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2017 Friends of Long Island Horticulture Committee

Left to Right: Jack Van de Wetering, Lyle Wells, Robert Van Bourgondien, Ray Bell and Dr. Mark Bridgen

SAVE THESE DATES:

March 8, 2018:	Digger's Ales N' Eats Restaurant annual fundraiser
July 7, 2018:	Open House
September 6, 2018:	Plant Science Day & BBQ

Letter from the Director
2017

This year, as we begin to prepare for our 100th anniversary celebration in 2022, we had a wonderful surprise for the Center. A Long Island couple, who for now would like to remain anonymous, have committed $100,000 to the Center for the renovation of our building that we use for student housing. About 8 years ago, we needed to close down our student housing because it did not have a sprinkler system. Cornell University does not allow any of its students to sleep in housing that does not have a fire sprinkler system.

What makes this generous donation very special is that the donors are not Cornell University alumni and they are not from the agriculture community. They are Long Islanders who have seen the wonderful work that we do here, and who want to support student experiential learning here at the Center. Before the student housing was closed, we had undergraduate and graduate students come down from Ithaca, and other universities, and we had inexpensive housing to offer them. Since we closed the dormitories, we still have students working here to get hands-on experience and to work with our scientists, but it has been more complicated to find temporary housing for them. This renovation project will take a couple years to finish, but it will be very helpful to our mission for education. I will keep you up-to-date on its development.

In 2017, our university faculty continued to bring recognition to Cornell University and distinction to themselves. Margery Daughtrey received the prestigious Award of Merit from the Northeastern Division of the American Phytopathological Society. Dr. Meg McGrath is part of a national team on a large USDA/NIFA SCRI grant that was funded for just over $2 million titled '*Managing Downy Mildew and Fusarium in Basil with New Resistant Varieties, Improved Genetics, Seed Treatment, and Disease Occurrence Mapping.'* Margery, Meg, and I are also principal investigators on several other large Hatch research grants that are supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture,

This year we had one of our long-time research technicians retire. Lucille Siracusano worked in the entomology program with Dan Gilrein since 1996 and was a dedicated and hard-working employee. Another member of the Cornell Cooperative Extension of Suffolk County team, Alice Wise, received her 30 year award at the 2017 CCE Suffolk Annual Meeting and Recognition program.

The LIHREC is a one-of-a-kind center in the USA; it is as distinctive and important as the agriculture industry in Suffolk County is to the state of New York. I hope that you will take the opportunity to visit us during our open houses, twilight meetings, and especially on Plant Science Day next year on September 6, 2018. You can visit our website at any time to view events and activities at the Center (www.LongIslandHort.cornell.edu).

Please feel free to contact me if I can ever be of assistance.

Mark

Mark Bridgen
Professor and Director
mpb27@cornell.edu

Like us on Facebook!

2017 Staff at the LIHREC

Cornell University Program Leaders		Commodity Responsibility
Dr. Mark Bridgen	Horticulture Section	Plant Breeding/Tissue Culture
Margery Daughtrey	Plant Pathology & PMB Section	Ornamentals/Greenhouse Crops
Dr. Margaret McGrath	Plant Pathology & PMB Section	Vegetables
Joseph B. Sieczka	Professor Emeritus	Potatoes

Cooperative Extension Program Leaders	Commodity Responsibility
Dr. Nora Catlin	Agriculture Program Director/Floriculture
Daniel Gilrein	Associate Agriculture Program Director/IPM/Entomology
Sandra Menasha	Vegetables/Potatoes
Dr. Andrew Senesac	Weed Science
Mina Vescera	Nursery/Landscape
Alice Wise	Viticulture
Dr. Faruque Zaman	IPM/Entomology

Support Staff	Affiliation	Position
Amanda Gardner	Cooperative Extension	Program Educator
Diane Hanwick	LIHREC	Administrator
Sean Halliwell	Horticulture Section	Research Associate Specialist
Andrew Hoil	Cooperative Extension	Program Assistant
Lynn Hyatt	Plant Pathology & PMB Section	Research Support Specialist
Kelly Jackson	Cooperative Extension	Program Educator
Wayne Lindsay	LIHREC	Field Assistant
Sandra Mulvaney	LIHREC	Administrative Assistant
Diane Noto	Horticulture Section	Research Associate Specialist
Paulina Rychlik	Plant Pathology & PMB Section	Research Support Specialist
Zachary Sexton	Plant Pathology & PMB Section	Research Support Specialist
Lucille Siracusano	Cooperative Extension	Research Technician
Mark Sisson	LIHREC	Farm Supervisor
Irene Tsontakis-Bradley	Cooperative Extension	Program Manager
Agnieszka Ulinski	Horticulture Section	Research Technician
Anastasia Yakaboski	Cooperative Extension	Program Educator
Gerard 'Rod' Zeltmann	LIHREC	Field Assistant

Seasonal Support Staff	Affiliation	Seasonal Support Staff	Affiliation
Rosemarie Andrews	Vegetables	Harrison Forte	Plant Pathology
Haley Bufkins	Plant Pathology	Stephanie Hayes	Plant Pathology
Yuqi Chen	Horticulture	Lauren Marigliano	Viticulture
Collin Downing	Plant Pathology	Bill McGrath	Viticulture
Sharon Graziano	Vegetables	George Prechtl	Vegetables
Cheryl Drosin	Plant Pathology	Kyle Smith	Floriculture
		Rex Spielmann	LIHREC

2017 LIHREC Staff

Row 1: Collin Downing, Harrison Forte, Haley Bufkins, Rose Andrews, Anastasia Yakaboski and Lauren Marigliano.

Row 2: Meg McGrath, Paulina Rychlik, Diane Hanwick, Sandi Mulvaney, Marie Boulier, Amanda Gardener, Drew Hoil and Andy Senesac.

Row 3: Dominick Zeppetella, Mark Bridgen, Lynn Hyatt, Mark Sisson, Nora Catlin, Mina Vescera, Marge Daughtrey, Rex Spielmann and Yuqi Chen.

Row 4: Diane Noto, Rod Zeltmann, Dan Gilrein, Kyle Smith, Bill McGrath, Faruque Zaman, George Prechtl and Zack Saxton.

2017 Cornell Gardeners' Membership List

Accurso, Christine
Baldari, Anita
Bastiaans, Lisa
Bligh, Rita
Bowen, Gayle
Bridgen, Mark
Brown, Denise
Brown, Lillie
Brown, Linda
Bruno, Valerie
Bryant, Mike
Bulter, Sandra
Canzoneri, John
Canzoneri, Millie
Clemente, Frank
Crook, Catherine
Cunningham, Delia
Curran, Ronnie
D'Emilia, Vincent
Dechert, Lorraine
Dechert, Rudolf
DeMott, Bob
DeSomma, Carole
DiGano, Joann
Egitto, Frank
Emma, Lillian
Ferraro, Bob
Foerster, Valerie
Foster, Jane
Gangone, Deborah
Gangone, Thomas
Gleason, Nancy
Goldstein, Barbara
Gross, Margaret
Henry-Vansko, Diane
Killorin, Christine
Kurchey, Andrew
Lambert, Thomas
Lange, Doug
Leonard, Lois
Lesica, Jerry
Lesica, Mirjana
Lewis, Judy
Lo Cascio, Ann
Massimino, Phil
Micheels, Jim
Mohring, Ken
Monahan, Michael
Nicholson, Sharna
Ninan, Remani
Novellano, James
Olenick, Lorretta
Olsen, Jennifer
Ott, Sharon
Paccione, Phyllis
Pagnotta, George
Pagnotta, Marsha
Pasaric, Dan
Pirrotta, Annette
Polashock, Eleanore
Quinn, Margaret
Redlefsen, Frieda
Redlefsen, Nahmen
Reitz, Barbara
Runyan, Trudy
Sande, Ann
SantaMaria, MaryEllen
Schiller, Lyn
Schlyer, Lin
Schwartz, Victor
Shea, Kevin
Slade, Michael
Terrill, Donna
Vlcek, Beverly
Weresnick, Bill
Wolkoff, Bill
Young, Sharon
Ziino, Nancy

2017 Funding from Grant Programs & Government Agencies

American Floral Endowment
Cornell University – Ag. Experiment Station
Cornell University – CALS
Cornell University – Horticulture Section
Cornell University – Plant Breeding-Genetics Section
Friends of Long Island Horticulture
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New York State DAM Specialty Crop Block Grant Program
New York State Dept. of Ag & Markets
New York State Dept. of Environmental Conservation
New York State IPM Program
New York Wine & Grape Foundation
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USDA IR-4 Biopesticide and Organic Support Program
USDA IR-4 Project
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2017 Advisory Council Members

March 28, 2017 Meeting
Left to Right: John Conzdella, Sr., Rebekah Schulz, Jessica Anson, Matt Pendleton, Ali Tuthill, and Dr. Mark Bridgen,

2017 Cornell Gardeners

2017 List of Contributors

The majority of the LIHREC's financial support is provided by county, state, federal and other agencies through grant programs. In addition, the following companies, associations, growers and individuals have provided plant material, equipment, supplies or grants-in-aid. Industry support is vital for supplementing general operational funds and is greatly appreciated.

Ag-Bio, Inc.
Anderson, Bob & Maryann
Arysta LifeScience
Ball Horticultural Co.
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Bayer Environmentals Science
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Plant Peddler

Ornamental Plant Breeding and Greenhouse Production

Program Leader Dr. Mark Bridgen, Director
Professor of Horticulture and Plant Breeding
Long Island Horticultural Research & Extension Center
3059 Sound Avenue
Riverhead, NY 11901

Program Objectives

To use traditional and *in vitro* breeding techniques to hybridize and develop new ornamental plants.

To conduct applied research with greenhouse and floriculture crops on topics of significance to professionals in the green industry.

To conduct demonstration trial gardens for commercial herbaceous perennial plants.

To work closely with all agriculture industries on Long Island and to share the successful research projects of staff members at the LIHREC.

Dr. Mark Bridgen
mpb27@cornell.edu
Ph: 631-727-3595
Fax: 631-727-3611

Program Summary

The breeding and development of new plants is a priority for our research program. Traditional and state-of-the-art biotechnological breeding techniques are used to hybridize different ornamental plant species.

Our main research project is to breed resistance to Impatiens Downy Mildew (IDM) in Garden Impatiens (*Impatiens walleriana*). Our ultimate goal is to hybridize attractive and downy mildew resistant F_1 hybrids that can be propagated by seed. Cornell is now the first university to have walleriana-type Impatiens that are resistant to downy mildew. During the summer of 2017, our first field trials were conducted and approximately 25% of the hybrid plants were resistant to IDM. The next step of this program is to continue to inbreed while selecting for IDM resistance. Eventually, the resistant hybrids will be used to develop seed lines. M.S. candidate, Nor Kamal Ariff has been using *in vitro* mutation techniques to develop new varieties of *Vitex agnus-castus*, the Chaste Tree. He is also outlining the procedures to micropropagate this plant. Our breeding program of *Alstroemeria* (Inca Lily) hybrids shifted directions in 2015. After several years of evaluation, superior, winter-hardy selections were identified and a decision was made to place these elite plants *in vitro*. In order for these plants to be successful commercially, Inca Lilies need to be micropropagated; this is the first step to get our new cultivars commercialized.

Our research program to evaluate the growth regulation effects of ultraviolet-C (UV-C) radiation on ornamental plants continues to have exciting results. The correct dosage rate of UV-C light to greenhouse plants will reduce plant height and increase branching in some annual species. Effects on flowering have also been observed showing earlier flowering in some species and delayed flowering in others.

Program Justification

New downy mildew-resistant Impatiens interspecific hybrid.

Plant breeding is necessary for the discovery of new genetic resources and the development of new plants for food, fiber, and beauty. The continued growth and competitiveness of America's agriculture depends on innovative research, rapid application of this research, and clear communication about its benefits to stakeholders. By continuing to develop new, commercial plants, the American horticulture systems will remain highly competitive in the global economy.

Impact to Industry

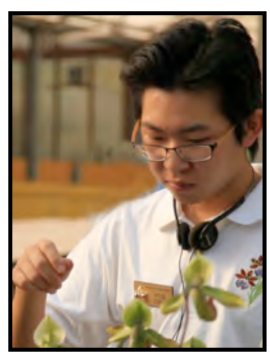
A variety of research is being conducted in plant breeding, plant physiology, and plant propagation with the ultimate objective of developing useful and new plants. These plants will hopefully be useful additions to the American horticultural industry. Traits such as new flower colors, disease suppression, extended postharvest longevity, and novel attractive growth habit and flowering are admirable goals. The education and training of students that goes along with this research, are not only the mission of Cornell University, but are worthy endeavors for our world.

Program Team
Research Associates

Agnieszka Ulinski
Diane Noto
Sean Halliwell

Graduate Student
Nor Kamal Ariff ,
M.S. candidate
Cornell University

Student Intern
Yuqi Chen,
B.S. candidate
Cornell University



Floriculture Program

Program Leader Nora Catlin, Ph.D.
Extension Educator, Floriculture Specialist
Cornell Cooperative Extension of Suffolk County
423 Griffing Avenue, Suite 100
Riverhead, NY 11901

Program Objectives

Through educational programs, demonstrations, publications, and individual consultations, provide Long Island greenhouse and floriculture growers with up-to-date information on best management practices and recommendations for crop selection, crop production, pest management, business management, environmental issues, and applicable regulations.

Conduct demonstration trials of annual plant cultivars and applied research on various aspects of integrated pest management and crop production at the Long Island Horticultural Research and Extension Center as well as at commercial operations.

Nora Catlin
nora.catlin@cornell.edu
Ph: 631-727-7850 x214
Fax: 631-852-3205

Program Summary

The Floriculture Extension program works closely with the industry to address current needs and to anticipate future needs. Main areas of focus include demonstration trials of annual plants and applied research that investigates various aspects of crop production.

Educational programs are continually tailored to keep growers on the forefront of developing issues and research-based information. Some examples of educational outreach include an annual Long Island Greenhouse and Floriculture Conference and Trade Show, the Floriculture Session of the annual Long Island Agricultural Forum, and open houses that highlight the annual plant trials. Newsletters and e-newsletters are distributed, including *Long Island Agricultural News*, *Northeast Greenhouse Notes*, and *e-Gro Alert* (http://e-gro.org/alerts.php). Internet content is also posted on the Floriculture Program web page (http://ccesuffolk.org/agriculture/floriculture) and a Facebook page (https://www.facebook.com/LIGreenhouse). In addition to organized educational programs and educational materials, information and recommendations are provided on an individual basis on topics such as crop production, pest and disease management, business management, environmental issues, and regulatory issues.

Program Justification

Long Island Annual Plant Trial

The New York floriculture industry currently ranks in the top ten states in the nation for commercial sales, with Long Island accounting for approximately 50% of the ~$180 million statewide wholesale value. With over 10 million square feet in greenhouse production, there is a definite need for local support to assist the local industry in remaining competitive as well as maintaining environmental stewardship.

Impact to Industry

- Up-to-date information is provided to growers and industry professionals through individual consultation, educational programs, publications, and internet content. Educational programs and publications improve growers' and industry professionals' knowledge and understanding of relevant information pertaining to crop production, pest and disease management, business management, environmental issues, and regulatory issues.

- Demonstration trials of annual plant cultivars keep growers informed and up-to-date by allowing the comparison of plant material from different breeding and marketing companies, particularly the many new introductions that occur each year. This trial also demonstrates plant performance under local conditions and assist growers in choosing the best plants to produce and market.

- Applied research at the Long Island Horticultural Research and Extension Center and at commercial operations provides useful information on pest management methods, cultural practices, and new and commercially available products.

Program Team

Nora Catlin, Floriculture Specialist, Program Leader
Kyle Smith, Program Assistant

Key Collaborators:
Neil Mattson, Margery Daughtrey, Mark Bridgen, Cornell University;
Elizabeth Lamb, NYS IPM Program; Dan Gilrein, CCE-Suffolk

Plant Pathology – Ornamental Crops

Program Leader Margery Daughtrey
Senior Extension Associate
Dept. of Plant Pathology and Plant-Microbe Biology
Long Island Horticultural Research & Extension Center
3059 Sound Avenue
Riverhead, NY 11901

Program Objectives

Improve understanding and management of diseases of greenhouse and nursery crops:

• Help growers better utilize new tools, including new reduced-risk fungicides, biological controls, and SAR (systemic acquired resistance) materials

• Identify new diseases confronting the industry and develop control recommendations

• Develop new information to improve management strategies for diseases that commonly cause crop losses

Margery Daughtrey
mld9@cornell.edu
Ph: 631-727-3595
Fax: 631-727-3611

Program Summary

This program combines applied research with immediate extension of results to growers in NY and nationwide. Extension activities address pressing issues affecting ornamental crop health.

Powdery mildews and downy mildews:
Our studies include cultivar comparisons, biological control trials, biorational and reduced-risk chemical tests. Impatiens, calibrachoa, poinsettia, zinnia, verbena, coleus, and rose are used in our experiments. USDA Floriculture and Nursery Research Initiative and Farm Bill funding has fueled progress in managing both powdery and downy mildew diseases. The relatively new downy mildew problems on impatiens and coleus are the focus of ongoing research.

Root rots and vascular wilts:
Pythium* and *Phytophthora: We work to identify which species are affecting greenhouse crops, find the reservoirs of these organisms in the greenhouse, learn how cultural controls may reduce problems, evaluate the impact of fungicide resistance, and develop biological and chemical management strategies. Collaborative studies with Carla Garzon at Oklahoma State University are funded primarily through the USDA Floriculture and Nursery Research Initiative.

Black root rot (*Thielaviopsis*): We seek chemical and cultural controls and compare cultivars.

Boxwood blight: We are comparing boxwood cultivars for their susceptibility to boxwood blight.


Bacterial Blight on Begonia

Program Justification

In these challenging times, growers can ill afford plant diseases, as these invariably lead to dollar losses. Disease preventive treatments add to profitability. Disease control must also be designed to safeguard health of workers and the environment. Studies on biology of pathogens and trials evaluating new control techniques provide valuable information to the ornamentals industry. Leading growers today actively seek well-informed advice on how to improve their pest management programs, and closely follow applied research so that they can adopt better methods immediately.

Impact to Industry

Our investigations on impatiens downy mildew have identified a number of effective fungicides and we are continuing to study survival—and working with Mark Bridgen to identify more resistant plants. Growers have been given management strategies for this high-impact disease, which was once again very problematic in the landscape in 2017.

The *Juniperus chinesis* cultivar 'Robusta Green' has been found to host *Gymnosporanium sabinae*, the pear trellis rust, on Long Island, while additional *J. chinensis* cultivars have been found to harbor *G. yamadae*, the Japanese apple rust. Learning more about the host-pathogen-environment interactions should help us to manage these new diseases with non-chemical means.

Root disease management has been improved through studies on control of *Pythium*, *Phytophthora, Fusarium* and *Thielaviopsis*. Ongoing work at Cornell in collaboration with researchers at Oklahoma State University has increased knowledge of what pathogen species are present in greenhouses today, how they may be identified using new DNA technologies, and how they may be better managed.

The *Compendium of Bedding Plant Diseases and Pests* has been co-authored with A.R. Chase and R.A. Cloyd. This comprehensive illustrated reference will be available from APS PRESS midsummer 2018.

Collaborations with federal, state and county agencies have allowed investigations of oak wilt (*Bretziella fagacearum*) on Long Island, culminating in the LI Oak Wilt Symposium in October 2017 (videotapes of the talks are online at the CCE-Suffolk website). Our goal is to keep this disease from spreading on LI.

Program Team

Research Support Specialists:
Lynn Hyatt (at right)
Paulina Rychlik (at left)

Collaborators include:
Carla Garzon, Oklahoma State University; Nina Shishkoff, USDA-ARS
Cristi Palmer, Rutgers University/IR-4; Chuan Hong, VA Tech
Cornell Cooperative Extension of Suffolk County Educators

Long Island Entomology Program

Program Leader Daniel Gilrein
Extension Entomologist
Cornell Cooperative Extension of Suffolk County
Long Island Horticultural Research & Extension Center
3059 Sound Avenue
Riverhead, NY 11901

Program Objectives

The Entomology Program supports economic and environmental health of Long Island's agriculture and ornamental horticulture industries with applied research, technical information, advice, diagnostic services and educational programs concerning insect and mite pests, pest management, and biological control in agricultural production and professional landscape maintenance situations.

