acid bacterium important in the fermentation of wine. The genetic characterization of the bacteria provides a strong scientific basis for the selection of better strains of starter culture for wine making.

GROWING CROPS COMPETITIVELY

Carrot Blight Thwarted

Demonstrated the impact of scouting and the use of tolerant varieties in the management of leaf blight diseases of carrot in commercial carrot fields in collaboration with growers. The results showed that the established threshold of 25%-infected-leaves before spraying is an effective management strategy. The number of fungicide applications was reduced using this program in spite of wet weather that fueled an epidemic development of *Cercospora* leaf blight on carrots.

Plant pathologists at Geneva helped carrot growers manage carrot blight more efficiently and cost-effectively.

Evaluating Soil Health

The Cornell Cooperative Extension Program Work Team on Soil Health is developing protocols for measuring soil health in commercial and experimental vegetable fields and promoting practices to improve soil quality and productivity. Some of the properties being monitored are: aggregate stability, water infiltration, soil compaction, bulk density, water holding capacity, macroporosity, root disease suppressive capacity, number and diversity of plant-parasitic and free-living nematodes, decomposition rate, mineralizable nitrogen, particulate organic matter, root depth, nodule score, macro- and micro-nutrients, pH, above-ground pest problems at mid-season, and marketable yield and quality. These tests will aid growers in the sustainable management of their soils to achieve higher crop yields and increased profitability. The root disease suppressive capacity and nematode numbers and types are assessed in laboratories at Geneva.

Reduced Fungicide Use in Grapes

Improved the understanding of the biology of the disease Black Rot and the various factors that impact its control, and thus were able to develop an integrated program for managing it in grapes. By pruning diseased tissues from the vine during dormancy, and focusing fungicide sprays during the limited period when fruit are highly susceptible to infection, the same level of control formerly achieved in a six- to eight-spray program can now be achieved with two or three sprays. Reducing the frequency and total amount of applied pesticide has environmental and economic benefits.

Plant pathologists at Geneva were able to develop a program to help manage the Black Rot disease that makes grapes inedible.

FOSTERING ECONOMIC DEVELOPMENT

Grape breeder Bruce Reisch released GR7—a new red wine grape—in Buffalo, NY, at Viticulture 2003.

New Wine Grape

Released the grape 'GR7', dubbed "the working man's red," for its solid all-around performance. Grape growers and wine makers pushed Cornell to officially release the red wine grape because it had proven so vigorous, productive, disease-resistant, and winter-hardy. The grape makes dark, soft wines with good quality and attractive cherry favors. It is already under cultivation in Finger Lakes vineyards and used commercially in wine, particularly red wine blends. The viticulture and enology programs at Geneva have helped expand the New York State wine industry to over 190 wineries.

REACHING OUT TO EDUCATE

New Extension Director

Cornell Cooperative Extension (CCE) gained an associate director (2001) and then director when Helene R. Dillard, professor of plant pathology and former plant pathology department chair at Geneva, was named to the directorship in Oct. '02. At CCE, Dillard focuses her attention on strengthening and further developing extension and outreach efforts across New York. She also works to reinforce and build industry and organizational partnerships at the county, state and federal levels. Dillard maintains a research program at Geneva that focuses on the biology and control of fungal and bacteria pathogens of vegetables. Dillard also serves as an Associate Dean in the College of Agriculture & Life Sciences, and in the College of Human Ecology.

Helene Dillard, professor of plant pathology at Geneva, became director of Cornell Cooperative Extension (CCE) in 2002. CCE has been a major player in Cornell's land-grant mission since 1869.

Watch the GAP Workshop

A Good Agricultural Practices (GAP) workshop was held in Geneva as a "train the trainer" workshop to inform extension educators about GAP and how to assist growers with implementing GAP on the farm. In addition to training, Cornell scientists from the departments of Food Science in Ithaca and Food Science & Technology in Geneva conduct research that supports development of new GAPs. Their goal is to improve food safety, and prevent microbial contamination of fresh fruits and vegetables.

Tree.Fruit.Berry.Pathology.com

Launched a new extension web site, **http:// www.nysaes.cornell.edu/pp/extension/tfabp/**, that covers tree fruit and berry pathology for commercial growers and homeowners. The site contains information on pome fruits, stone fruits, small fruits and hops, fact sheets on diseases, information for weather and disease forecasting, and pesticide registration information. The site is also home to the "New York Berry News," a monthly newsletter that details pest management in berry fruit crops and many other aspects of berry fruit production.

DEVELOPING VALUE-ADDED PRODUCTS & PROCESSES

Running on Corn Cobs

Refined the process by which useful chemicals can be produced from corn cobs. *Pichia stipitis*, a yeast, is used to create ethanol from residual sugars in corn cobs. Scientists at Geneva found that using an enzyme common in juice preparation could greatly increase the amount of ethanol produced. Ethanol can be used as a fuel, or as an additive to create higher-octane, cleaner-burning gasoline. Corn cob waste has also been used with *Rhizopus oryzae* to provide a source of L(+)-lactic acid, a physiologically important acid that has many uses in the food, fermentation, pharmaceutical, and chemical industries.

Spud Control

Helped Martens Country Kitchen Products, a farm-based operation in Port Byron, NY, that grows, packs, processes, and ships potatoes to institutional kitchens, develop value-added processes and avoid microbial problems. Food scientists and microbiologists at Geneva helped the company develop better processing controls, health and safety monitoring systems, and sanitation programs to improve quality and extend shelf-life.