Daniel Gilrein
dog1@cornell.edu
Ph: 631-727-3595
Fax: 631-727-3611

Program Summary

The Entomology Program includes three main focus areas:

Applied research addresses regional questions and problems concerning insect and mite management on ornamental plants, vegetables, and fruit. Effective pest control options of lower toxicity and environmental impact are emphasized with particular interest in ground and surface water protection.

Diagnostic services for horticultural industries and public entities identify agents causing injury or infestation and suggest appropriate management options. The Diagnostic Laboratory staff receives plant and insect samples, screens for invasive or new pests, conducts field visits, and provides phone and email consultations. The Program provides a gateway to national entomological expertise in taxonomy, identification, and management where necessary for difficult determinations or special situations and to confirm new and invasive pests or biotypes.

Educational programs disseminate useful information on new pest management products, technologies, and trends; pests and pest control issues; invasive species; and management strategies. Training programs are also provided for new growers and professionals as well as experienced practitioners. Media includes illustrated lectures, articles in trade magazines and newsletters, fact sheets, technical publications, web-based content, trainings, and informal discussions.

Program Justification


Arborvitae leafminer

Long Island's agricultural and ornamental horticulture industries are valued over $250M. Quality standards and crop values are high, with a low tolerance for damage or infestation. Pests are constant threats, but groundwater, other non-target environmental impacts, and health concerns related to pesticide use are also important issues in our region. Long Island growers and landscape professionals are progressive adopters of technology and look to the Entomology Program as a source of impartial information and research to support critical decisions on new insect and mite management solutions that minimize risks while maintaining profitability.

Impact to Industry

In 2017 Entomology Program staff made 34 presentations to over 1,620 participants from vegetable, fruit, nursery, greenhouse, professional landscape, home garden and other audiences; fielded more than 990 consultations by phone, email, or in person, processed over 287 Diagnostic Lab samples, and completed 25 trials and demonstrations investigating pesticide alternatives and new methods for managing insect and mite pests such as biological control and pheromone mating disruption. Nearly ¾ of all Suffolk orchard acreage now uses mating disruption to manage pests.

Invasive pests are a potential economic threat to Suffolk County, damaging crops, forest and landscape plants. Recent arrivals include hop aphid, *Phoradon humuli*, giant resin bee, *Megachile sculpturalis,* and lily leaf beetle, *Lilioceris lilii*. Spotted wing drosophila, brown marmorated stink bug and southern pine beetle remain serious pests and part of our monitoring program.

Groundwater protection is a primary concern of the Entomology Program, addressed through applied research and educational outreach including Best Management Practice Guides for imidacloprid users in potatoes, fruiting and cucurbit vegetables, greenhouses, landscape trees and shrubs, and turf. These incorporate alternatives and recommendations that minimize risks to groundwater. Imidacloprid detections have dropped from 11.7% in 2006 to 2.1% (1141 samples, Apr 2015 – Mar 2016) with levels dropping to 2.2 ppb or less (most ≤0.3 ppb) from a high of 12.9 ppb.

The Program updates the Cornell *Pest Management Guidelines for Commercial Production and Maintenance of Trees and Shrubs*, contributes to the *Guidelines* for perennials & greenhouse crops and vegetables, co-edits *Branching Out* newsletter, provides content for other regional publications, and serves on the Suffolk County Tick Control Advisory Committee. The Program is a resource to government agencies and civic groups, supports the Certified Nursery and Landscape Professional Program, CCE Suffolk's Home Horticulture Diagnostic Labs and Master Gardener Program, to extend entomological research and expertise to homeowners and professionals with up-to-date information on beneficial insects and pests specific to Long Island.

Program Team

Dr. Faruque Zaman, Associate Entomologist
Kelly Jackson, Program Assistant

Collaborators:
Nora Catlin, Floriculture Specialist
Mina Vescera, Nursery and Landscape Specialist
Sandra Menasha, Vegetable/Potato Specialist
Becky Wiseman, Dominick Zeppetella, Katherine Poulos,
& Shannon Moran, Agriculture Stewardship Program, Cornell Cooperative Extension of Suffolk County

Disease Management for Vegetable Crops

Program Leader Margaret Tuttle McGrath
Associate Professor
Plant Pathology & Plant-Microbe Biology Section
Long Island Horticultural Research & Extension Center
3059 Sound Avenue
Riverhead, NY 11901

Program Objectives

Optimize management of diseases affecting vegetables and herbs grown on Long Island within organic and conventional production systems by:

- studying pathogen biology, including sources.
- investigating fungicide resistance and impact on control.
- developing scouting protocols and action thresholds.
- evaluating control practices, including fungicides, resistant varieties, and integration of chemical and genetic control.

Examine impact on diseases of biofumigation with mustard cover crop and practices to improve soil health with focus on reduced tillage.

Diagnose disease problems for growers.

Margaret T. McGrath
mtm3@cornell.edu
Ph: 631-727-3595
Fax: 631-727-3611

Program Summary

The fungal pathogen that causes powdery mildew in cucurbits, which is the most important disease of this crop group, has proven itself adept at evolving to overcome management tools; therefore, to ensure management guidelines developed for growers are sound, efficacy of fungicides and resistant varieties, which are the only management tools for powdery mildew, needs to be examined regularly. Research conducted in 2017 included 1) testing registered and new, conventional and organic fungicides used alone and in combinations; 2) evaluating fungicides suitable as alternatives for chlorothalonil; 3) examining fungicide sensitivity of pathogen isolates from commercial and research fields; 4) examining fungicide sensitivity of pathogen populations using a seedling bioassay; and 5) evaluating Halloween pumpkin varieties resistant to powdery mildew grown with or without fungicides.

Biopesticide programs were evaluated for Phytophthora blight in pepper and pumpkin.

Results from fungicide evaluations provide growers information on efficacy to assist with selection of registered products and are used by companies to make development decisions about new products.

Cucumber varieties resistant to downy mildew were evaluated.

A seedling bioassay was used to survey for fungicide resistance in cucurbit downy mildew pathogen.

A sentinel plot was maintained for the national cucurbit downy mildew forecasting program.

A monitoring program was conducted for basil downy mildew (national) and late blight in tomato.

Three experiments were conducted for an organic reduced-till project with researchers in Ithaca, ME, and MI. Winter-kill cover crops (tillage radish and/or oats) were compared preceding organic reduced-till-planted spring peas. Legume winter-hardy cover crops and rye were compared preceding organic fall cabbage transplanted using reduced tillage. Soil was covered with impermeable silage tarps (‘tarping’) to manage weeds for 3 weeks, 6 weeks, or overwinter before seeding beets.

Organic reduced-till beets seeded in dead oat cover crop following 6 weeks soil covered with silage tarp.

Program Justification

Powdery mildew is the most important disease affecting cucurbit crops every year throughout LI. Fungicide resistance is a major concern.
Downy mildew of cucurbits also can cause significant losses, especially in organically-managed crops. It occurs sporadically varying greatly year to year in date of first observation and crop types affected.
Cucurbits, especially pumpkin, are very important crops on Long Island.
Tomato is another important crop impacted regularly by foliar diseases.
Phytophthora blight is an important disease occurring in NY every year.
Need for efficacy data for organic and conventional fungicides.
Recognized need for practices like reduced tillage to improve soil health in organic and conventional cropping systems.

Impact to Industry

Research conducted in 2017 yielded information useful to growers producing vegetables in NY.

Research on efficacy of fungicides with targeted activity for cucurbit powdery mildew (PM) and sensitivity (resistance) of the pathogen to these fungicides added to the knowledge base about product efficacy and fungicide resistance in this pathogen. Pristine (FRAC code 7+11), Torino (U6), and Luna Sensation (7+11) all failed to control PM on the underside of leaves. Failure of Luna Sensation was surprising because in past laboratory bioassays conducted for this project, isolates resistant to boscalid, FRAC 7 active ingredient in Pristine, exhibited sensitivity to fluopyram, FRAC 7 ingredient in Luna Sensation. Failure of Torino was also surprising because this product has the most strict use restriction to manage resistance: only 2 applications, not consecutive, allowed to a crop. Resistance has not yet been documented in the U.S. Procure (3), Quintec (13), and Vivando (U8) all preformed well. During spring 2017 pathogen isolates collected in fall 2016 from research plots and commercial pumpkin crops were tested for fungicide sensitivity. Boscalid resistance was detected in 43% of isolates; 3% of isolates were resistant to 200 ppm quinoxyfen (13); and 3% were resistant to 120 ppm myclobutanil (3). The most resistant isolate came from plot treated with only Quintec in the fungicide efficacy experiment: it was resistant to boscalid, 120 ppm myclobutanil, and 200 ppm quinoxyfen (Quintec would be ineffective), documenting use of one fungicide can select for isolates resistant to it and other fungicides not used.

Resistant pumpkin and cucumber varieties varied in ability to suppress powdery and downy mildews, respectively. Cornell bred cucumber was best. Homozygous resistant pumpkin varieties were better then heterozygous. PM was controlled best with integrated program (fungicides applied to resistant varieties).

Sulfur and mineral oil proved to be effective alternatives to chlorothalonil.

Biopesticide programs were ineffective for Phytophthora blight in pepper and pumpkin. Disease pressure was high due to an intense rainfall providing very favorable conditions for the pathogen.

As a result of monitoring work, growers knew when important diseases were occurring on LI, and thus when to apply fungicides. Late blight was detected in Sept. Cucurbit downy mildew was first found in cucumber on 31 July and in cantaloupe 9 days later. No other crop types were affected.

The web-based monitoring program for basil downy mildew proved useful for tracking and sharing information about its occurrence, and contributed to recognition of its importance in the USA. 2017 was another important year for basil downy mildew with numerous reports from throughout most of the USA.

The 3 organic reduced-till experiments were successful.

Program Team

Zack Sexton, Research Support Specialist
Haley Bufkins, Research Assistant
Collin Downing, Research Assistant
Cheryl Drosin, Research Assistant
Harrison Forte, Research Assistant
Stephanie Hayes, Research Assistant

Organic reduced-till snap peas seeded in winter-killed tillage radish cover crop.

Vegetable and Potato Research and Extension Program

Program Leader Sandra Menasha
Vegetable and Potato Specialist
Cornell Cooperative Extension of Suffolk County
423 Griffing Ave, Suite 100
Riverhead, NY 11901

Program Objectives

The vegetable and potato program provides educational programming and conducts applied research and on-farm demonstration trials to assist growers and industry personnel with various aspects of production and agricultural stewardship. These projects include integrated pest management (IPM), nutrient management, organic production, cover cropping, variety trailing, soil health, food safety, cultural practice evaluation and marketing.

Rosemarie and Anastasia helping to plant a Brussel Sprout variety Trial at LIHREC

Sandy Menasha
srm45@cornell.edu
Ph: 631-727-7850
Fax: 631-852-3205

Program Summary

- Pest Management: Development and implementation of IPM elements such as biological control, crop rotation, sanitation, action thresholds, resistant varieties, and the use of reduced-risk pesticide materials, including organic pest management practices.
- Vegetable Variety and Cultural Practice Trials: The development of cultural practices that increase yields and/or crop quality under Long Island conditions while reducing environmental impacts are critical functions impacting the long-term viability of vegetable and potato operations. Experiments are conducted to provide growers with up-to-date information. Studies are implemented to determine the adaptability of new varieties, experimental lines, and "niche" crops. The potato program concentrates on evaluating clones that have golden nematode resistance.
- Agricultural Stewardship: Concerns about ground and surface water contamination from agricultural use of pesticides and fertilizers on Long Island necessitates the development of best management practices. These practices address the environmental issues by incorporating new ideas and technologies such as the use of controlled release nitrogen fertilizers to reduce nitrate leaching, utilizing deep zone/reduced tillage practices to improve soil health, and using mustard cover crops to manage soil-borne plant pathogens and reduce pesticide applications.
- Educational/Extension programs: The extension of applied research is a key component of this program. Information is disseminated through grower meetings, field days, conferences, on-farm demonstration trials, on-farm consultations, newsletters, and bulletins.

Program Justification

When measured by the value of vegetables/potatoes sold and acreage in production, Suffolk County ranks 5th in New York based on the most recent Census of Agriculture.

- Approximately 7,000 acres of fresh market vegetables and another 1,800 acres of potatoes are grown on Long Island.
- These industries generate about 35 million dollars annually.
- The vegetable and potato industries, coupled with acreage in rotational field crops, comprise about a third of the 36,000 acres of cropland in Suffolk County.
- The 150 farm stands and farm markets in Suffolk County, the agri-entertainment business, and the open space provided by farmland are key components to the 1.3 billion dollar tourism industry.

Impact to Industry

- Pest Management: Implementation of a weekly scouting program in vegetables, potatoes, and small fruit with a monitoring trap network for sweet corn pests including the corn earworm, fall armyworm, and a new pest western bean cutworm. Evaluation of insecticides to control the Colorado potato beetle including reduced risk and organically approved materials.
- Vegetable Variety and Cultural Practices: Variety and cultural practice evaluations at commercial farms and LIHREC are published in the Long Island Potato and Vegetable Variety, Cultural Practice, and Fungicide Efficacy Results booklet. The Golden Nematode quarantine necessitates evaluation of new resistant potato varieties and the vegetable industry has indicated a need for disease resistant variety evaluations. Growers have adopted new cultural practices such as reduced tillage and mustard cover crops after evaluation by the program.
- The Organic Research Block at the LIHREC: A two-acre block was established to address the production needs of an increasing number of organic growers. Research activities include the development and assessment of organic cultural and pest management practices, fertility management, as well as vegetable variety and cover cropping trials.
- Educational/Extension programs: Conferences and meetings including the Long Island Agricultural Forum, winter vegetable meetings, and summer twilight meetings have extended research results and educational programming to growers. The weekly newsletter, “Fruit and Vegetable Update”, provides growers with up-to-date information on management guidelines.

Program Team

Anastasia Yakaboski, Program Technician
Sharon Graziano, Program Assistant
Rosemarie Andrews, Program Assistant
George Prechtl, Program Assistant
Katherine Poulas, Ag Stewardship Technician
Shannon Moran, Ag Stewardship Technician
Dominic Zepetella, Ag Stewardship Technician

Collaborators:
Dr. Walter De Jong, Cornell University
Dr. Meg McGrath, CU/LIHREC
Crystal Stewart, ENY Horticulture Program
Justin O’Dea, CCE Ulster County

Anastasia Yakaboski, Vegetable and Potato Program Technician

Garlic bulbs drying in the greenhouse from a trial evaluating management practices to reduce fusarium

Weed Science Program

Program Leader Andrew Senesac, Ph.D.
Senior Extension Specialist
Cornell Cooperative Extension of Suffolk County
Long Island Horticultural Research & Extension Center
3059 Sound Avenue
Riverhead, New York 11901

Program Objectives

The Weed Science Program assists the agricultural and horticultural industry by developing educational programs and conducting applied research in weed biology and management in several horticultural enterprises including vegetables, grapes, turf, woody and herbaceous perennial production in the field and containers, field-grown cutflowers, container-grown chrysanthemums, and landscape use of woody and herbaceous plant materials.

Andrew Senesac, Ph.D.
afs2@cornell.edu
Ph: 631-727-3595
Fax: 631-727-3611

Program Summary

The Weed Science program focuses on two major areas:

Applied Research: Several weed management problems are being addressed through research. The program investigates both traditional weed control approaches and alternative and cultural methods that can be integrated and used successfully.

Educational Extension Efforts: Some major areas of focus are the Cornell Pesticide Management Guide for Commercial Production of Trees and Shrubs and the Cornell Pesticide Management Guide for Production of Greenhouse Crops and Herbaceous Ornamentals, as well as other means of disseminating information about the results of recent research such as weed identification display gardens, articles in trade journals, illustrated lectures, fact sheets, and website contributions.

An additional role has been involvement with a consortium of representatives from several other state and regional governmental and non-governmental organizations in the Long Island Invasive Species Management Area (LIISMA) Committee to control and prevent new infestations of invasive weeds.

Rhinoncomimus latipes on *Persicaria perfoliata*

Program Justification

Growers and end-users of horticultural products are constantly confronted with potential loss of quality and economic loss due to weed competition in both the production cycle and in the end-use.

Additionally, great concern about the potential contamination of the single source aquifer from which Long Island draws its drinking water has resulted in fewer registrations of herbicides here and loss of several older materials that were heavily relied upon.

The weed science program is continually evaluating new and alternative methods and measures that will help solve some of these issues.

Impact to Industry

Several recent research projects have had either direct or indirect impact on the industry.

A recent study evaluated the effect that misuse of Ready-to-use consumer- oriented 'extended control' herbicide products can have on commonly established landscape tree and shrubs. Our research shows that most of the products available off the shelf have a fairly high level of safety against injury to established plants. However, at least one product can easily cause long lasting plant injury if misapplied. Outreach of these results has been undertaken to reach our commercial landscapers and arborists who may need to diagnose these problems.

Mile-a-Minute Weed (Persicaria perfoliata) has invaded natural areas and some farmland in increasing severity over the last 20 years. A program to manage this weed using small plant-eating weevils was developed at the University of Delaware. In the past few years, Weevils were released on the East End on highly infested private property. Evaluations will continue and additional release sites will be established to determine the effectiveness of this biological control.

To help educate the public about invasive weeds, a mobile weed identification display cart, nicknamed the 'Weed Wagon', has been constructed. It is stocked with forty of the worst invasive weed species and is used for educational purposes at stakeholder meetings and public functions.

Program Team

Andrew Senesac, Program Leader
Irene Tsontakis-Bradley, Program Manager
Drew Hoil, Program Assistant

Collaborators:
Jenny Kao-Kniffin, Weed Science, Dept. of Horticulture, Cornell University
Brian Eshenaur, NYS IPM Program
Elizabeth Lamb, NYS IPM Program

Commercial Nursery & Landscape Program

Program Leader **Mina Vescera**
Nursery & Landscape Specialist
Cornell Cooperative Extension of Suffolk County
423 Griffing Ave. Suite #100
Riverhead, NY 11901

Program Objectives

- To address individual inquires, questions, and concerns that members of the horticulture industry may have, including those related to plant production, land management, and diagnosis
- To provide educational programs and resources for professionals in the horticulture industry including regional conferences, local meetings and workshops, print publications, written articles, web-resources, and guest lectures
- To conduct trials and demonstration projects that address concerns relating to sustainable plant production and/or land

Mina Vescera
mv365@cornell.edu
Ph: 631-727-7850
Fax: 631-852-3205

Program Summary

Educational Conferences and Events

Long Island Horticulture Conference –addresses some of the most pressing issues and cutting-edge research in plant production and landscape management

Managing Landscapes Sustainably – features sustainable land management topics

Landscape Architects' Educational Event –features classroom-style lectures followed by visits to local nurseries and hands-on learning opportunities for landscape architects

Nursery Session of the Long Island Agricultural Forum –addresses important issues that help prepare Long Island nursery growers for the upcoming growing season

Outreach and Demonstration/Research Initiatives

The Long Island Gold Medal Plant Program – purpose is to identify and promote underutilized plants of exceptional merit that are particularly suited for growing on Long Island

Nitrogen Fertilizer Management for Field Nurseries – ongoing research into the effect of reduced nitrogen fertilizer rates using controlled-release fertilizer and nutrient monitoring on the growth of field-grown trees

IPM Scouting Nurseries – provide direct assistance to nursery growers to enhance their integrated pest management programs

Program Justification

NY State ranks 9th in value of sales of ornamental horticultural crops in the U.S. (USDA 2012 Census of Agriculture)

Suffolk County is the #1 county in NY State for the value of sold horticultural commodities and is the 15th county in the entire U.S. (USDA 2012 Census of Agriculture).

Nursery crops gross over $5 billion nationally and are an Important component of the U.S. economy. (USDA National Agricultural Statistics Survey)

Impact to Industry

2017 Outreach on Long Island that made a positive contribution to the environment:

- Several guest lectures, presentations, or tours
- Nearly 50 individuals assisted during site visits or in-person consultations
- Responded to over 250 phone or e-mail inquiries
- Directly reached over 800 participants at conferences, meetings, guest lectures, and field days throughout the year
- Provided insect and disease scouting to nursery growers
- Conducted research trials on California privet and installed a Long Island demonstration garden on lesser-known ecotypic ornamental plants.

Several helpful publications are available on the Nursery & Landscape Program webpage at:
http://ccesuffolk.org/agriculture/commercial-nursery-landscape

- *Long Island Horticulture Resource Guide*
- *Cover Crop Strategies for Field Nurseries*
- *Gold Medal Winners Flyer*s
- *Salt-spray Tolerant Groundcovers, Shrubs, & Trees for Eastern Long Island*
- *Photographic Guide to Boxwood Pests & Diseases on Long Island*
- *Finding Alternatives to Invasive Ornamental Plants in New York*

Program Team

Mina Vescera, Nursery & Landscape Specialist (Program Leader)

Collaborators:
Nora Catlin, Extension Educator, Floriculture
Margery Daughtrey, Senior Extension Associate, Plant Pathology
Dan Gilrein, Extension Entomologist
Dominick Zeppetella, Agricultural Stewardship Technician
Andy Senesac, Senior Extension Specialist, Weed Scientist

Grape Research and Extension Program

Program Leader Alice Wise
Sr. Issue Educator/Viticulturist
Cornell Cooperative Extension of Suffolk County
Long Island Horticultural Research & Extension Center
3059 Sound Avenue
Riverhead, NY 11901

Program Objectives

The Grape Program conducts applied research in vineyards and coordinates educational opportunities for the Long Island wine industry. We focus on short and long term objectives that address ecological pest management as well as economically viable yields of quality fruit. Our goal is to assist vineyard managers in making management decisions that are effective, financially sound and environmentally sensitive.

Alice Wise sampling fruit

Program Summary

Applied research projects focus on several broad goals:

a) Pest management – Projects include the following: current and future materials for efficacy and use strategies; use of reduced risk and organic pesticides for control of insects and disease; viticultural and other farm practices and their effect on pest development; alternative strategies for vineyard floor management; disease tolerant varieties.

b) Fruit quality and quantity – 1.5 acres of the 2.4-acre research vineyard is devoted to a trial evaluating the viticultural characteristics of 35 different winegrape varieties with multiple selections of individual varieties.

c) Educational efforts include meetings such as the LI Agricultural Forum, presentation of research results, hosting visiting experts from across the country, newsletters, grower visits, webcasts and moderation of a vineyard manage list serv. We provide technical support to the Long Island Sustainable Winegrowing program. We have a dedicated program website that hosts information for both commercial growers as well as home growers. Visit http://ccesuffolk.org/grape-program.

Bill McGrath harvesting a research trial

Program Justification

With over 2000 acres of vinifera winegrapes, Long Island hosts three appellations (American Viticultural Areas): The North Fork of Long Island, The Hamptons and Long Island. There are 56 wine proprietors producing an estimated 500,000 cases (1.2 million gallons). Forty-two winery tasting rooms open to the public. With an estimated 1.3 million visitors annually, the wine industry contributes to the economic well-being of the East End of Long Island. Many vineyards have also sold development rights, ensuring the land is maintained as open space in perpetuity. The wine industry is an important part of the East End's agricultural- and tourism-based economy.

Impact to Industry

- Evaluation of new and interesting winegrape selections has helped to the potential wine quality and commercial viability. A number of selections that have shown well in the vineyard and in the winery have been adapted by the industry. It is economically important to avoid undesirable plant material as planting a vineyard can exceed $20,000 an acre.

- We are committed to helping growers with environmental stewardship. We achieve this through targeted pest management research projects, educational programs and technical support for the Long Island Sustainable Winegrowing program.

- We scrutinize cultural practices that purportedly reduce pesticide use while maintaining or improving fruit quality. For example, prebloom application of anti-transpirant sprays may reduce berry set, rendering clusters looser and less susceptible to cluster rot. Management of cover crops or native vegetation in the area under the grapevine trellis may help to reduce herbicide use while reducing excessive vine vigor.

- We create educational programs that introduce new ideas, new technologies and the latest research results to vineyard managers, winemakers and marketing personnel. We involve Cornell faculty, researchers from other institutions as well as individuals from private industry to bring unique and thought provoking information to the industry.

Program Team
Amanda Gardner, Program Assistant
Lauren Marigliano, Field Assistant
Bill McGrath, Field Assistant

Cornell collaborators:
Marc Fuchs, SIPS/Plant Pathology & Plant-Microbe Biology
Tim Martinson, SIPS/Horticulture
Justine Vanden Heuvel, School of Integrative Plant Science/Horticulture
Tim Weigle, NYS IPM Program
Wayne Wilcox, SIPS/Plant Pathology & Plant-Microbe Biology

Amanda Gardner assessing fruit for a research trial

Applied Pest Management in Fruit and Other Crops

Program Leader Faruque U. Zaman, Ph.D.
Associate Entomologist
Cornell Cooperative Extension of Suffolk County
Long Island Horticultural Research & Extension Center
3059 Sound Avenue,
Riverhead, NY 11901

Program Objectives

- Address pest management issues for tree fruit, berries, and grape growers.
- Educate growers in using reduced-risk and environmentally sustainable pest management technologies.
- Coordinate applied research, develops technical information and educational materials on fruit and other pest management topics.

Faruque U. Zaman
fz88@cornell.edu
Ph: 631-727-3595
Fax: 631-727-3611

Program Summary

The Applied Pest Management Program (APM) works on emerging and current pest management problems in tree fruit, small fruit, and wine grape production, providing new technology and research-based solutions for Long Island growers. Issues include invasive insects such as spotted wing drosophila, brown marmorated stink bug, dogwood borer, San Jose scale, Apple midge as well as improving management of existing pests with new techniques, such as plum curculio, oriental fruit moth, codling moth and peach tree borers. Special projects for greenhouse and nursery production are also included. The program promotes use of reduced-risk and low environmental impact control options and provides stakeholder support through educational presentations, magazine articles, newsletters, field visits, phone, and email consultations.

Applied research and extension projects include:

- Seasonal monitoring of spotted wing drosophila in crops and adjacent forests.
- Expansion of non-insecticide based area-wide mating disruption techniques for insect control.
- Surveys of the newly emerged/invasive insects and damage risk in tree fruits.
- Integrated pest management in tree fruit through early detection, damage survey, timely recommendation, and reduced-risk products.
- Coordinate response to tree fruit disease related inquiry from growers.
- Conducting experiments on the effectiveness of current and newly developed insecticides, biopesticides, attractants, and biological controls.

Program Justification

Tree fruit and wine grapes are economically important commodities of Long Island agricultural industries. Beside the direct market value of production, L.I. fruit farms and vineyards are a valued part of local tourism industries. Intensive fruit production is under constant threat from both invasive and native pests. Concerns related to groundwater and food safety associated with pesticide use important issues in fruit production. The program addresses the need for a high quality product produced in environmentally and economically sustainable way.

Impact to Industry

In 2017, the APM team responded to nearly 250 pest and problem inquiries through farm visits, diagnostic lab samples, phone calls, and emails. Four presentations were delivered to over a total of 112 participants from fruit industries and other stakeholders. 6 extension 3 peer reviewed research articles were published in various agricultural news magazines and journals distributed over hundreds of subscribers.

Producing tree fruit on Long Island is a challenge made easier by the Entomology and Agricultural Stewardship's Fruit IPM programs, providing growers with timely and specific pest information particular to each unique orchard. Nearly 70% of L.I.'s tree fruit acreage is using non-pesticide mating disruption to manage important pests. Some orchards have reduced insecticide sprays from 8 to 1or 2 per year and started using reduced-risk alternatives. Overall tree fruit damage by insect was <3.95% in 2017.

Last year spotted wing drosophila damage ranges between 5 – 30% among raspberries, blueberries, and blackberries, which was lower than the previous year. L.I. growers have been notified the time of population increase and infestation level. Timely information was helpful for growers reducing infestation level to some extent. At this point SWD poses minor threat to vineyards (>1.5% fruit damage) reassuring growers and eliminating the need for pesticides to control it.

The APM team joined with regional collaborators to monitor brown marmorated stink bug populations in orchards using commercial pheromone lures. Four BMSB adults and nymphs were captured in traps in 2017. Population on Long Island is still very low (0.50 BMSB/trap/season) compared to the provisional management threshold (10 BMSB/trap/season) caused < 0.15% tree fruit damage.

Program Team

Daniel Gilrein, Extension Entomologist
Kelly Jackson, Program Educator

Collaborators:
Greg Loeb, Arthur Agnello, NYSAES, Geneva, NY.
Peter Jentsch and Srdjan Acimovic, Hudson Valley Lab
Juliet Carroll, NYSIPM
Shannon Moran, Stewardship Program
Cornell Cooperative Extension of Suffolk County

Floriculture and Greenhouse Crops

Propagation of hybrid *Alstroemeria*
Investigators: Mark Bridgen, Agnieszka Ulinski and Sean Halliwell
Location: Long Island Horticultural Research and Extension Center

Alstroemeria, the Inca Lily or Lily-of-the-Incas, is popular because of its colorful and long-lasting cut flowers. Traditional and *in vitro* breeding techniques have been used to hybridize *Alstroemeria* species with the goal to develop new winter-hardy hybrids for the garden. Originally, multiple crosses were made with *Alstroemeria* species from Brazil and Chile. Hybrid embryos were rescued after pollination via plant tissue culture. Once the embryos germinated *in vitro*, they were subcultured onto micropropagation medium, grown, rooted, and transferred to the greenhouse until flowering. Clones were produced and plants were field tested. Two cold-hardy (USDA hardiness zone 5) varieties already have been introduced by Cornell University, 'Mauve Majesty' and 'Tangerine Tango'. Interest in this new garden perennial has increased throughout the United States.

Now that new winter-hardy hybrids have been successfully developed, the next step is to propagate the plants to increase their numbers. Traditional division and *in vitro* micropropagation are being used to propagate these new hybrids. After sufficient numbers have been achieved, the new garden plants will be introduced to the American market.

Use of Ultraviolet-C (UV-C) radiation on ornamental plants for growth regulation
Investigator: Mark Bridgen
Location: Long Island Horticultural Research and Extension Center

The objective of this research is to determine the effects of ultraviolet-C irradiation (UV-C) on commercially-valuable greenhouse ornamental plants with specific interest in growth regulation (height/branching/fresh weight). The use of UV-C irradiation is a low-cost technique that is easy to apply to plants. It has already been shown to be a defense-inducible biological elicitor in horticultural products that can extend the postharvest vase life of cut flowers, suppress attack from natural diseases such as *Botrytis cinerea, Penicillium expansum*, and other plant pathogens, and act as a natural growth regulator. Under normal growing conditions, effects of UV-C light are not seen on plants because Ultraviolet-C wavelengths (below 280 nm) are highly energetic, absorbed by ozone and are not present in the sunlight at the earth's surface.

Ultraviolet-C irradiation (UV-C) has been successfully used as an environmentally-friendly and safe pre-harvest treatment to increase fresh mass and lateral branching. It has also been shown to affect the flowering time of plants either by increasing the time to flower or delaying the time to flower, depending upon the species.

To apply treatments, germicidal low-pressure vapor UV lamps (Osram HNS OFR) were suspended in the LIHREC greenhouses over greenhouse benches. Each lamp has a nominal power output of 30 W and peak wavelength emission of 253.7 nm. The dosage rate was measured at room temperature (~25 °C). Uniform potted plants of *Impatiens walleriana, Zinnia elegans, Catharanthus roseus, Salvia splendens* and others were subjected to 0, 5, 10, or 15 minute treatments of UV-C every 7 days for 5 weeks. Plants that receive too high a dosage rate are damaged by the UV-C light. Plants that received UV-C were shorter than control plants and more highly branched.

The impact of applying this technology to whole plants would be a breakthrough for the floriculture industry. It will save time and money, and it will have tremendous benefits for the environment by reducing pesticide applications to plants and decreasing the need for plant growth regulators. This is a novel and sophisticated, low-cost technique that can be a sustainable and environmentally-friendly. This project is funded by the Cornell University Agricultural Experiment Station's Hatch funds and the American Floral Endowment.

Breeding for downy mildew resistance in *Impatiens walleriana*
Investigators: Mark Bridgen and Margery Daughtrey
Location: Long Island Horticultural Research and Extension Center and Ithaca

Prior to 2011, impatiens (*Impatiens walleriana*) was one of the most popular annual flowers for gardens and landscaping. Their ability to grow and flower in full shade or sun, as well as the presence of a wide range of color forms, led to a large following among consumers, greenhouse growers, and garden centers. Economically, they formed an important part of the early season economy for greenhouse growers. However, in 2004, the presence of impatiens downy mildew (IDM), Plasmopara obducens, was documented on vegetatively-propagated impatiens cultivars which had been commercially distributed over a wide area. By 2011, the infection had spread and had been reported across the nation and worldwide. While New York State had reported over $10,027,000 in sales of common impatiens in 2009, by 2014 this had dwindled to only $1,052,000 (USDA NASS, 2015).

The advent of this virulent new race of Impatiens Downy Mildew (IDM) has defoliated and decimated impatiens plants across the United States, as well as worldwide. Often a key crop for greenhouse growers and nurseries, and a fixture in landscapes and home gardens, susceptibility appears to be near-universal in the common species, *Impatiens walleriana*.
Due to the IDM epiphytotic, there has been a critical need for breeding research with Impatiens species to develop resistance. We have successfully confirmed that Impatiens species that are compatible with *I. walleriana* are resistant and useful for breeding new, resistant forms. Cornell University has 2 lines of I. walleriana hybrids that are resistant to Impatiens Downy Mildew. In order to be produced, these lines need to be propagated vegetatively by cutting propagation, Growers in New York were surveyed about vegetatively-propagated Impatiens, and their response was unanimous: they want seed-propagated Impatiens. Therefore, the next step in this important research is to continue this breeding research and develop seed-propagated lines of Impatiens that are resistant to Impatiens Downy Mildew. By doing this, we will be able to fill

the garden niche that has been held by Impatiens and provide more options for growers and gardeners.

Evaluation of herbaceous perennial plants on Long Island
Investigators: Mark Bridgen and Sean Halliwell
Location: Long Island Horticultural Research and Extension Center

This multi-year project evaluates new herbaceous plants and compares them to other commercially valuable plants when grown under Long Island's climatic conditions. The trial and display gardens at the Long Island Horticultural Research and Extension Center (LIHREC) are also used for educational purposes with more than 300 species and cultivars of winter-hardy herbaceous ornamental plants. The gardens are organized and planted by species in order to effectively evaluate different cultivars of the same genus growing side-by-side.

The project allows new plants to be evaluated and introduced into the trade and promotes interest in the use of herbaceous plants for the landscape. Each year, these plants are tested and evaluated from a professional landscaper's perspective. Their maintenance, flower and foliage integrity, bloom period, and insect and disease resistance are recorded and reported to the nursery and greenhouse industries. Winter hardiness is also recorded. Educational programs, such as conferences, all-season demonstrations, open houses, field days, workshops, and symposia keep growers informed and in touch with these research findings.

2017 Evaluations of dahlias
Investigators: The Cornell Gardeners and Long Island Dahlia Society
Location: Long Island Horticultural Research and Extension Center

The Long Island Dahlia Society trials and displays more than 150 different varieties of dahlias at the LIHREC each summer. The Dahlia Garden is located to the south of the main gardens. This bed is replanted every spring; in the fall the tuberous roots are removed from the ground, cleaned, and stored for the following year. More than 200 guests visited the gardens during 2017 to enjoy the beauty, variety, size, and duration of bloom of the dahlia.

Dahlias are considered one of the most spectacular garden flowers because there is a great variety of form in their flowers. They are available in showy dinner-plate size to the bright, little single ones. Dahlias require some special care for winter storage, however, with minimum care, beautiful dahlia flowers can grace gardens from July until frost. Dahlias should be planted in a sunny location in rich and well-drained soil.

2017 Long Island annual plant trial
Investigator: Nora Catlin
Location: Long Island Horticultural Research and Extension Center

The Long Island Annual Plant Trial is a demonstration garden that allows observation of new and recent introductions of bedding and potted garden plants from various breeding and marketing companies under local conditions. The trial is located at the Long Island Horticultural Research & Extension Center in Riverhead, NY. This year over 60 cultivars, including many new cultivars, were grown and displayed in the Long Island Annual Plant Trial. Plants were submitted by Ball Horticultural Company and Proven Winners.

Rooted cuttings or plugs were received in April, transplanted, and maintained in the greenhouse until planted outdoors. While in the greenhouse, plants were sub-irrigated and fertilized with a constant feed of 125-150 ppm N of 20-10-20 and pests were managed as needed. During the first week of June, plants were transplanted into containers outside. For each cultivar, three 12-inch containers were planted with three plants each. Containers were drip irrigated and fertilized with constant liquid feed, alternating between 20-10-20 and 15-5-15, ~200 ppm N. Since most consumers are interested in identifying low maintenance annuals, pests and diseases are not managed once plants are outside, nor are the plants trimmed, pruned, or deadheaded.

Plants were evaluated six times from mid-June though late August. Flower display, foliage quality, and overall impact were rated on a scale of 0-5 (5=best; the flower display rating was omitted for the plants that are regarded as foliage plants such as alternanthera and colocasia) and evaluations were averaged to determine the season-long plant rating. The plants with the highest season-long scores included: Alternanthera ‘Plum Dandy’ and ‘Purple Prince’; Begonia ‘Megawatt Pink Bronze Leaf’, ‘Megawatt Red Bronze Leaf’, and ‘Megawatt Rose Bronze Leaf’; Colocasia ‘Royal Hawaiian Aloha’; Cuphea ‘Fairy Dust Pink’; Hypoestes ‘Hippo Rose’; Millet ‘Copper Prince’; Pepper ‘Mad Hatter’ and ‘Ornamental Midnight Fire’; Petunia ‘Supertunia Hot Pink Charm’, ‘Supertunia Vista Fuchsia’, ‘Supertunia Vista Silverberry’; Salvia ‘Rockin' Deep Purple’ and ‘Rockin' Playin' the Blues’; Thunbergia ‘A-Peel Lemon’ and Thunbergia A-Peel Tangerine Slice’.

Find reports and top performing plants from previous years’ trials at *http://ccesuffolk.org/agriculture/floriculture/long-island-trial-gardens* or contact Nora Catlin, nora.catlin@cornell.edu or 631-727-7850 x214. In addition, trail data has been entered into the National Plant Trials Database. On the National Plant Trials Database, you can see trial results from the Long Island Trial, as well as from other trials throughout the country. Visit *http://www.planttrials.org*; the Long Island Annual Plant Trial is listed as ‘Cornell Long Island’.

This trial is supported in part by the participating companies, as well as generous assistance and donations from Ivy Acres and Jiffy Products of America.

Efficacy of new foliar treatments for the management of Botrytis blight of lily (2017)
Investigator: Nora Catlin
Location: Long Island Horticultural Research and Extension Center

Various labeled and experimental products were tested for their efficacy in managing Botrytis blight of lily, caused by *Botrytis eliptica*. Tested products included: *Aureobasidium pullulans* strains DSM 14940 and DSM 14941 (Botector, 10 oz/100 gal), *Bacillus amyloliquifaciens* strain F727 (MBI110; 6 qt/100 gal), *Bacillus subtillis* strain B111 (Prophytex EC, 40 fl oz/100 gal and Prophytex WP, 20 oz/100 gal), *Ulocladium oudemansii* strain U3/g (BW165N 3lb/100 gal + Cohere, 8oz/100gal), fenhexamid (Decree, 1.5 lb/100 gal), fluxapryoxad + pyraclostrobin (Orkestra/BAS70306F, 8 oz/100 gal), isofetamid (IKF-5411, 13.5 oz/100gal), mandestrobin (S2200, 7.5 oz/100 gal), polyoxin D salt (Affirm, 8 oz/100gal), the proprietary product F9110

(45.7 oz/100 gal), and, thyme oil (Proud 3, 1 gal/100 gal). An untreated and uninoculated control and an untreated and inoculated control were also included. Treatments were replicated across 5 single plant replicates per treatment.