A New Hot Sauce Company

The Northeast Center for Food Entrepreneurship (NECFE) helped Lisa Anziano and Manny Ortiz, of Bayshore, LI, create a new business to produce and market their line of hot sauces. NECFE, a joint venture with the University of Vermont, helps small-scale and start-up businesses by offering technical and business advice, including information on marketing, sanitation, and federal and state regulations. Manny's Pit Bull Hot Sauce is one of many companies NECFE helped in 2002 and 2003.The entrepreneurs now sell their sauces on-line, and in 50 different stores in Long Island, New York City, and Massachusetts.

With help from NECFE, Manny Ortiz (r) and Lisa Anziano (l) were able to develop and market their line of Pit Bull Hot Sauces, now available in Massachusetts, New York, and on-line.

Making the Cash Register Ring

Hosted the third annual Small-Scale Food Processors Conference to provide food processors with technical help and assistance regarding financing, marketing, incubator kitchens, and distribution. The two-day event featured educational seminars, a trade show and networking opportunities. Small-scale food processors bring value-added products to market and help New York farmers get more money for their raw products.

APPLYING BIOTECHNOLOGY

Stays Fresh Longer

Created apples with improved freshness and storage life by successfully modifying the expression of genes in several apple lines to limit the production of ethylene. Ethylene is a hormone that controls ripening in apples. It can lead to softening and rotting during storage and limit shelf-life. Lines of Royal Gala and McIntosh apples stayed fresh far longer than non-transgenic lines. In 2002, there were 2.6 million bushels of apples in storage in New York State.

Apples with lower levels of ethylene that resist rot have been developed by food scientists at Geneva.

GROWING HEALTHY CROPS & SUSTAINING THE ENVIRONMENT

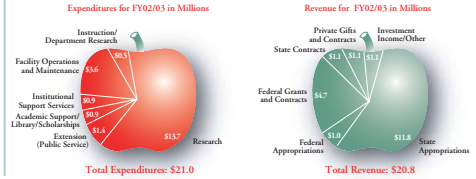
Thrips Testing

Entomologists at Geneva have developed a novel technique called a Thrips Insecticide Bioassay System (TIBS) that enables onion growers to determine in one day whether the thrips populations in their fields are susceptible to an insecticide prior to spraying. Quick analysis allows growers to avoid using an insecticide to which the thrips are resistant, thus saving themselves money and protecting the environment from unnecessary pesticide applications. TIBS could be used to predict the level of control the grower would get if he sprayed a particular insecticide, and will be instrumental in developing a resistance management strategy for thrips on onions and other crops.

Entomologists at Geneva developed TIBS to help growers quickly determine the extent of thrips (inset) infestations in their onion fields.

Mites Eating Mites

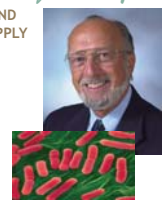
Completed a 5-year study that demonstrates the effectiveness of mite biological control. Chemical pesticide programs have been devised that allow for survival of the predaceous mite, *T. pyri*, in orchards and vineyards. Pest mites in apples and grapes can cost growers over $50/acre annually to control. The mites also rapidly develop resistance to chemically based control tactics. The alternative—using predaceous mites to control pest mites—is a nearly cost-free sustainable control. If half the apple growers in New York used this method of mite control, there would be a yearly savings of about $1.25M.



ENSURING A SAFER AND HEALTHIER FOOD SUPPLY

Rapid E. coli Detection

Developed a biological sensor that reduces the detection time for *E. coli* and other foodborne pathogens from days to minutes. Previous technology took one or more days to culture and test samples for the presence of *E. coli*. The new sensor is simple and sensitive enough to achieve very rapid results in the field. In one form, the sensor works like a home pregnancy test, creating a colored band on a special strip of paper if the pathogens are present.



Food scientist Dick Durst is helping make our food supply more secure by developing tiny biosensors that can detect E. coli (in red) more quickly.

Healthy Diets; Healthy People

Reported a new mechanism by which vitamin C fights cancer, and enhanced the understanding about vitamin C's inhibitory effect on carcinogenic tumor promotion. Working in conjunction with Seoul National University in South Korea, scientists at Geneva found that vitamin C blocks the carcinogenic effects of hydrogen peroxide on gap junction intercellular communication. They also concluded that quercetin, a phytochemical found in apples, has stronger anticancer activity than vitamin C.

"The most powerful weapon we have in the fight against cancer is prevention with a healthy diet," said food chemist Cy Lee, in the January 12, 2002, issue of *Lancet*.

Safer Sprouts

Developed two new techniques for decontaminating alfalfa sprouts of the bacterium *E. coli* O157:H7. One uses chitin, a hard structural protein found in insects, while the other applies mild heat to the sprout seeds. The two techniques are the only ones currently available that achieve the 100,000-fold reduction in *E. coli* O157:H7 recommended by the FDA. The O157:H7 strain of the bacterium is one of the major foodborne pathogens in the U.S., and is responsible for an estimated 73,000 infections each year.

Honey, I Shrunk the Germs

Demonstrated that the antibacterial properties of some types of honey such as tarweed and Montana buckwheat can inhibit the growth of foodborne bacteria including *E. coli* O157:H7, *Listeria monocytogenes*, *Staphylococcus aureus*, and *Bacillus cereus*. Additional research projects will target the identification and origin of the active compounds in honey.