Lily ‘Vermeer’ bulbs were planted on 13-June into 5.5-inch pot using a standard commercially available potting media. Plants were kept in the greenhouse until after the first treatment. After the first treatment, plants were moved into a hoop house fitted with shade cloth and overhead irrigation in order to provide ideal disease conditions. Containers of symptomatic plants were placed among the plants to serve as inoculation and the untreated-uninoculated control plants were set on the opposite side of the house, in an unshaded section a distance away from the inoculum.

Treatments were applied weekly for 5 weeks, with the exception of the fluxapryoxad + pyraclostrobin treatment and the mandestrobin treatment, which were applied every 2 weeks. Treatments started on 19-July (36 d after planting). Foliar sprays were applied to drip using a CO_2-powered sprayer fitted with a TeeJet 8003 nozzle at 30psi. Plants were evaluated weekly, starting one week prior to treatment. Disease severity was evaluated using a 0-10 scale (0=no symptoms) and the number of affected leaves were recorded.

At the final evaluation, the treatments with the fewest affected leaves and lowest disease severity ratings were the isofetamid, fluxapryoxad + pyraclostrobin, mandestrobin, and the untreated-uninoculated treatments. Complete data analysis is available upon request.

Project work supported by the USDA IR4 Program.

Evaluation of plant safety of various fungicides on poinsettia
Investigator: Nora Catlin
Location: Long Island Horticultural Research and Extension Center

Plant safety of foliar sprays of pydiflumetofen (13.7, 27.4, 54.8 oz/100 gal), pydiflumetofen+fludioxonil (27.8, 55.6, 111.2 oz/gal), pydiflumetofen+azoxystrobin+propiconazole (13.7, 27.4, 54.8 oz/100 gal), mono- and di-potassium salts of phosphorous acid+hydrogen peroxide (OxiPhos; 1, 2, 4 gal/100 gal), mandestrobin (7.5, 15, 30 oz/100 gal), and *Pseudomonas chlororaphis* strain AFS009 (67, 100, 200 oz/100gal) was evaluated on poinsettia ‘Prestige Red’. Treatments and a water-treated control were replicated across 10 single-plant replicates. Treatments were applied as foliar sprays applied to drip using a CO_2-powered sprayer fitted with a TeeJet 8003 nozzle at 30psi. Treatments were applied on 18-Sept (24 days after pinch) to new growth after pinch, and repeated during bract color on 8-Nov, 21-Nov, 6-Dec.

Trial plants were evaluated for symptoms of phytotoxicity 1 and 2 weeks after the 18-Sept treatment, prior to and 1 week after the 8-Nov treatment, and 1 week after both the 21-Nov and 6-Dec treatments. Any symptom of phytotoxicity was evaluated using a 0-10 scale (0 = no symptoms); fungicide residue was evaluated on a 0-10 (0=no residue). Additionally, plant height and width were measured approximately 1 week after the first treatment and at the conclusion of the trial.

After the first treatment to the new growth after pinch, no or minimal phytoxicity was observed on all rates of the pydiflumetofen, mandestrobin, and *Pseudomonas chlororaphis* treatments. Chlorosis was observed on the pydiflumetofen +fludioxonil treatments, and on the high rates of mono- and di-potassium salts of phosphorous acid+hydrogen peroxide. Some necrotic spotting and leaf edge burn was also observed on plants treated with the high rates of mono- and di-potassium salts of phosphorous acid+hydrogen peroxide. Some chlorosis also observed on pydiflumetofen+azoxystrobin+propiconazole; these treatments also showed symptoms of necrotic spotting and leaf edge burn. Residue observed on the plants treated with pydiflumetofen +fludioxonil, mandestrobin, and *Pseudomonas chlororaphis* strain, and the high rate of pydiflumetofen.

Various symptoms of phytotoxicity were observed after the second through fourth applications, made to plants with bracts in color:

On plants with bracts in color, no phytotoxicity symptoms were observed after the 1st treatments of pydiflumetofen, however minimal specks and faded areas were observed on the bracts after multiple applications. There was minimal residue observed at the low rate, but residue was observed at the higher rates, increasing with multiple applications.
On plants treated with pydiflumetofen+fludioxonil, faded spots and patches were observed on bracts and some bract edge curl was observed after multiple applications. Residue was observed at all rates, increasing with each application.

Plants treated with pydiflumetofen+azoxystrobin+propiconazole showed symptoms of discolored and necrotic spots and patches on bracts as well as distortion of new growth. Symptoms more severe at higher rates and increased with multiple applications. Symptoms were mostly seen on bracts though leaf symptoms also observed, particularly at the higher rates. Low to minimal residue was observed.

Faded and/or necrotic spots were observed on bracts treated with mono- and di-potassium salts of phosphorous acid+hydrogen peroxide. Symptoms were more noticeable at the higher rates and increased after multiple applications. New leaf symptoms were not observed, however symptoms from the first application (18-Sept) could still be seen. Residue was low to minimal at the low rate, but was observed at the high rates.

No phytotoxicity symptoms were observed after the first application of mandestrobin to plants with bracts in color, however some faded spots and patches on bracts observed at the high rates after multiple applications. No to minimal residue was observed.

No phytotoxicity symptoms were observed after two treatments of *Pseudomonas chlororaphis* to bracts, however some minor spotting and discoloration seen after third application. Heavy residue was observed on all rates, increasing with multiple applications.

The author would like to acknowledge Kyle Smith, Kelly Jackson, Katherine Poulos, and Dominick Zeppetella for their assistance with plant maintenance and data collection.

Project work supported by the USDA IR4 Program.

Cultivar trial comparing seed-grown impatiens for their susceptibility to impatiens downy mildew
Investigators: Margery Daughtrey, Nora Catlin and Lynn Hyatt
Location: Long Island Horticultural Research and Extension Center

Impatiens downy mildew has been the scourge of landscape plantings of *Impatiens walleriana* on Long Island (and beyond) since 2011. In 2017 numerous plantings on the North Fork were destroyed by the downy mildew early in the garden season. The disease is not being seen in the bedding plant trade, so it is most likely that overwintering oospores in the soil are the source of these continuing infections. In this trial, we wished to compare a range of white and colored-flower cultivars to see if there is any correlation between flower color and downy mildew susceptibility. Growers have often commented that the whites are more susceptible, or the reds are more susceptible, and we wanted to collect some data on this question. Seeds of 28 colored- and white-flowered cultivars were received from Syngenta and Benary, and plugs of a red and a white cultivar were supplied from Ball Seed. All were transplanted on 29 Aug into 4.5" pots in Promix BX. At planting, 0.3 g Osmocote was added to each pot. Fertilizer (15-5-15) was also used on a constant-liquid-feed basis while plants were in the greenhouse. The impatiens were moved outdoors on 28 Sept, which brought them immediately into contact with downy mildew inoculum available from adjacent experiments. Plants were watered 15 min each day at 5:40 am. The impatiens were rated on disease incidence on 9 October by counting the number of leaves showing downy mildew sporulation on each plant. On 12 October, plants were rated on a 5-point quality scale, with 1=defoliated, 2=some leaf drop, 3=advanced chlorosis, 4=one yellow leaf and 5=healthy plant.

Under these high-inoculum conditions, there was a surprising similarity in susceptibility to downy mildew across all cultivars. It is quite apparent that *Impatiens walleriana* from a diversity of genetic backgrounds are extremely susceptible to *Plasmopara obducens*, the cause of downy mildew, regardless of flower color. The various white flowered cultivars showed some of the most and some of the least sporulation on 9 Oct. There was some statistical separation when the sporulation of the leaves was rated: Super Elfin White had the highest number of sporulating leaves, more than 24 of the other plants tested. The two cultivars with the lowest number of sporulating leaves were Accent Salmon and Accent Premium Red. Most of the cultivars were statistically similar. It is possible that some plants with lower counts were actually advanced in disease development because once they were defoliated, leaves escaped being counted. Most importantly, the plant quality rating on 12 October indicated that all the plants were similar, with the mean score rating varying only from 3.0 to 4.2. None were unaffected by the disease, and plants continued to defoliate after this rating on 12 October. We saw no correlations between petal color and disease susceptibility.

Powdery mildew management trial with BAS 75002F on zinnia
Investigators: Margery Daughtrey and Lynn Hyatt
Location: L. I. Horticultural Research and Extension Center

This trial compared three rates of a BASF experimental fungicide, BAS 75002F, for effectiveness against powdery mildew (*Golovinomyces cichoracearum*) on zinnia. The three rates of the experimental were comparison to Terraguard SC as an industry standard and to a nontreated control. Zinnia 'Magellan Orange' was seeded 21 July 17 into ProMix BX in #804 trays. Seedlings were transplanted 30 August into Metro Mix 510 (Fafard) in 6-in. azalea pots. Plants were grown until inoculum became available from a local farm. The first spray treatment was made 6 Sept, and inoculum was added to the center of the plot the next day, on 7 Sept. Treatments were made with a hand-held CO_2 sprayer, using a hollow cone nozzle, at 35 psi, on 6, 13, 20, and 27 Sept. Plants were arranged in a randomized complete block design, in 5 replications of 4 plants for each treatment. The zinnias were maintained with 200 ppm 15-5-15 applied at every watering (by hand). Visual ratings were made of the upper surface of all the leaves on each plant weekly from 13 Sept to 11 Oct. Data (colony counts or estimates of percent leaf coverage) were analyzed using Tukey's LSD, *P*=005.

Powdery mildew first appeared in the non-treated controls on 12 Sept. All three treatments with BAS 75002F (ranging from 3.0-6.0 fl oz/100 gal) were extremely effective against powdery mildew. No colonies of powdery mildew were seen on zinnia foliage in any of the BAS 75002F treatments or the Terraguard at 6.0 fl oz/100 gal in ratings made from 13 Sept to 11 Oct. The inoculated, nontreated controls, in contrast, had 29% leaf coverage by powdery mildew by 11 Oct. No phytotoxicity was observed from any of the spray applications. The zinnias were watched carefully for signs of powdery mildew following the last data collection on 11 October, to see when the control benefit would wear off. No powdery mildew was evident in treated plants on 27 Oct. On 30 October, powdery mildew was evident for the first time on the treated plants. It appeared on all of the fungicide treatments, on just the top two leaf pairs under the slightly senescent flower head and on petals, and there were no apparent differences between the various fungicide treatments. The plants were discarded on 30 Oct. Growers would typically rotate to a material from a different FRAC group after one or two fungicide applications. BAS 75002F appears to be an effective material for use on powdery mildew control in zinnias.

Picatina and Picatina Flora fungicides evaluated for the control of Botrytis blight on angelonia
Investigators: Margery Daughtrey and Lynn Hyatt
Location: Long Island Horticultural Research and Extension Center

Plugs of 'Serena White' angelonia were obtained from Van de Wetering Greenhouses and planted into 4-in. pots filled with Pro Mix BX on 17 Mar. Treatments were begun 27 April. The potted angelonias were arranged in a randomized complete block design on the greenhouse bench, with 4 replications of 4 plants for each of 7 treatments. A hand-held CO_2 sprayer was used to apply protective fungicide sprays at 35 p.s.i. using a hollow cone nozzle on 27 April and 4, 11 and 22 May. At least 3 times per week, inoculum of *Botrytis cinerea* was blown into the tent from colonies on petri plates of potato dextrose agar at sunset, after first misting the plants. A sugar spray was applied on 10 and 16 May to encourage infection by *B. cinerea*. Plants were misted and tented with plastic during the night for the duration of the experiment. The angelonias were watered by hand from overhead, with constant liquid feed of Peters 20-10-20 at 200 ppm. During the day the greenhouse was set to vent at 70°F and minimum night temperature was set to 60°F. The angelonias were rated for symptom severity of Botrytis blight on 22 and 29 May and 5 June, using a 6-point scale in which no symptoms = 0, a dead lower leaf = 1, 2 or more dead lower leaves = 2, a necrotic leaf lesion on upper leaves = 3, a canker on a shoot or a main stem = 4 and wilt of whole plant or a significant branch = 5. Data were analyzed using Tukey's LSD, *P*=0.05. Plants were harvested at the soil line at the end of the trial and dried overnight before taking dry weight measurements.

The cultivar of angelonia used for the trial did not appear to be especially susceptible to Botrytis blight. Canker symptoms were seen primarily in the nontreated control plants; there were also some scattered leaf spots as well as death of lower leaves. Dry weights indicated no significant differences between treatments. There were no indications of phytotoxicity from either Picatina (applied at 10.0 and 13.5 fl oz/100 gal) or Picatina Flora (20.0 and 27.0 fl oz/100 gal) used on a 7-10 day schedule. Symptom severity ratings on 22 and 27 May indicated that all the fungicide treatments [Picatina and Picatina Flora at the rates given above, Orkestra (FRAC Groups 11+7) at 8 fl oz/100 and Fontelis (FRAC Group 7) at 24 fl oz/100] provided significant protection relative to the nontreated controls. The higher rate of Picatina Flora tested (27.0 fl oz) and Orkestra (8.0 fl oz) were not significantly better than the nontreated control on the final rating on 5 June. Picatina Flora and Picatina performed similarly to an industry standard (Orkestra) in this trial, and appear to have value for Botrytis management.

Pythium population assessment in Long Island greenhouses, 2017
Investigators: Margery Daughtrey, Paulina Rychlik and Carla Garzon
Location: Long Island Horticultural Research and Extension Center

Over 1000 samples of soilless container mix were collected from herbaceous ornamentals at 7 collaborating greenhouse operations in 2017. The plants in the sampled containers were most often symptomless, but mix from symptomatic plants was also included in the data set when available. The majority of the samples were taken from chrysanthemum (448) and poinsettia (180), as these crops are important hosts of *Pythium aphanidermatum*, the species that we are particularly interested in studying. Dahlias were sampled 100 times, followed by New Guineas and Sunpatiens (51 samples) and geraniums (45 samples) and smaller numbers of 21 other crop species.

Using a potato piece baiting method, *Pythium irregulare* and *P. cryptoirregulare* were isolated from tablespoon-volume samples of mix, as well as *P. aphanidermatum*, *P. myriotylum* and *P. rostratum*. These identifications were made with microscopic observation, using morphological features. Further characterization of the populations will be made through molecular analyses of the collection at Oklahoma State University. A total of 207 *Pythium* sp. isolates were obtained from the samples. There were 78 isolates from chrysanthemum, but only 2 from poinsettia. This might reflect the fact that the chrysanthemums were garden mums finished (and sampled) outdoors, whereas poinsettias are grown indoors. Poinsettias may also be more likely to receive fungicide drenches than garden mums. Along with chrysanthemums, colocasias, dahlias, geraniums and calibrachoas were the crops most frequently associated with *Pythium* isolation.

Use of low intensity LED lamps to reduce basil downy mildew in the greenhouse
Investigators: Neil Mattson, Margery Daughtrey, Nora Catlin, Margaret McGrath, Lynn Hyatt and Paulina Rychlik
Location: Long Island Horticultural Research and Extension Center

Basil downy mildew (BDM, caused by *Peronospora belbahrii*) has been in the U.S. only since 2007. It is a devastating disease in greenhouse, field and home production of sweet basil.

Symptoms include yellowing between leaf veins or chlorosis of the whole leaf; grey sporulation also appears on leaf undersurfaces and plants are unmarketable. BDM control methods beyond fungicides are sought, particularly because organic basil has higher commercial value. With funding from Friends of Long Island Horticulture we built on the findings of Israeli research that studied effects of light on an epidemic. BDM requires at least 7 hours of darkness to sporulate; lighting at 5-10 $\mu mol \cdot m^{-2} \cdot s^{-1}$ during the entire night or first half of the night stops spore production. Only exposed leaf surfaces benefit. We tested some of the new energy-efficient LED flowering lamps (red, white and blue, Lumi-Grow Pro) for BDM suppression. ‘Dolce Fresca’ basil (PanAm Seed) was planted into 128-cell trays cut into eighths (“subflats”), then grown until the first true leaves were 1 cm long. All plants were wetted and then inoculated by wiping infected basil leaves across them and incubating in a tent under mist for 18 hrs. The basil plants were moved 15 Feb into square plots of 16 subflats and set underneath LED lights. Red-, white- and blue-lighted benches were contrasted with a control bench shielded from light at night. Peak wavelengths were 668 nm (red), 445 and 605 nm (white) and 444 nm (blue). Lights were run from 4 pm to 4 am. Two non-inoculated control flats of basil were set on an unlighted bench in the same greenhouse. Plants were watered by hand as needed and examined for symptoms or signs of downy mildew daily. Data on sporulation was collected on 5, 13 and 16 March. On 3 and 9 March the humidity was raised in the greenhouse by flooding trays around the basil and wetting the greenhouse floor.

Sporulation appeared first in 13 plants of the no-light treatment and on one vertically-oriented leaf of the blue-lighted treatment on 25 Feb; red- and white-lighted basil showed no sporulation. Based on SPAD-meter readings on plants on 3 March, all but 8 seedlings in the trial had been successfully inoculated and were chlorotic. On 3 March, basil plants with downy mildew sporulation were seen for the first time in the red-lighted group (7 plants/256). On 5 March, when every seedling was examined, the No-Night-Light treatment showed an average of 97% infection, the blue 44%, the red 50% and the white 0% (considering just the central 4 subflats). Even on 13 March, although all the plants were yellowed (infected), plants in the white-lighted group were still not showing any sporulation 26 days after inoculation, while all of the other plants in the experiment were sporulating. Bagging the plants in the white-LED treatment to hold them at 100% RH resulted in uniform sporulation 48 hrs later, so it was clear that the plants had been infected all along, just not sporulating. The ability of the red and blue lights to slow sporulation, and of the white light to completely curb sporulation of infected leaves, provides us with a new IPM tool that we can utilize in the control of BDM—and possibly other diseases as well.

Grapes and Other Fruit

Evaluation of vinifera winegrape varieties and clone
Investigators: Alice Wise, Amanda Gardner and Bill McGrath
Location: Long Island Horticultural Research and Extension Center research vineyard, Riverhead

A 1.5 acre variety and clone trial is located at LIHREC. The goal of this work is to assess viticultural characteristics and fruit quality for 33 red and white vinifera winegrape varieties. With vineyard installation costs ≥$20,000/acre, it is critical to plant varieties with reliable, economic yields of high quality fruit. For all bearing vines, the following data was taken: crop weight, cluster number, berry number/cluster, and fruit quality assessments (°Brix, titratable acidity, pH). A full report and harvest data can be viewed on the grape program website: http://ccesuffolk.org/grape-program.

Rainfall was average to slightly above average during the 2017 season; consequently, disease pressure was moderate to high. Downy mildew became established in early July and was difficult to control the remainder of the season. Surprisingly, *Botrytis* bunch rot was present but at very low levels.

The variety selection is continually renovated to screen varieties new to Long Island. A vinifera-American hybrid Regent was planted in May. This German hybrid is reportedly tolerant to many fungal diseases while producing quality vinifera-like fruit. Vines were vigorous in year one and developed minor powdery mildew by September (vines were unsprayed). 2018 will provide another opportunity to gauge the degree of disease tolerance under Long Island conditions. The reportedly disease tolerant hybrid Itasca will be planted in 2018.

The variable quality of nursery vines continues to impact local vineyards. Additional Arneis, Moscato Giallo and Vermentino vines (all 5 yrs old in 2017) were lost to crown gall and virus. Saperavi, planted in 2015, should have produced its first crop in 2017. However, vine growth was poor. Leaves developed pronounced late season reddening, often a sign of virus. Thus far vines have tested negative for virus.

The cool spring delayed phenology so that bloom, veraison (start of ripening) and harvest were all 1-2 weeks later than the long term average, forcing growers to be patient with harvest. Brix (sugar) were modest, generally 19-21°, and acids ranged from 5-8 g/l. Growers expect to make nuanced, balanced wines with mineral notes and a good finish.

Investigation of leaf roll and red blotch virus
Investigators: Alice Wise, Amanda Gardner and Bill McGrath, CCE-SC, and Marc Fuchs and Keith Perry, Cornell SIPS Dept. of Plant Pathology
Location: Long Island vineyards and Long Island Horticultural Research and Extension Center vineyard

Leaf roll and red blotch viruses have become increasingly common in vineyards throughout the U.S., including Long Island. Infections debilitate vines, leading to reductions in yield and fruit quality. To assess the degree of virus infections in local vineyards, we extensively sampled suspicious vines in the industry and in the research vineyard. Cornell virologists Marc Fuchs and Keith Perry generously provide testing services. Together with vineyard performance records, knowing virus status allows growers to make decisions on either roguing out infected vines or replanting entire blocks.

Virus is introduced into vineyards via infected nursery vines, that is, infected scion and/or rootstock material is used for propagation. There is a huge national effort to address this situation. Unfortunately, there is also evidence that vectors, mealybugs and scale insects, are implicated in the spread of leafroll. There is no evidence of red blotch spread on Long Island; however, spread is well-documented in CA. To assess possible RB transmission on Long Island, we assisted a virology graduate student by collecting wild vine samples (none tested positive for RB virus) and by putting out yellow sticky cards in a block with known RB infections. Cards were collected and sent to Cornell every 2 weeks to be checked for insects and to test insects for the presence of RB. Fortunately, none tested positive.

Control of cluster rot diseases: use of an anti-transpirant to loosen clusters and reduce cluster rot
Investigators: Alice Wise, Amanda Gardner and Bill McGrath
Location: Long Island Horticultural Research and Extension Center Chardonnay

In dry seasons, cluster rot diseases are minimal. In seasons with abundant rainfall, particularly in the post-veraison period (approximately mid-August until harvest), cluster rot can be problematic. While *Botrytis cinerea* is often the primary invader, a number of other fungi, bacteria and yeast can also be present. In varieties such as Chardonnay, Sauvignon Blanc and Pinot Noir, cluster rot may lead to reductions in yield as infected fruit must be sorted prior to processing. This is a significant additional expense for growers but it is necessary as inclusion of rot-infected clusters can impart off flavors and degrade color.

Based on research done in Italy, a trial was implemented exploring the use of anti-transpirants to reduce berry set. These materials are labeled on a variety of crops to reduce transpiration, temporarily limiting photosynthesis. Properly timed, anti-transpirant sprays have been shown in other studies to reduce berry set in grapes, thereby reducing cluster compactness. Two pre-bloom applications of Vaporgard (menthene, Miller Chemical, Hanover, PA) were made to *Vitis vinifera* grapevines cv. Chardonnay. There were no statistical differences between treatments among any of the yield components measured, including berry weight, berries per cluster and berries per cm of rachis, a measure of cluster compactness.

Control of cluster rot diseases: Evaluation of biofungicides for control of Botrytis bunch rot
Investigators: Alice Wise, CCE-SC and Wayne Wilcox, Cornell SIPS Section of Plant Pathology
Location: Long Island Horticultural Research and Extension Center Chardonnay

Four recently registered low impact fungicides were evaluated for their impact on *Botrytis* bunch rot:

1. Botector, active ingredient *Aureobasidium pullans*, Westbridge Agricultural, Vista, CA. Organically approved, this biological fungicide competes with disease organisms for infection sites on plant surfaces. Labeled only for Botrytis control.
2. Fracture, a.i. BLAD protein from germinating lupine plants, FMC Corporation, Philadelphia, PA. Breaks down fungal cell walls.
3. Ph-D, a.i. polyoxin-D salt, Arysta LifeSciences, Cary, NC. A synthetic version of a naturally occurring soil microorganism. Inhibits synthesis of chitin, a component of fungal cell walls.
4. Vacciplant, a.i. laminarin, Arysta, a polysaccharide sugar that occurs naturally in plants. Classified as an SAR (systemic acquired resistance) inducer, purportedly causes plants to turn on their own natural defenses.

While only Botector is organically certified, the others have qualities that suggest they are low toxicity products. Six treatment combinations were implemented. Treatments were applied with a CO_2 backpack at standard botrycide timings: late bloom, cluster closing, veraison and veraison

+ 2 weeks. Unfortunately, there were no differences between treatments likely due to very low levels of *Botrytis* bunch rot, even in untreated plots. The data suggested, however, enhanced control in plots with Vacciplant. For this reason, we will pursue a revised treatment schedule in 2018.

Gauging vine water status
Investigators: Alice Wise, Amanda Gardner and Bill McGrath
Location: Long Island Horticultural Research and Extension Center Merlot, North Fork Cabernet Franc vineyard

The Long Island wine region focuses on the production of high quality vinifera winegrapes. Three of the most important attributes of quality, particularly for red winegrapes, are terroir/vine phenology, vine nitrogen status and vine water status. Mild water stress in the pre-veraison period, for example, contributes to improvement in flavor and color in red winegrapes. Currently, evaluation of vine water stress is based on visual cues and vineyard manager experience. A pressure chamber (PC), instrumentation that is standard practice in irrigated winegrape regions, was used to measure vine water status over a range of scenarios specifically in plots utilizing under vine mowing and seeded fescue. These practices are gaining favor as a means to tame vigorous vines and reduce herbicide use. However, fescue is known to be competitive for water and nutrients. A replicated trial in LIHREC Merlot had the following treatments: season long under vine mowing, glyphosate and a no mow fescue mix and a fescue/rye grass mix. In 2017, there were no differences between treatments in PC readings, likely due to the abundant seasonal rainfall. Cluster weight and the number of berries/cluster was significantly lower in fescue plots compared to other treatments. There were no differences in fruit ripening among treatments. However, vines in herbicide plots were significantly larger than other treatments. In a CF vineyard, a demonstration trial compared vines in a low lying area with heavy soil to vines on a sandy hillside, both herbicided plots and plots seeded with a no mow fescue mix. There were no differences in PC readings, vine pruning weights or fruit ripening. We plan to take measurements one more season to document the impact of different under-vine regimens on vine performance and vine water status.

Use of under vine fescues in Long Island vineyards
Investigators: Alice Wise, Amanda Gardner and Bill McGrath
Location: North Fork Cabernet Franc vineyard

As part of a commitment to environmental stewardship, Long Island grape growers seek to reduce conventional herbicide use. Organic herbicides are an option but tend to be expensive and only moderately effective. Under vine mowing has been successfully adopted by several businesses but requires the purchase of a specialized mower. There is great interest in the seeding of cover crops under vines, though there are concerns about cost, management and impact on vines. In previous work on Long Island, under vine fescue was deemed more successful than under vine clover. Under vine fescue may help to tame vines with excess vigor, an advantage in terms of fruit quality. To further explore this, a replicated trial was seeded in a Cabernet Franc vineyard with larger than desired vines. Single fescue species were compared with a fescue mix and herbicided plots. Data collected included shoot length, yield components, fruit quality and vine water status. There were no differences between treatments, likely due in part to intermittent rainfall throughout the growing season. Unfortunately, we were unable to collect pruning weights in this block. We plan to continue with this experiment for one more season to document differences in vine performance in different under-vine management regimens.

Evaluation of organic fertilizers in Long Island vineyards
Investigators: Alice Wise and Amanda Gardner
Location: North Fork Merlot vineyard

Small annual applications of nitrogen fertilizer are required in some vineyards to maintain vine health and productivity. A majority of growers use synthetic materials such as calcium nitrate. Organic fertilizers are not commonly used due to cost, as much as 6 times higher than equivalent synthetic materials. However, organic fertilizers offer distinct advantages. They improve soil organic matter which could be helpful in retaining nitrogen and water on sandy sites. Leaching of nitrogen to groundwater may also be reduced as organic fertilizers release nitrogen slowly rather than in a flush. There is also evidence that organic products may help to improve soil biology, further improving uptake and utilization of various nutrients from the soil. A demonstration trial comparing calcium nitrate (15.5% N) with organically approved peanut meal (8% N) was implemented in a Merlot block. Based on tissue and soil analysis as well as pruning weights, there were no differences in vine performance between treatments. Future activities will include biological analysis of soils, continued nutrient testing and extensive fruit analysis.

2017 grape commodity survey
Investigators: Alice Wise, Amanda Gardner, CCE-SC, and extension associates statewide
Location: Long Island vineyards

The 2017 grape commodity survey was conducted in conjunction with Cornell Cooperative Extension's NYS IPM Program and Grape Programs in the main growing regions of New York State; Lake Erie, Finger Lakes, Long Island and the Hudson Valley. Both commercial vineyards and grapevine nurseries were included in the study. This work was sponsored by NYS Dept of Ag & Markets. Pheromone traps were deployed for several exotic moth pests - European grape vine moth, European grape berry moth, light brown apple moth and vine mealybug. All of these are found in several west coast grape growing regions. They have the potential to cause widespread damage, leading to potential reductions in yield and quality of winegrapes. Two sets of traps were placed in each of nine vineyards. Traps were checked every other week late June through October. Fortunately, the intended targets were not found in Long Island traps or in traps placed throughout upstate NY. Vineyards were also scouted for Australian grapevine yellows disease, a phytoplasma (simple bacteria) that can infect grapevines in particular Riesling and Chardonnay. It can cause restricted growth in the spring as well as late season leaf curl and berry shrivel. There was no evidence of grapevine yellows infections. Vineyards were also sampled for leaf roll and red blotch virus. Several vineyards tested positive for one or both. Both of these viruses manifest differently in different vineyards/varieties but in general, they cause a reduction in quality and quantity of fruit. Finally, we visually examined trunks for signs of spotted lanternfly, a recent invasive species that has been detected in the mid-Atlantic region.

Damage to grapes and tree fruit can be extensive. There will be significant future efforts to monitor for this pest.

Veraison to Harvest newsletter coverage of fruit ripening in New York
Investigators: Alice Wise, Amanda Gardner and Bill McGrath, CCE-SC; Tim Martinson, Cornell statewide extension viticulturist and extension associates statewide
Location: Long Island vineyards

Veraison marks the point in time that winegrowers consider the beginning of the ripening period. Berries develop color, soften, lose acids and develop sugar, flavors and aromas. The progression of ripening is important to monitor and compare to previous seasons. This facilitates planning for both harvest and winemaking activities. Extension personnel statewide sampled fruit from commercial vineyards at weekly intervals. Six blocks were sampled in two different North Fork vineyards. Each region forwarded juice samples to the wine analytical lab at Geneva for analysis of sugar, acid, pH, tartaric, malic, citric and acetic acids. In addition to juice analysis results, extension personnel from each region composed weekly articles describing fruit quality, varieties being harvested, issues facing vineyard managers and so on. The analytical results and regional blurbs were compiled in a weekly newsletter to growers, distributed electronically by State Viticulturist Tim Martinson. Timely technical articles from research and extension personnel were also included where appropriate. While this work does not supplant the need to thoroughly understand and monitor one's own vineyard, it provides a useful point of reference for winegrowers. To access Veraison to Harvest newsletters: http://grapesandwine.cals.cornell.edu/veraison-to-harvest/.

Status of the Long Island tree fruit IPM – 2017 season
Investigator(s): Faruque Zaman and Shannon Moran
Location: Participating Long Island Fruit Farms

Tree fruits and berries such as apple, peach, pear, blueberry, raspberry, strawberry, and raspberry productions are important components for the agro-tourism based economic activities in the eastern Long Island. Like other agriculture production efficient pest management is crucial for a successful farming operation. Production of good quality fruits and economic sustainability of orchards largely depend on timely control of the pests. In 2017, ten apple and five peach orchards on Long Island were participated in a fee based tree fruit integrated pest management project run by the Agriculture Stewardship and Entomology Program of Cornell Cooperative Extension, Suffolk County. Growers were provided season-long weekly pest monitoring and pest management recommendations through with staff from CCE-Suffolk County, NYSAES at Geneva, and Cornell University's Hudson Valley Lab. In 2017, prior to harvest, a total of 21,000 apples and 3,500 peaches were inspected for insect related fruit (500 fruits/sample checked from 10 interior and 10 border trees). Codling moth, plum curculio, oriental fruit moth, tarnished plant bug, European apple sawfly, San Jose scale, and stink bug were the most significant insect pests in pome and stone fruits on Long Island.

In 2017, less than 1.0% apples were damage by the codling moth which was much lower than 2016 (2.47%). Over the past three years codling moth damage has been reduced from average 23% to <1% because of mating disruption tie use, effective pest control products choice, and precise timing of insecticide applications. In the past season, plum curculio was the most damaging pest on Long Island apples has caused 2.87% fruit damage and this amount of damage is normal in the region. Our relatively small orchard size surrounded by long forest borders and multiple cultivars within block present challenges for PC control on L.I. farms. Over the past four years Long Island fruit growers made significant progress in plum curculio control primarily by early detection services provided by Cornell cooperative extension staff and timely use of effective insecticides. Tarnished plant bug damage (TPB) was low in apples (0.63%) and peaches (0.43%) in 2017. European apple sawfly damage was much low to 0.2% in 2017, down from 2.0% in 2012 (highest in the past 6 years). Stink bug damage was very low, less than 0.15% apples and 0.10% peaches were found showing some kind of injury. Stink bug damage has not been increased in the region and the population has not been increased (based on trap catch in fruit orchards) over the past three years on Long Island. We have seen very low brown marmorated stink bug (*Halyomorpha halys*) population in traps (0.5 BMSB/trap/season, highest catch 1.75 in 2014) as well as lower number of reported detections (about 20) from local homeowners. Oriental fruit moth (OFM) damage was low in all peach orchards this year. About 0.75% peaches had been found to be damaged by OFM. In 2017, overall insect damage in tree fruits was 3.97%, slightly lower than 2016 (4.26%) and 2015 (5.94%) in Long Island orchards. Six growers (own nearly 70% tree fruit acreage) on Long Island used pheromone mating disruption techniques for controlling OFM, CM, peach tree and dogwood borers in tree fruits. Since 2013, we have seen an upswing of CM and OFM damage in the region but damage have decreased in these locations in 2016 and 2017 primarily because of timely monitoring and applications of efficient pest control products including mating disruption.

Thanks to the participating orchard and The Friends of Long Island Horticulture.

Season-long monitoring of emerging insects in fruit orchards and vineyards on Long Island.
Investigator(s): Faruque Zaman and Shannon Moran.
Location: Participating Long Island Fruit Farms

Invasive insects such as brown marmorated stink bug, spotted wing drosophila, San Jose scale, leopard moth, and dogwood borer pose new threats to the Long Island's fruit production. Currently, not all of these insects cause significant economic damage but constant monitoring is necessary for timely decision making and management application before they become a havoc. In 2017 growing season, these new invasive insect populations and damage from these pests were monitored in some selected tree fruit orchards on Long Island.

We have seen very low brown marmorated stink bug (*Halyomorpha halys*) population in traps (0.5 BMSB/trap/season, highest catch 1.75 in 2014 on LI) as well as lower number of reported detections (about 20) from local homeowners. The tentative economic threshold for BMSB management with insecticide is 10 BMSB/trap/season. Stink bug damage was very low, less than 0.15% apples and 0.10% peaches were found showing some kind of injury. Since, stink bugs including brown marmorated stink bug, green stink bug, and brown stink bug often do similar fruit injury, damage was not attributed to any particular stink bug species.

Season first spotted wing drosophila emergence was occurred around June 7 and the population was much low in June ranging between average 0.5 to <4.0 flies/trap/week. The number increased from <4.0 to >15.0 in July and >27.0 flies/trap/week at the end of August. However, in mid-September SWD populations were suddenly increased to several hundred/trap/week. Favorable weather condition and lot of cultivated and wild ripen fruits in field might be responsible for high population increase in a short period. The SWD population was slightly higher this year than the past 3 seasons on Long Island. Berry fruit damage was found between 5 – 25% depending on the time of harvest and berry types. In recent years berry fruit damage from SWD were decreased because of grower's awareness of the pick emergence, management timing, and frequent harvesting. Grape damage was limited to <1.5% mainly in rows near forest. Other emerging pest such as San Jose scale were found in 4 orchards particularly in one peach orchard the population was very high (>40% infested fruits). This pest is slowly increasing in eastern Long Island. Dog wood borer was captured from two apple orchards and the number was low around 2.5 /trap/season. No tree damage was observed in these two orchards. No leopard moth was captured in two traps placed in one apple orchard. No new tree damage in this orchard. Weekly pest updates based on collected data were made available through CCESC newsletter and other communication channels. The information generated from this study has provided valuable decision-making support to the growers and extension staff for timely management and avoiding pesticide application when it was not necessary or economically viable.

This work was partially funded by The Friends of Long Island Horticulture.

Monitoring spotted wing drosophila populations and assessing the impacts on Long Island fruit productions.
Investigator(s): Faruque Zaman
Location: Participating Long Island fruit farms

Since 2012, the Cornell Cooperative Extension of Suffolk Co. entomologists are continuously monitoring spotted wing drosophila (SWD), a serious pest of small fruits and grapes. SWD populations were monitored from June to early September 2016 in one commercial field each of raspberry, blueberry, blackberry, and grape using two traps per field. Traps used were commercially available chemical lures and plastic traps from Scentry (Scentry Biologicals, Inc., Billings, MT). The Scentry *D. suzukii* traps is comprised of a Scentry lure and Scentry trap. The Scentry lure combined the four lure components in a gel matrix contained in a plastic bag (7.5 cm × 7.5 cm). The Scentry trap consisted of a clear plastic jar (15 cm-height × 9 cm-diameter) furnished with a white screw cap on top and was encircled by a solid red label (7 cm wide). Traps were checked approximately once per week. Samples were brought back to LIHREC for identification of SWD and compared with degree-day information from local weather stations and fruit infestation levels in fields. Data were compared with past seasons to determine any consistencies that might help predict infestations and time controls.

In 2017, first SWD was captured on June 7 from a raspberry field in the Northville area. The time of first capture was pretty much similar to the last 5 years with the exception of 2015 when first capture was in the first week of July. SWD population was very low (>4 flies/week/trap in June, then >15.0 in July and >27 in August. We have seen major fruit damage from the end of July through September. During the entire monitoring period SWD population was slightly higher than the population in 2016. Fruit damage by SWD was found less in 2017 ranging 5 – 25% depending on the time of harvest and berry types. Blueberries harvested by early August were not affected at all. Late harvested blueberries (mid-August to onward), fall raspberries, and blackberries were sustained about 25% fruit infestations which was lower than the past several years. Grape damage was limited to <1.5% mainly in rows near forest. Fruit damage from SWD were decreased because of timely pest updates provided by the CCESC staff and grower's awareness of the pick emergence, management timing, and frequent harvesting.

This work was partially funded by the Friends of Long Island Horticulture.

Nursery, Landscape & Ornamentals

***In vitro* procedures for the development of new *Vitex* varieties**
Investigators: N.K.A. Nor Hisham Shah and Mark Bridgen
Location: Long Island Horticultural Research and Extension Center

Vitex *agnus-castus L.* is grown for its delicate-textured aromatic foliage and spikes of lavender flowers that form in late summer and attract butterflies. In the United States, the interest in Vitex as a garden plant is increasing because it is a plant that deer will not eat. It is also becoming more popular because of its high drought tolerance and its ability to grow in almost any soil type as long as it has good drainage. Vitex grows as a shrub to a height of 5-15 feet, spreading from 15 to 20 feet; in home gardens, plants are often pruned to a shorter height. The leaf of this deciduous plant is palmately compound, lanceolate shaped with pinnate venation and is bluish-green to green in color. To grow well, this plant requires full sun or partial shade along with well-drained soil. Vitex is hardy to USDA Zone 7 and grows on Long Island and south in North America to USDA Zone 11.

The objectives of this research are (1) to develop *in vitro* techniques such as somaclonal variation and mutation induction techniques to develop new varieties of Vitex *agnus-castus L.*, (2) to outline the appropriate micropropagation and propagation protocols for the commercial production of the new hybrids, and (3) to release new ornamental plant cultivars to the American horticultural market.

Vitex *agnus-castus*, also known as the Chaste Tree, is a fantastic woody ornamental plant. However, there is a need for breeding with *Vitex agnus-castus* to reduce the plant's growth habit, improve its winter hardiness, and improve the range of flower colors that are available. Essentially, this valuable plant could use a makeover. The goal is to develop plants with variegated leaves, shorter and more compact growth, new flower colors, new leaf forms, and much more. The concurrent research developing micropropagation techniques will allow the new plants that are developed to be quickly propagated and introduced to the nursery industry.

Display gardens at Cornell University's LIHREC
Investigators: The Cornell Gardeners
Location: Long Island Horticultural Research and Extension Center

The "Cornell Gardeners" are an enthusiastic group of volunteers of all levels of experience and abilities who enjoy the creativity of gardening. To get an idea of what this group is about, just walk through Cornell’s gardens and explore LIHREC’s perennial and annual trial plants that are maintained by the volunteers.

As visitors enter Cornell’s parking lot, they are surrounded by gardens. Each garden was designed and maintained by a group of volunteers. These Front Gardens are seven unique beds each with its own microclimate. On the west is the main office building visitors can experience the six separate gardens collectively known as the Bloom Gardens. These gardens were originally designed in 2004, however over the years, some plants grew too large and were moved while others succumbed to the voles and woodchucks. Many of the original plantings remain and thrive, however, and the focus has been to maintain the original design where possible. Take a moment to notice how the area was divided so as to have you wander among the plantings. New additions have been evergreens and sedums. A large tree in this area recently died; as a result, the plantings are being adjusted. A fastigiate Gingko *biloba* tree is in this space now—it will be a stunning yellow in contrast with a blue fall sky!

As visitors leave the Bloom Gardens and walk through the gates of the deer fencing they will see several gardens in an L-shape following the north and west deer fence. In the Herb Garden there are self-seeders, edibles, fragrant and showy plants. The pergola structure is a favorite place to sit to enjoy the gardens. Bill Wolkoff designed this structure and it was built by members of the group. The foliage of the various flowering *Clemati*s plants on the trellising lattice and posts provide additional shade.

Walking the path through the themed gardens beyond the pergola you come to: the Bulb Garden where members have been experimenting with cover plantings that will grow over the bulbs after they have bloomed; the Fragrance Garden; the redesigned Evergreen Garden with a new rhododendron ‘PJM’, skimmia, and bayberry. The Pollinator Garden is an on-going effort to provide host plants especially for monarch butterflies. Pollinator food plants and bee houses are maintained here too. The garden then continues on the winding path through the Cottage Garden. Next to the L-gardens are two row-gardens of Dahlias--every one labeled. The season’s hard work is evident now in the new growth happening in the soil enriched last spring with soil conditioner, compost and manure. Later in the season, the dahlias are in peak bloom. New varieties are added each year and here is a small bed of seedlings. There is an experimental Vegetable Garden bed adjacent to the dahlias. The garden was started with a grant from “Friends of Long Island Horticulture” a few years back. Now this garden demonstrates techniques for growing edibles in small spaces. This year there is more vertical squash, an experimental Jasper tomato, sunflowers to attract pollinators, and snap and green bush beans. The design demonstrates how to grow in containers, square-foot beds, rows and on vertical structures. Companion planting is also used.

Another Bill Wolkoff design that the Cornell Gardeners built is the green-roof shed. The temperature-regulating effects make this shed a pleasure to use. Of course, the inside has been organized and re-organized many times more than even a pantry closet. Bill designed an unusual sloping, up-curved roof so that the plantings can be viewed from almost anywhere. On the ‘porch’ are two large Hypertufa planters with claw feet created by some of our members. Next to the shed is the Weed Identification Garden.

Control of cottony hydrangea scale on hydrangea
Investigators: Daniel Gilrein and Kelly Jackson
Location: Long Island Horticultural Research and Extension Center

Cottony hydrangea scale (*Pulvinaria hydrangea*), a soft scale, is an occasional nursery and landscape pest building to high levels and leaving noticeable cottony egg masses in spring and honeydew residue on foliage that can be objectionable in landscapes and cause rejection of nursery plants at sale. Several foliar insecticides were evaluated for control on 3-gal container-grown *Hydrangea macrophylla*. A mix of two cultivars, 'Shamrock' and 'Pink Beauty,' was used in this trial. Plants were obtained from a commercial nursery and maintained on drip irrigation for the duration of the study. Treatments, formulations, active ingredients and application rates included TriStar 8.5SL (acetamiprid, 16.5 fl oz/100 gal), Distance 0.86EC (pyriproxyfen, 12 fl oz), and Kontos 2F (spirotetramat, 3.4 fl oz). Crawlers were observed in early July. Pre-treatment counts of settled nymphs were taken on August 1 by tallying the number found on four randomly selected leaves per plant. Applications were made on August 4 to 5 or 6 single-plant replications per treatment using a CO2-powered backpack sprayer fitted with a TeeJet 8006 VS twin fan nozzle operating at 30 psi. Control plants were sprayed with water and CapSil (3 fl oz/100 gal) wetting agent was included in all treatments. Plants were sprayed to thoroughly wet all surfaces and then arranged in a randomized complete block design. Treatments were evaluated by tallying live nymphs on the same leaves from each plant on August 21 (17 DAT) and percent control calculated using Henderson-Tilton's formula (correcting for mortality in controls). Although scale nymph populations were lower on August 21 in all treatments, the difference was significant (97.7%) only on plants treated with TriStar. There was some reduction in Distance (29.5%) and Kontos (38.5%) treatments relative to controls, but the differences were not significant. Scale nymphs appeared to be second instars at time of application and not developing; earlier application may have been more effective particularly for Distance, an insect growth regulator.

Introduction of biological controls for lily leaf beetle
Investigators: Daniel Gilrein, Brian Eshenaur (NYS IPM Program) and Lisa Tewksbury (Univ. of RI)
Location: Long Island Horticultural Research and Extension Center

Lily leaf beetle (*Lilioceris lilii*, LLB), a European pest of *Lilium* spp. and several related plants, was first reported in North America in Montreal in 1945, then in Cambridge, MA in 1992. It is now common in New England and parts of NY State. LLB was first reported in Suffolk (Bohemia) in samples brought to the LIHREC Entomology Diagnostic Lab in 2010 and is now common around eastern Long Island. Two non-native biocontrols (larval parasitoids) are approved for release to control this insect and in 2017 three release sites in Suffolk were chosen where LLB is established. Two sites, in Riverhead, had LLB recently established (2016 and 2017) and the third, in Holbrook, has had a LLB population established for several years. Samples of LLB larvae were taken from each location June 20 prior to releases and sent to the University of Rhode Island Biological Control Laboratory to check for prior parasitism. Dilute honey solution was sprayed on plants immediately prior to releases made. 16 Lemophagus errabundus (Ichneumonidae) were released at the Holbrook site on June 22. 50 *Tetrastichus sertifer* (Eulophidae) were released at one Riverhead site on June 23 and again July 7. 30 T. sertifer were released at the second Riverhead site on June 28. T. sertifer were observed laying eggs in larvae at the second Riverhead location immediately after release. Releases will continue in 2018. Thanks to Marie Camenares for her assistance, to Lisa Tewksbury, Research Assoc., Univ. of Rhode Island for providing parasitoids, and to Brian Eshenauer and Betsy Lamb (PI and co-PI), NYS IPM Program, for their coordination and for securing funding. Funding was provided by NIFA/USDA through Cornell University Cooperative Extension, proposal 2016-17-229.

In-Season preemergent herbicide crop safety: IR-4
Investigators: Andrew Senesac and Irene Tsontakis-Bradley
Location: Long Island Horticultural Research and Extension Center

Several trials were conducted as part of the USDA IR-4 Ornamental Horticulture Program to determine the tolerance of ornamental crops to several pre-emergence herbicides. Samples were treated within seven days of transplant and again six weeks later (except as noted, see V-10233 Trial below). Visual assessment of injury data was collected at 1, 2, and 4 weeks after each treatment.

Biathlon Trial:
Biathlon 2.75G (oxyfluorfen + prodiamine) was applied at 2.75, 5.5, and 11 lb ai/A to *Calluna vulgaris* 'Winter Chocolate', *Chamaecyparis pisifera* 'Gold Mop', *Chrysanthemum* x *morifolium* 'Danielle Purple', *Chrysanthemum* x *rubellum* 'Clara Curtis', *Crassula capitella* 'Campfire', *Delosperma cooperi* 'Table Mountain', *Echeveria shaviana* 'Black Prince', *Hypericum frondosum* 'Sunburst', K*erria japonica* 'Pleniflora', *Leucanthemum* x *superbum* 'Becky', *Osteospermum ecklonis*, *Picea pungen*s, and *Santolina chamaecyparissus*. Severe injury was observed to *Crassula* and moderate to severe injury was observed in *Echeveria*. Moderate injury was seen in *Kerria*, *Leucanthemum*, and *Delosperma*. All other species were observed to have mild injury or no injury.

Freehand Trial:
Freehand 1.75G (dimethenamid + pendimethalin) was applied at 2.625, 5.25, and 10.5 lb ai/A to *Arctostaphylos uva ursi* 'Massachusetts', *Crassula capitella* 'Campfire', *Delosperma cooperi* 'Table Mountain', *Echeveria shaviana* 'Black Prince', *Kalmia latifolia* 'Raspberry Glow', and *Vinca major* 'Expoflora'. Very slight injury was observed in Kalmia. In all other species, mild to moderate injury was observed.

Gemini Trial:
Gemini G (prodiamine + isoxaben) was applied at 200, 400, and 800 lb product/A to *Acer rubrum*, *Campanula portenschlagiana* 'Birch Hybrid', *Digitalis purpurea* 'Dalmatian Purple', *Euonymus alatus* 'Compacta', *Hydrangea macrophylla* 'Paraplu', *Nepeta* x *faassenii* 'Walker's Low', *Quercus virginiana*, *Rosa* x 'Horcoherent', and *Tagetes erecta* 'Taisha Gold'. Moderate to severe injury was observed in *Digitalis*, *Hydrangea*, and *Tagetes*. Minimal to moderate injury was observed in *Euonymus* and *Nepeta*. No injury was observed in the other species.

Pendulum Trial:
Pendulum 2G (pendimethalin) was applied at 3.0, 6.0, and 12.0 lb ai/A to *Sedum kamtschaticum* var. *floriferum* 'Weihenstephaner Gold' and *Sedum spurium* 'John Creech'. Mild injury was observed early in the trial with complete recovery by trial end.

Dimension Trial:
Dimension 2EW (dithiopyr) was applied at 0.5, 1.0, and 2.0 lb ai/A to *Sedum spurium* 'John Creech' and *Solanum jasminoides* 'Variegata'. Moderate to severe injury was observed in *Sedum*. Results for *Solanum* were unreliable as the crop failed to thrive.

V-10233 Trial:
V-10233 76WG (flumioxazin + pyroxasulfone) was applied as a directed spray at 7.5, 15.0, and 30.0 oz ai/A to *Juglans nigra*, *Salix gracilistyla* 'Mt. Asama', and *Taxus cuspidata* 'Hicksii' once established then again eight weeks later. Minor to moderate injury was observed in *Salix*. No injury was observed in *Juglans* or *Taxus*.

Tolerance of Fiesta pre and post dormancy: IR-4
Investigators: Andrew Senesac and Irene Tsontakis-Bradley
Location: Long Island Horticultural Research and Extension Center

Pre and post dormancy ornamentals were tested for tolerance to Fiesta (FeHEDTA 26.52%). Treatments consisted of application of Fiesta at three rates (25, 50, and 100 oz/1000 sf), each rate applied at both 50 and 200 gallons per acre. Three applications were made at two week intervals. Height data was collected before commencing and at trial termination. Visual observations of injury were collected weekly throughout the trial, and for the dormant trial, post-dormancy.

Active Trial:
This trial was conducted in the spring of 2017 in an open-air container nursery. Actively growing samples of four ornamental species were treated on 5/3/17, then two and four weeks later. *Juniperus horizontalis* 'Prince of Wales' and *Ammophila breviligulata* (American beachgrass) were unaffected by any treatment during the study. *Erianthus ravennae* (L.) P. Beauv. (hardy pampas grass) and *Carex cherokeensis* (Cherokee sedge) were significantly affected at all rates and both spray gallonages. Injury began to appear after the third application. Both species began to show recovery by the end of the study.

Dormant Trial:
This trial was conducted in the winter of 2017 in an unheated poly-covered house. Dormant samples of four ornamental species were treated on 2/15/17, then two and four weeks later. Applications to three species of dormant deciduous shrubs, *Fothergilla gardenii* 'Mount Airy', *Physocarpus opulifolius* 'Coopertina', and *Kerria japonica* 'Pleniflora', caused significant injury that was evident once the plants began to leaf out in the spring. *Ilex x meserveae* 'Mesog' (China Girl holly) was also injured, which was observed from three weeks after the initial treatment.

Tolerance of directed application of V-10233
Investigators: Andrew Senesac and Irene Tsontakis-Bradley
Location: Long Island Horticultural Research and Extension Center

A trial was conducted at the Long Island Horticultural Research and Extension Center to examine the tolerance of several ornamental shrubs to directed applications of V-10233. V-

10233 76WG (flumioxazin+pyrosulfuron) was applied at 10, 20, and 40 oz/A, SureGuard 51WDG (flumioxazin) was applied at 6.6, 13.2, and 26.4 oz/A, and Tower 6EC (dimethenamid) was applied at 32 fl oz/A as directed sprays at spring flush and eight weeks later (4/28/17 and 6/3/17). The ornamentals treated were established specimens of *Cornus sanguinea*, *Taxus cuspidata* 'Densa', *Rhododendron maximum* 'Roseum', and *Buddleia davidii* 'Tutti Frutti' that were maintained in a container nursery with daily overhead irrigation. Visual assessment of phytotoxicity was collected throughout the season. Plants were pruned before the second application to facilitate directed application.

In *Cornus* and *Buddleia*, injury to lower foliage was observed at two weeks after treatment (WAT). This may have been due to inadvertent drift contact with the treatments during application or splash of irrigation waters onto lower foliage shortly after application. By 4WAT the affected lower foliage was no longer present and no additional injury was observed. In Taxus, minor injury was observed (browning of foliage) in plants treated with the high rate of V-10233. Complete recovery was observed by season end.

Rotation practices phytotoxicity and efficacy
Investigators: Andrew Senesac and Irene Tsontakis-Bradley
Location: Long Island Horticultural Research and Extension Center

A trial was conducted at the Long Island Horticultural Research and Extension Center in 2017 to determine the efficacy and safety of herbicides applied in three rotations at six week intervals. Sequential rotation applications, applied 5/31, 7/12, and 8/23/17, were as follows (first/second/third rotation respectively): (1) Biathlon/Freehand/Freehand, (2) Biathlon/Freehand/Marengo, (3) Gallery+Pendulum/Tower/Tower, and (4) Gallery+Pendulum/Tower/ Tower+Pendulum.

The rotation applications consisted of Biathlon 2.75G at 100 lb prod/A, Freehand 1.75G at 175 lb prod/A, Marengo 0.0224G at 150 lb prod/A, Gallery 4.16SC at 1.0 lb ai/A, Pendulum 3.3EC at 3.6 pt prod/A, and Tower 6EC at 32 fl oz prod/A (except when in combination with Pendulum at 21 fl oz prod/A).

Treatments were applied to container-grown *Gazania splendens* 'Big Kiss Red', *Solidago* x 'Little Lemon', *Hemerocallis* x 'Mini Pearl', *Hosta* x 'Sum and Substance', and *Salvia sylvestris* 'Blue Hill'. Treatments were also applied to flats filled with media and seeded with Rice flatsedge, Spotted spurge, Common purslane, and Horseweed. Each rotation was applied to weed seeds that were sown on fresh media. Efficacy and phytotoxicity data was collected 2, 4, and 6 weeks after each rotation application.

Results indicate that minor to moderate injury was observed with complete or nearly complete recovery in all species except Salvia. In Salvia, samples treated with Gallery+Pendulum/Tower/Tower, and Gallery+Pendulum/Tower/ Tower+Pendulum were moderately injured and did not recover by trial end.

For weed control, the second and third rotation treatments were very effective except Marengo on purslane. At the first rotation, Biathlon provided minor to moderate control of all four weeds.

Efficacy of Glyphosate and SureGuard SC for vegetation management
Investigators: Andrew Senesac, Tamson Yeh and Irene Tsontakis-Bradley
Location: Long Island Horticultural Research and Extension Center

In 2017, a field study was conducted at the Long Island Horticultural Research and Extension Center to evaluate the efficacy and longevity of control of various combinations of SureGuard SC (flumioxazin) and Roundup PowerMax (glyphosate). The plot area was selected because it was an abandoned turf area that was heavily infested with perennial weeds, notably white clover (Trifolium repens) and narrowleaf plantain (Plantago lanceolata). The resident vegetation was representative of weedy herbaceous plant growth that vegetation managers would normally need to control with regular applications of glyphosate. The abundant presence of white clover was a boon to the study. Glyphosate is generally only fair in controlling species such as clover that are in the Fabaceae Family. The goal of the study was to determine if the addition of SureGuard SC to the glyphosate applications would extend or broaden the weed control, thus allowing for vegetation managers to make fewer return trips.

Eight treatments were replicated 3 times in RCB design. The plots were 6’x15’. The treatments were applied with a CO2 powered back sprayer with (2) 8003LP nozzles delivering 43 GPA. Treatments were applied either on May 10, 2017 and/or June 9, 2017. The first array evaluated SureGuard SC applied at either 0.5, 0.625 or 0.75 lb ai/A in combination with 1 lb ae/A Roundup PowerMax. These combinations were compared to Roundup PowerMax applied alone on either May 10, June 9 or on both dates. A split application of SureGuard SC applied at 0.5 lb ai/A and Roundup on both dates was also evaluated.

The treatments effects were measured by scheduled visual evaluations of percent control compared to the nearby untreated area within each plot. The observations were made at 16, 22, 30, 44 and 77 days after the May10 treatment.

The results indicate that the May 10 application of Roundup alone provided good initial control. However, by 77 days after treatment, the overall control was only 37%. Overall control was greatly improved if the Roundup alone application was delayed until June. Early white clover control was significantly improved if SureGuard SC at any rate was added. The split application with SureGuard and Roundup provided excellent overall control throughout most of the season and this control was still evident after the effects of the other treatments were erased by weed regrowth.

Weed management in green roof sedums
Investigators: Andrew Senesac and Irene Tsontakis-Bradley
Location: Long Island Horticultural Research and Extension Center

A greenhouse trial was conducted to evaluate pre and post emergence herbicide tolerance in five sedum species. The species chosen are ones that are popular with commercial growers for producing green roof pallets. The pallets are usually grown outdoors for a few months before shipping and installation. During that time, the flats are susceptible to weed seed invasion.

This study was conducted to determine if the sedum species will tolerate spray and granular applications of topramezone, metsulfuron, OHP 1701, OHP 1702 and dimethenamid-P + pendimethalin. Topramezone (Pylex) is of particular interest because it is a sprayable formulation that can provide post emergence control of some key weed species with over the top applications. Pylex is currently registered in New York State (including Long Island) for various turf sites. The hope is that ornamental tolerance may be exhibited and allow for label expansion. The numbered OHP compounds are soon to be EPA registered granular combinations. We were interested in comparing them to Freehand (dimethenamid-P + pendimethalin), a combination granular formulation that is currently registered on all sedum species.

The plants were grown outdoors for several days before treating. The preemergence treatments were irrigated immediately and the postemergence treatments were irrigated 24 hours after treatment. Three days after treatment, the flats were moved into a heated greenhouse with supplemental metal halide lighting. The flats were evaluated for visual signs of injury at 10 and 20 days after treatment.

The results indicate a high level of tolerance of the sedums to topramezone at the 1X and 2X rates. At the 4X rate, only *Sedum album* showed significant injury to this treatment. These results are promising and suggest that topramezone should be further evaluated. OHP 1701 injured one of the five sedums at the 1X rate and two species at the 4X rate. This also suggests further evaluation. OHP 1702 was injurious to three species at the 1X rate and it would not be a candidate for further study. Freehand was very well tolerated by all five species at the 4X rate.

Modified soil solarization
Investigators: Andrew Senesac
Location: Long Island Horticultural Research and Extension Center

In early spring 2017, a demonstration plot was established to evaluate three methods of pre-plant soil management to decrease weed seeds in the soil bank. The plot area was rototilled prior to treatments being established on April 20, 2017. The treatments consisted of clear/opaque plastic sheeting applied and sealed over the tilled soil. Two plastic thicknesses were evaluated, 6 mil and 3.5 mil, compared to the untreated control which was bare ground. The plastic sheets stayed in place for 6 weeks then removed on June 2. Once the sheets were removed, the emerged weed growth was sampled and fresh weight and plant numbers were recorded. At this point the emerged weeds were rototilled, treated with 1 lb ae/A glyphosate, or left untreated. One week after these treatments were applied, three species of annual cutflowers (sunflower, zinnia and cosmos) were seeded. The results of this single replicate trial were very interesting and presented themselves in two stages.

The first was the weeds that emerged following the clear plastic sheeting application. There were many more grassy weeds (95% large crabgrass) in both plastic plots than the untreated. The untreated plot had many fewer weeds and greater number of broadleaf weed species than either of the plastic plots. These results indicate that the early season clear plastic application was successful in encouraging many more weeds to germinate early than if the ground was uncovered.

The second stage was evaluated 8 weeks after the plastic was removed. The fewest number and lowest weed fresh weight was in the plot that had glyphosate but no other cultural disturbance. This was followed by the plots that had plastic with rototilling after and the weediest plot was where no measure was taken to manage the weeds after the plastic was removed. These preliminary results indicate that seeded cutflowers could be successfully grown in at least one of the plots without the addition of a residual herbicide or black plastic mulch. These results are encouraging and we hope to follow up in 2018 with a replicated trial.

Evaluating horseweed (*Conyza canadensis*) accessions for resistance to Glyphosate
Investigators: Andrew Senesac
Location: Long Island Horticultural Research and Extension Center

In the Midwest and to a lesser extent other parts of the country, there is widespread resistance of horseweed (marestail) biotypes to glyphosate - mostly due to resistant biotypes being released by continual glyphosate application in glypho-resistant crops. Because the seed of this weed is capable of long distance dispersal in the wind, there is concern that Long Island may be hosting glyphosate-resistant biotypes. During the summer, two live samples of horseweed, collected from two separate areas of eastern Long Island were sent to the LIHREC for evaluation for resistance to the herbicide glyphosate. Managers at both locations had difficulty with postemergence control of these plants. We collected viable seed from each accession and planted some in the LIHREC greenhouse in September 2017 along with seed from a local glyphosate-susceptible population. Once the seedlings were at the 2-3-inch rosette stage, the plants were treated with 6 strengths of glyphosate ranging from 5% to 0.75% solutions. The results indicate that both suspect populations were in fact susceptible to glyphosate at the same level that the control population was. This indicates that environmental conditions or growth stage may have been responsible for lack of control seen by the managers in 2017.

Nutrient management for field nurseries
Investigator: Mina Vescera
Location: Demonstration garden of underused Long Island native plants, Riverhead, NY

During the first growing season of 2017, two rows that had been fallow were prepped and planted in mid-June. Each 130 feet by 2 feet rows were planted with 22 native species (Table 1) grown from seed (collected from natural areas by the Long Island Native Plant Initiative). Both rows had the same species opposite each other, with three to five plants per species planted. Three annuals, three grasses, eleven herbaceous perennials, one vine, and four shrubs comprised the plant selection. To compare effect of garden inputs, one row was amended with 30 cubic yards of mushroom compost (amended row), while the other row was left as is (no-frills row). No fertilizer was used in the first season, instead both rows received supplemental irrigation and weeding as needed to allow for good establishment. During the first growing season, the primary difference between the two rows was the reduction of weeds in the amended row. Most plants established well and there was no visible difference in growth between the amended and no-frills row. *Spirea tomentosa* performed poorly in both rows and all plants had powdery mildew; dead plants were removed and replaced in the fall. In spring 2018, the amended row will receive fertilizer and supplemental irrigation, while the no-frills row will not receive any inputs. Weeding will be done in both rows.

Table 1. Underused native plant species used in the Long Island native plant demonstration garden.

Annuals	**Perennials**
Chamaecrista fasciculata	*Chrysopsis mariana*
Pseudognaphalium obtusifolium	*Eupatorium hyssopifolium*
Trichostema dichotomum	*Hibiscus moscheutos*
Grasses	*Hypericum virginicum*
Deschampsia flexuosa	*Lespedeza capitata*
Dichanthelium clandestinum	*Lespedeza hirta*
Sorghastrum nutans	*Sisyrinchium atlanticum*
Vines	*Solidago odora*
Vaccinium macrocarpon	*Solidago sempervirens*
Woodies	*Symphyotrichum laeve or Aster laevis*
Rosa carolina	*Vernonia noveboracensis*
Rosa palustris	
Rosa virginiana	
Spiraea tomentosa	

This project was made possible in part by a grant awarded by the Long Island Nursery and Landscape Association.

Evaluating fertilizer type in field production of California privet (*Ligustrum ovalifolium*)
Investigator: Mina Vescera
Location: Riverhead, NY

A trial was established that will investigate various fertilizers on *Ligustrum ovalifolium*, an important nursery crop on Long Island. Three fertilizer treatments and an untreated control treatment will be compared. Fertilizer treatments include a widely-used fertilizer in ornamental production with a 16-8-8 analysis applied as several spilt applications throughout the growing season because of its high solubility; a 20-4-8 nursery blend with 20% sulfur-coated controlled-release nitrogen and select micronutrients; and a 8-0-4 organic blend with mycorrhizae added. During the 2017 growing season, plants were allowed to establish with only tissue tests and soil tests collected for evaluation during the first year of the trial. During the second year, in addition to the soil and tissue sampling, five shrubs per treatment and the control will be harvested to compare root and shoot dry weights.

This project was funded by the New York State Environmental Protection Fund.

Assessing Trimtect and growth regulator combinations for suppressing vegetative growth on *Euonymus kiautschovicus* 'Manhattan'
Investigators: Mina Vescera and Dan Gilrein
Location: Riverhead, NY

Trimtect (paclobutrazol 0.72 SC) is a plant growth regulator produced by Rainbow Treecare Scientific Advancements and is used to suppress shoot elongation for many woody ornamental shrubs and trees. A trial was conducted to evaluate efficacy of foliar sprays on *Euonymus kiautschovicus* 'Manhattan' comparing two rates of Trimtect alone, Trimtect tank mixed with ethephon (RTSA 550, 0.33SC) plus a proprietary adjuvant (RTSA 600), or with the proprietary adjuvant only. Control plants were sprayed with water only. All treatments included Audible 90 nonionic surfactant (glycerin, diethylene glycol and alkyl polyglucoside, 90%) at 0.53 ml/l.

Even though visual observations suggested a treatment effect, statistical analyses did not show any differences between treatments at the error rate $p=0.05$. When testing for goodness of fit within each treatment, control plants showed significant variability in stem height measurements particularly on the last two dates at 8 weeks (August 4th) and 12 weeks (Sept. 1st) after treatment ($W = 0.750109$, $p = 0.0298$, and $W = 0.741486$, $p = 0.0248$, respectively). The variability of stem measurements within each treatment and the relatively low number of replications may have made it difficult to detect subtle treatment effects. The transformed data did reveal additional differences of growth over time ($F = 18.3749$, df = 3,103, $p < 0.0001$) within treatments 1 ($F = 3.2970$, df = 3,103, $p = 0.0234$) and 2 ($F = 6.1618$, df = 3,103, $p = 0.0007$), and the control ($F = 10.0850$, df = 3,103, $p = <0.0001$). Growth over the 12-week observation period was similar among all treatments with stark differences from the control.

On September 9th, all plants were hedged and clippings weighed. Pictures were taken throughout the trial for documentation. Contact Mina Vescera for information on detailed results and images.

This project was funded by Rainbow Treecare Scientific Advancements, Minnetonka, MN.

Efficacy of BAS 440 00I and experimental Biopesticide X for control of western flower thrips on marigold
Investigator(s): Faruque Zaman, Kelly Jackson and Dan Gilrein
Location: Long Island Horticultural Research and Extension Center

Western flower thrips (*Frankliniella occidentalis*) is a common agricultural pest with an extremely wide host range including fruit, vegetable, and ornamental crops. Western flower thrips (WFT) can impact the host plants in both appearance and growth; in addition to feeding on foliage. WFT are also vectors of multiple tospo viruses. In this study, seven foliar treatments were compared for the control of WFT in an early spring trial on greenhouse marigolds. Treatments included BAS 440 00I (afidopyropen 100g/l SC, BASF) and BotaniGard ES (*B. bassiana* strain GHA 11.3% ES, BioWorks, Inc) at one rate for the duration of the trial, experimental product alone at two different rates, and combined in a tank mix with BAS 440 00I at one rate. Water-sprayed plants were used as a control. The trial was conducted from late January to early May, 2017 on ‘Taishan Orange’ marigold (*Tagetes erecta* L.). Plants were maintained throughout the trial on greenhouse benches, initially on overhead irrigation as needed then later moved to ebb-and-flood irrigation for the remainder of the trial. On March 14, the trial plants were exposed to the thrips population. The thrips population was allowed to establish for 21 days before the pre-trial assessments were conducted. Treatments were randomly assigned to plants, using eight single-plant replications per treatments. Applications were made on April 5, 13, and 20 using a CO_2-powered backpack sprayer. For data collection, both adults and nymphs were counted from the whole plant by gently tapping each plant over a white board. Overall phytotoxicity ratings were recorded on each observation date. Additionally, plant growth and injury ratings were taken on the first data collection date and the last. ANOVA and multiple comparisons among treatments were performed using a statistical multiple comparison procedure (Least Squares Means, Tukey's HSD; JMP Pro 13, SAS Institute).

The biopesticide treatments in this trial demonstrated mixed effects on WFT populations, both adult and immature. The adult populations were most significantly lowered by BAS 440 00I at 4.8 fl.oz./gal and 10.0 fl.oz./gal. A majority of the other treatments suppressed the adult WFT populations for a time, but experienced a rebound in the population before the end of the experimental period. The first treatment to demonstrate significant control was the experimental product X at 10 fl.oz./gal combined in a tank mixture with BAS 440 00I at 4.8 fl.oz./gal; there was also a rebound in adult thrips. The immature populations seemed to be less impacted by the treatments, for example, plants treated with BAS 440 00I at 4.8 fl.oz./gal were not significantly different from the control at any point during the trial. In two treatments with experimental product X at 6.0 fl.oz./gal and 10 fl.oz./gal), the immature populations trended lower than the control after the third spray, and there was continued suppression through the end of the experiment. Immature WFT populations on plants in the other treatments demonstrated mixed results similar to the adult populations, with some significant suppression during the trial, but no lasting effects through the final data points. Plant growth was not affected by the treatments. There was thrips injury to plants in all treatments that negatively impacted the plant quality. Insecticide residue was very light on plants and no phytotoxicity was observed in any treatment.

The investigators wish to thank BASF for their support of this trial.

Efficacy of experimental Biopesticide Y for control of western flower thrips on marigold
Investigators: Faruque Zaman, Kelly Jackson and Dan Gilrein
Location: Long Island Horticultural Research and Extension Center

Western flower thrips (WFT, *Frankliniella occidentalis*) is a common agricultural pest with an extremely wide host range including fruit, vegetable, and ornamental crops. Western flower thrips can damage flowers, fruit and foliage and is vector of tospoviruses. In this study seven foliar treatments were compared for the control of western flower thrips in a spring trial on greenhouse marigolds. Treatments included Experimental Biopesticide Y at four rates and BotaniGard ES (*B. bassiana* strain GHA 11.3% ES, BioWorks, Inc.) at one rate for the duration of the trial. Water-sprayed plants were used as a control. The trial was conducted from February to early June, 2017 on 'Taishan Orange' marigold (*Tagetes erecta* L.). On April 4 trial plants were exposed to a population of western flower thrips. The thrips population was allowed to establish for 21 days before pre-trial assessments were conducted. Treatments were randomly assigned to plants, using eight single-plant replications per treatment. Treatments were mixed immediately before application and applications were made late in the day on May 1, 8, 16, and 23, using a CO_2-powered backpack sprayer. Plants were arranged in a completely randomized design and maintained on a greenhouse bench. Plants were not allowed to flower and buds were removed prior to opening to avoid skewing data. Both adults and nymphs were counted from entire plants by gently tapping each plant over a white surface, gently brushing thrips back onto plants afterwards. ANOVA and multiple comparisons among treatments were performed on raw or transformed data using a statistical multiple comparison procedure (Least Squares Means, Tukey's HSD; JMP Pro 13, SAS Institute).

Over the course of this experiment, no treatment appeared to provide adequate control of adult or immature WFT. Immature thrips levels did significantly drop as measured just prior to the second application particularly on plants treated at the highest application rate (64 fl oz/gal) of the experimental product X and BotaniGard ES. Efficacy observed among treatments thereafter appear to have been marginal. There were some differences among treatments in adult populations on some dates but generally these did not appear meaningful. Adult WFT are highly mobile; in similar biopesticide trials, treatment impacts are sometimes obscured where populations are high and thrips are able to move to nearby plants from other less effective treatments. There were no effects on plant growth associated with treatment and no phytotoxicity was observed in any treatment.

The investigators wish to thank BASF for their support of this trial.

Efficacy of experimental Biopesticide Y for control of two-spotted spider mite on marigold
Investigator(s): Faruque Zaman, Kelly Jackson and Daniel Gilrein.
Location: Long Island Horticultural Research and Extension Center

Two-spotter spider mite (*Tetranychus urticae* Koch) is a common agricultural pest with an extremely wide host range. In this study, 3 rates of the experimental product Y (at 13.0, 21.0, and 42.0 fl. oz./100 gal) were compared with BotaniGard ES (*B. bassiana* strain GHA 11.3% ES, BioWorks, Inc) at 32.0 and 8.0 fl. oz./100 gal for the control of two-spotted spider mite (TSSM) in a fall trial on greenhouse marigolds. Water-sprayed plants were used as a control. This trial was conducted from mid-March to mid-June, 2017 on 'Taishan Yellow' marigold (*Tagetes erecta* L.). TSSM population from a colony reared on bean plants in the greenhouse were transferred to the experimental plants by placing infested bean leaves on each of the plants. The mite population was allowed to establish for 53 days before the pre-trial assessments were conducted. Treatments were randomly assigned to plants, using eight single-plant replications per treatments. Applications were made on May 2, 9, 16, 23, and 30, using a CO_2-powered backpack sprayer fitted with a TJ-60 8001VS twin-fan nozzle, operating at 20 psi and applied to wet, calibrated to deliver 100 GPA. Treatments were evaluated by randomly selecting four middle-aged leaves around each plant and counting the total number of TSSM on each leaf. ANOVA and multiple comparisons among treatments were performed on raw or transformed data using a statistical multiple comparison procedure (Least Squares Means, Tukey's HSD; JMP Pro 13, SAS Institute).

All treatments in this trial were effective in suppressing the TSSM populations. Highest control was seen after the second application of BotaniGard ES, and continued through the duration of the study. All three rates of experimental product Y had an effect on TSSM populations after the third application, and there also seems to be a statistically insignificant effect due to application rate, however the higher rates exhibiting numerically better control. The two lowest rates (13 fl.oz./gal. and 21.0 fl.oz./gal) suppressed the population through the second to last count, whereas the highest rate (64 fl.oz./gal) kept the population significantly lower than the control till the final count.

Plant growth, measured by taking height and width differed by treatment. The plants in the control experienced negative growth due to the tremendous amount of TSSM webbing on each plant. TSSM damage was significantly greater on control plants when compared to all other treatments. The residue on plants were very light and no phytotoxicity was observed in any treatment.

The investigators wish to thank BASF for their support of this trial.

Efficacy of experimental Biopesticide Y and BAS 440 00I for control of sweetpotato whitefly on poinsettia
Investigator(s): Faruque Zaman, Kelly Jackson and Daniel Gilrein
Location: Long Island Horticultural Research and Extension Center

Sweetpotato whitefly (*Bemisia tabaci* Genn.) is a common pest of ornamental and outdoor crops such as poinsettia, hibiscus, cucurbits, and tomatoes. Populations have developed resistance to several formerly effective insecticides, leaving relatively few options for treating infested plants. In this study, ten foliar insecticide treatments were compared for control of sweetpotato whitefly in a late fall trial on greenhouse poinsettias. Treatments included repeat applications of the Experimental biopesticide Y or BotaniGard ES (*B. bassiana* strain GHA 11.3% ES, BioWorks, Inc.) at one rate for the duration of the trial, and BAS 44000I (afidopyropen 100g/l SC, BASF) at one rate used in varying alternations with either experimental biopesticide Y at two rates or BotaniGard ES at one rate. Water-sprayed plants were used as a control. The trial was conducted from early August to mid-November, 2017 on ‘Prestige Red’ poinsettia (*Euphorbia pulcherrima* Willd. ex Klotzsch). On October 4, the trial plants were infested with Q-biotype whiteflies by introducing a laboratory-reared population to the range and allowing the adults to disperse. whiteflies from the colony were sent to Dr. Cindy McKenzie (Research Entomologist, US Horticultural Research Laboratory/ARS-USDA, Fort Pierce, FL) and all (20/20) were determined to be Q-biotype. The whitefly population was allowed to increase for two weeks before beginning the pre-trial population assessment. Treatments were randomly assigned to plants, using eight single-plant replications per treatment. Applications were made on October 17, 24, 31, and November 7, using a CO_2-powered backpack sprayer fitted with a TJ-60 8001VS twin fan nozzle, operating at 20 psi calibrated to deliver 100 GPA. Applications were made late in the day under shaded conditions to avoid direct sun. Treatments were evaluated by randomly selecting four middle-aged leaves around each plant and counting the number of immature (nymphs + pupae) and adult whiteflies on the undersides of each leaf. ANOVA and multiple comparisons among treatments were performed on raw or transformed data using a statistical multiple comparison procedure (Least Squares Means, Tukey’s HSD; JMP Pro 13, SAS Institute).

The experimental biopesticide Y treatment alone and in conjunction with BAS 440 00I, did not appear to significantly control the whitefly population in this trial. Similarly, when used after BotaniGard ES, BAS 440 00I also did not appear to suppress the whitefly population significantly. When BAS 440 00I was used for the first application and followed by BotaniGard, there appeared to be some suppression of the immature whitefly population after the third and fourth applications. However, there were no significant differences in population levels among treatments due to application rate. The adult data show fewer treatment effects or trends than the immature data, which could be related to a fairly low treatment impact on whitefly population and the high mobility of the adults. We did observe low numbers of the adults knocked down at the beginning of the trial, and for the majority of the trial, the population consisted of high numbers of nymphs and pupae. Towards the end of the trial, there were increasing numbers of newly eclosed adults, and there was a brief trend suggesting some efficacy in treatment. In past trials, we have observed significant suppression of *Bemisia* with weekly applications of BotaniGard. In those studies, no per-acre water use limit was placed and generally sprays were applied just to the point of drip. A higher water vloume application rate could possibly increase spray coverage and pest contact, particularly as plants grow and develop larger canopies. Residue was very light on plants treated with insecticides. There are some statistical differences in the phytotoxicity ratings and we have noticed injury from the BotaniGard ES formulation, but the aesthetic quality and marketability were not compromised.

The investigators wish to thank BASF for their support of this trial.

Efficacy of experimental Biopesticide X for control of sweetpotato whitefly on poinsettia
Investigator(s): Faruque Zaman, Kelly Jackson and Daniel Gilrein
Location: Long Island Horticultural Research and Extension Center

Sweetpotato whitefly (*Bemisia tabaci* Genn.) is a common pest of ornamental and outdoor crops such as poinsettia, hibiscus, cucurbits, and tomatoes. Populations have developed resistance to several formerly effective insecticides, leaving relatively few options for treating infested plants. In this study, eight foliar insecticide treatments were compared for control of sweetpotato whitefly in a late spring trial on greenhouse poinsettias. The treatments consisted of applications of Experimental biopesticide X at one of five increasing rates, or BotaniGard ES (*B. bassiana* strain GHA 11.3% ES, BioWorks, Inc.) at two different rates. Water-sprayed plants were used as a control. The trial was conducted from February to mid-June, 2017 on 'Euro glory red' poinsettia (*Euphorbia pulcherrima* Willd. ex Klotzsch). On April 28, the trial plants were infested with Q-biotype whiteflies by introducing a laboratory-reared population to the range and allowing the adults to disperse.

Treatments were randomly assigned to plants, using eight single-plant replications per treatment. Applications were made on May 12, 19, 26, and June 2, using a CO_2-powered backpack sprayer fitted with a TJ-60 8001VS twin fan nozzle, operating at 20 psi calibrated to deliver 100 GPA. Treatments were mixed immediately before application and agitated well while spraying. Applications were made late in the day under shaded conditions to avoid direct sun. Treatments were evaluated by randomly selecting four middle-aged leaves around each plant and counting the number of immature (nymphs + pupae) and adult whiteflies on the undersides of each leaf on May 11, 15, 18, 22, 25, 30, June 1, 5, 8, and 12. ANOVA and multiple comparisons among treatments were performed on raw or transformed data using a statistical multiple comparison procedure (Least Squares Means, Tukey's HSD; JMP Pro 13, SAS Institute).

The highest rate of the experimental product X has demonstrated a low level of significant control on the sweet potato whitefly populations, in both the adult or immature life stages. The adult data show fewer treatment effects than the immature data, which is likely related to the high mobility of adults. BotaniGard ES at 32 fl.oz./gal were the most effective treatment, significantly reducing the whitefly populations after the third and fourth applications. Though the results were not statistically significant for each subsequent date of data collection. While there was population suppression in both adult and immature life stages, the overall whitefly population on the treated plants was still fairly high for the duration of the experiment. Residue was very light on poinsettias treated with insecticides, and no cumulative impact was observed as the experiment progressed. Additionally, there was no phytotoxicity observed on any treatment, despite the fact that we have noticed injury from the BotaniGard ES formulation in past trials.

The investigators wish to thank BASF for their support of this trial.

Efficacy of experimental Biopesticide Y for control of foxglove aphid on salvia
Investigator(s): Faruque Zaman, Kelly Jackson and Daniel Gilrein
Location: Long Island Horticultural Research and Extension Center

Foxglove aphid (*Aulacorthum solani* Kalt.) is a common greenhouse pest of both ornamental and food crops, such as calibrachoa, petunia, tomato and pepper. In this study, six foliar insecticide treatments were compared for control of foxglove aphid in a late fall to early winter trial on greenhouse salvia. Treatments included Experimental biopesticide Y at four rates, and BotaniGard ES (*B. bassiana* strain GHA 11.3% ES, BioWorks, Inc). Water-sprayed plants were used as a control. The trial was conducted from August to early December, 2017 on Salvia 'Vista Red' (*Salvia splendens* Sellow ex Roemer & J. A. Schultes). Aphids used for this study were introduced from a colony started in August 2017, and reared on salvia plants. On October 18, each trial plant was infested with 5 foxglove aphids via paintbrush transfer and the population allowed to establish for five days before pre-trial assessments were conducted. Plants were maintained under ambient light for the duration of the study.

Treatments were randomly assigned to plants, using eight single-plant replications per treatment. Applications were made on October 23, 30, November 6, 13, and 20, using a CO_2-powered backpack sprayer fitted with a TJ-60 8001VS twin fan nozzle, operating at 20 psi calibrated to deliver 100 GPA. Treatments were mixed immediately before application and agitated well while spraying. Applications were made late in the day under shaded conditions to avoid direct sun. Treatments were evaluated by counting the number of immature and adult aphids on the entire plants. Overall phytotoxicity ratings and plant growth assessments were also done on each observation date over the course of the trial. After the final count was taken, overall plant quality was assessed. ANOVA and multiple comparisons among treatments were performed on raw or transformed data using a statistical multiple comparison procedure (Least Squares Means, Tukey's HSD; JMP Pro 13, SAS Institute).

All insecticide treatments provided moderate levels of control of foxglove aphid after one or two applications. There was no apparent response due to rate of the experimental biopesticide Y. BotaniGard was the most effective treatment with aphid populations less than 5% of those on control plants on Nov. 6 when aphid numbers were peaked. Aphid levels dropped quickly on all plants after this time for reasons which are not entirely clear. Very few predators and no parasitoids were present and no dead aphids were found on untreated plants. While foxglove aphid can have anholocyclic populations in greenhouse crops, some strains or populations appear to respond to daylength (short days) and we did observe a high proportion of alates in the population starting mid-November. Greenhouse temperatures were also lowered around this time to reduce aphid reproduction, in consideration of the time remaining for the trial and the very high numbers already on control plants. That may have provided an additional cue, resulting the declining and then very low numbers observed to the end of the trial across all treatments including the controls. There was some aphid injury (stunting and distortion) to plants in all treatments that negatively impacted plant quality, but damage was significantly greater on control plants. Residue was very light on plants treated with insecticide, and no phytotoxicity was observed in any treatment.

The investigators wish to thank BASF for their support of this trial.

Crop safety of several products for managing thrips.
Investigator(s): Faruque Zaman, Lucille Siracusano and Daniel Gilrein
Location: Long Island Horticultural Research and Extension Center

Foliar applications of several new insecticides and miticides were evaluated for safety to ornamental horticulture, greenhouse bedding and flowering pot crops. Crops evaluated included two cultivars each of coleus (*Solenostemon scutellarioides* cv. 'Wizard Jade' & ‘Wizard Velvet Red’), dahlia (*Dahlia sp.* cv. ‘Dahlietta Patty’ & ‘Dahlietta White’), gerbera (*Gerbera jamesonii* cv. ‘Revolution Rose Bright Eye’ & ‘Revolution Yellow Light Eye’), and one species of crape myrtle (*Lagerstoremia indica* cv. ‘Natchez’), foamy bells (*Heucherella sp.* cv. ‘Brass Lantern’), and stonecrop (*Sedum sp*. cv. ‘Autumn Fire’). Treatments included three rates each of Sultan (cyflumetofen 1.67SC, BASF) and BAS 440 00I (afidopyropen 100g/L SC, BASF) applied as sprays to foliage and flowers (when flowers were available). Water spray was included as control for all treatments and application schedule.

No symptoms of phytotoxicity were seen on foliage and flowers in dahlia, gerbera, and foamy bells sprayed with three rates of Sultan. No residue was seen on dahlia plants of both cultivars. No plant quality differences were observed in plant among treatments in both cultivars. Light to moderate residue was seen on gerbera plants increasing with higher application rates. The residue on foliage was visible from at least 2- 6ft distance from the plant depending on rates of application. However, these residues were not noticeably visible on flowers because of petal color contrast. Residue on foliage from higher application rate may compromise aesthetic quality of the plants to some extent. No growth (height and width) differences were observed in plant among treatments. No symptoms of phytotoxicity and residue were seen on foamy bell foliage sprayed with Sultan. No plant quality and growth differences were observed in plant among treatments. No symptoms of phytotoxicity were seen on foliage and flowers (when available) in coleus, stonecrop, and crape myrtle sprayed with three rates of BAS44000I. No residue was seen on tested plants. No significant plant quality differences were observed in plant among treatments.

The investigators wish to thank IR-4 program for their support of this trial.

Vegetables

Asparagus variety trials
Investigators: Mark Bridgen
Location: Long Island Horticultural Research and Extension Center

The asparagus plant (*Asparagus officinalis altilis* L.) is a valuable, winter-hardy vegetable that provides Long Island and New York growers with an early-season fresh product. New cultivars and varieties of this plant are available from Walker Brothers in New Jersey. These varieties have not been trialed on Long Island. The objective of this project is to compare new varieties of asparagus plants to some of the "tried-and-true" varieties that our vegetable growers have grown for several years. This is a 5-year study to evaluate their spear production as well as their resistance to common asparagus diseases and root rots.

On Long Island, stem rots and crown rots of asparagus can be caused by *Fusarium moniliforme* and *F. oxysporum asparagi*. Rust caused by *Puccinia asparagi* and Purple Spot can also be problems. With new cultivars of asparagus available, it would be valuable to determine the degree of disease resistance of these plants on Long Island.

During the summer of 2014, the crowns of several varieties of asparagus were planted at the LIHREC in Riverhead, NY. These cultivars were 'Grande F_1', 'Jersey Knight', 'Purple Passion', 'WB-210', 'Apollo F_1', 'Jersey Supreme', 'Jersey Giant', 'Atlas F_1', and 'UC157 F_1'. There are 4 blocks each with 3 plants of each cultivar planted in a randomized complete block design for statistical analysis of the results. The plants were irrigated and fertilized as necessary to grow quality plants.

Beginning in the spring of 2015, and continuing through 2018, annual production data on the number of spears that are produced from each variety will be recorded. The pounds per acre of asparagus spears will be calculated annually for each variety. The incidence of diseases such as crown rots, rust, and stem rots will be recorded for each variety. Other issues such as speed of growth, insect problems, etc. will be noted.

Comparisons of controlled release fertilizers to traditional fertilizers on the growth of field asparagus
Investigators: Mark Bridgen and Neil Mattson
Location: Long Island Horticultural Research and Extension Center

The objective of this research is to compare the growth, and to evaluate the spear production, of three commercial cultivars of asparagus when fertilized with four different forms of fertilizer. The traditional granular fertilizer application of 100#/acre is being compared to three Controlled Release Fertilizers.

Asparagus, *Asparagus officinalis altilis*, is a perennial vegetable grown for its delicious young, edible shoots. Rich in B vitamins, vitamin C, calcium, and iron, asparagus is one of the first crops of spring harvest. This valuable, winter-hardy vegetable provides Long Island and New York growers with an early-season fresh product.

In 2014, an asparagus field was planted at the Long Island Horticultural Research & Extension Center with the commercial cultivars 'Jersey Knight', 'Jersey Supreme' and 'Jersey Giant'. This project is comparing the growth of these cultivars to four types of fertilizer applications over at least 3 years. Three Controlled Release Fertilizers (CRF), with the formulation 15-9-12 and 8-9 month release, were used. Osmocote Plus Lo-Start® delivers an extra boost of nutrition later in the growth cycle, Osmocote Plus Hi-Start® delivers an extra boost of nutrition early in the growth cycle, and Osmocote Plus Standard® delivers a steady source of nutrition throughout the growth cycle. These 3 CRFs are being compared to traditional granular fertilizers. The control plants receive the traditional granular fertilizer application of 100#/acre applied at 40#/acre early in the season in late April/May, 30#/acre applied in June, and 30#/acre applied in late summer. All four fertilizers will be applied at the recommended rate of 100# N per acre/season. All CRF treatments are applied in late April/May, during harvest season, at the rate of 100#/acre. The commercial brands of Osmocote (produced by the Everris Co., bwww.everris.us.com) are the source of the CRFs for this research.

The asparagus are planted in a randomized complete block design with 12 blocks. Each of the 4 treatments are replicated 3 times. Each replication contains the 3 cultivars 'Jersey Knight', 'Jersey Supreme' and 'Jersey Giant'; there are 5 plants of each cultivar in each replication with a total of 180 plants to evaluate. The plants are irrigated and weeded as necessary throughout the summer to grow quality plants. Insect and disease problems are handled as they arise.

Beginning in 2016, annual production data on the number of spears that are produced from each cultivar was recorded for 4 weeks. In 2017, data were collected for 6 weeks and in 2018, date will be collected for 8 weeks. The pounds per acre of asparagus spears will be calculated for each variety and fertilizer treatments will be compared. This fertilizer regime will be repeated each year. Results will be presented to vegetable farmers on Long Island.

Evaluation of Biofence for managing Phytophthora blight in cucurbits
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

The primary objective of this study was to evaluate the soil amendment product Biofence for the control of Phytophthora blight on pumpkins compared to biopesticides. Biofence is an organic fertilizer made from a specially bred brassica crop high in glucosinolate. The field was chosen because it has a history of Phytophthora blight. *Phytophthora capsici* proliferation was encouraged the previous season by growing squash and pumpkin throughout the field with no management practices for Phytophthora blight.

The field was plowed on 25 Jun. Controlled-release fertilizer (N-P-K, 15-5-15) was applied on 28 Jun at 675 lb/A (101 lb/A N), Biofence (6-2-0) was applied to the appropriate plots at the same time at 2000 lb/A to provide 101 lb/A N. Pumpkins were planted with a vacuum seeder at approximately 24-in plant spacing on 7 Jul. Strategy 3 pt/A, Sandea 0.5 oz/A and Roundup PowerMax 22 oz/A were applied prior to seedling emergence for weed control on 7 Jul using a tractor mounted sprayer. During the season, weeds were controlled by cultivating and hand weeding as needed. Moisture was initially provided by overhead irrigation; drip line was laid on 17 Jul and used for the rest of the season. After plants were established drip irrigation was run for extended periods of time in order to over saturate the soil and help encourage the proliferation of *Phytophthora capsici*; this was performed on a semi-weekly basis until plants reached reproductive stages. Plots were two 10-ft rows spaced 68 in. apart. The 20-ft area between plots was also planted to pumpkin. A randomized complete block design with four replications was used. All plots received the following fungicide applications to control powdery mildew, Vivando 15 fl oz/A on 7 Aug, Torino 3.4 fl oz/A on 14 Aug, Procure 8 fl oz/A on 21 Aug, and Vivando 15 fl oz/A on 28 Aug. Four applications of biopesticides were made to soil with one before planting, one pre-emergence, and two while plants were small, the treatments were Bio-Tam 4 lbs/A and Taegro 4 oz/A applied on 29 Jun and 20 Jul, and SoilGard 12G 10 lbs/A applied on 13 Jul and 27 Jul. Foliar applications for Phytophthora blight were made five times on a 7-day preventive schedule beginning on 3 Aug and ending on 1 Sep. Actinovate AG 12 oz/A plus Regalia 3 qt/A were applied in rotation with Double Nickel 1.5 lbs/A plus Cueva 2 qt/A plus Regalia 3 qt/A. All nine soil and foliar applications were made using a tractor-mounted boom sprayer equipped with twinjet (TJ60-11004VS) nozzles spaced 17 in. apart that delivered 72 gal/A at 50 psi and 2.3 mph. Plots were evaluated for Phytophthora fruit rot symptoms on 24, 28, and 31 Aug. At each assessment, all fruit within the plot were inspected for rot and recorded as a percentage of the total fruit.

An intensive rainstorm on 18 Aug with 3.28 in. rain likely provided favorable conditions for Phytophthora blight. Symptoms were first observed in this experiment on 24 Aug. Both treatments failed to significantly suppress Phytophthora fruit rot. Average incidence of affected fruit on 31 Aug was 60% for the Biofence soil amendment, 47% for the rotation treatment of biopesticides, and 60% for the untreated control. Disease pressure was high but distribution throughout the field was highly variable. Effective control was achieved with conventional fungicides in an adjacent experiment with the same variety (see following report).

This project supported by NYS Department of Agriculture & Markets.

Evaluation of biopesticides for managing Phytophthora blight in cucurbits
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

The primary objective of this study was to evaluate a program with a combination of biopesticide products used alone or added to a conventional fungicide program for control of Phytophthora blight on pumpkins. All products tested are labeled for this disease. Biopesticides were selected to cover the diversity of labeled active ingredients. The field was chosen because it has a history of Phytophthora blight. *Phytophthora capsici* proliferation was encouraged the previous season by growing squash and pumpkin throughout the field with no management practices for Phytophthora blight.

The field was plowed on 25 Jun. Controlled-release fertilizer (N-P-K, 15-5-15) was applied on 28 Jun at 675 lb/A (101 lb/A N). Pumpkins were planted with a vacuum seeder at approximately 24-in plant spacing on 7 Jul. Strategy 3 pt/A, Sandea 0.5 oz/A and Roundup PowerMax 22 oz/A were applied prior to seedling emergence for weed control on 7 Jul using a tractor mounted sprayer. During the season, weeds were controlled by cultivating and hand weeding as needed. Moisture was provided all season using overhead irrigation. Plots were three 12-ft rows spaced 68 in. apart. The 20-ft area between plots was also planted to pumpkin. A randomized complete block design with four replications was used. All plots received the following fungicide applications to control powdery mildew: Vivando 15 fl oz/A on 7 Aug, Torino 3.4 fl oz/A on 14 Aug, Procure 8 fl oz/A on 21 Aug, and Vivando 15 fl oz/A on 28 Aug. Four applications of biopesticides were made to soil with one before planting, one pre-emergence, and two while plants were small, the treatments were Bio-Tam 4 lbs/A and Taegro 4 oz/A applied on 29 Jun and 20 Jul, and SoilGard 12G 10 lbs/A applied on 13 Jul and 27 Jul. Foliar applications for Phytophthora blight were made five times on a 7-day preventive schedule beginning on 3 Aug and ending on 1 Sep. Actinovate AG 12 oz/A plus Regalia 3 qt/A were applied on 3 Aug, 17 Aug, and 1 Sep in rotation with Double Nickel 1.5 lbs/A plus Cueva 2 qt/A plus Regalia 3 qt/A applied on 11 and 25 Aug. Applications for the conventional fungicide treatment were also made five times: Revus 8 fl oz/A plus K-Phite 1 qt/A on 3 Aug, 17 Aug, and 1 Sep, and Presidio 4 fl oz/A plus K-Phite 1 qt/A on 11 and 25 Aug. All soil and foliar applications were made using a tractor-mounted boom sprayer equipped with twinjet (TJ60-11004VS) nozzles spaced 17 in. apart that delivered 72 gal/A at 50 psi and 2.3 mph. Plots were evaluated for Phytophthora fruit rot symptoms on 24, 28, and 31 Aug. At each assessment all fruit within the plot were inspected for rot and recorded as a percentage of the total fruit.

An intensive rainstorm on 18 Aug with 3.28 in. rain likely provided favorable conditions for Phytophthora blight. Symptoms were first observed in this experiment on 24 Aug. The rotation treatment of biopesticides failed to suppress Phytophthora fruit rot: there was an average of 38% affected fruit in these plots on 31 Aug compared to 32% in untreated plots. The conventional fungicide treatment was effective: only 1.6% of fruit in these plots had Phytophthora fruit rot symptoms. The conventional fungicide treatment with the additional early-season biopesticide soil treatment had similarly low level of Phytophthora fruit rot incidence (2.5%) but it was not significantly distinguishable from the untreated control due to the high variability of disease occurrence across the field. No benefit of applying biopesticides was documented in this experiment, which could partly be due to disease onset being associated with very favorable conditions.

This project supported by NYS Department of Agriculture & Markets.

Evaluation of biopesticides for managing Phytophthora blight in pepper
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

The purpose of this experiment was to evaluate a program with a combination of biopesticide products for the control of Phytophthora blight on peppers when compared to conventional fungicides. All products tested are labeled for this disease. Biopesticides were selected to have a full range of available active ingredients. The field was chosen because it has a history of Phytophthora blight. *Phytophthora capsici* proliferation was encouraged the previous season by growing squash and pumpkin throughout the field with no management practices for Phytophthora blight.

The field was plowed on 25 Jun. Controlled release fertilizer (N-P-K, 15-5-15) was applied on 28 Jun at 675 lb/A (101 lb/A N). Plants were seeded in the greenhouse on 15 May and transplanted into the field on 5 Jul. Prowl H20 2.1 pt/A and Reflex 1 pt/A were applied for weed control on 3 Jul using a tractor-mounted sprayer. During the season, weeds were controlled by cultivating and hand weeding as needed. Moisture was provided all season using overhead irrigation. Plots were five 8-ft rows spaced 34 in. apart with 6 plants per row at 16 in spacing. The 20-ft area between plots was not planted. A randomized complete block design with four replications was used. Four applications of biopesticides were made to soil with one to seedling trays (29 Jun) and three while plants were small (13, 20, and 27 Jul). Those treatments were Bio-Tam 4 lbs/A combined with Taegro 4 oz/A on 29 Jun and 20 Jul, and SoilGard 12G 10 lbs/A on 13 Jul and 27 Jul. Foliar applications for Phytophthora blight were made five times on a 7-day preventive schedule beginning on 3 Aug. Actinovate AG 12 oz/A plus Regalia 3 qt/A were applied on 3 Aug, 17 Aug, and 1 Sep, and Double Nickel 1.5 lbs/A plus Cueva 2 qt/A plus Regalia 3 qt/A on 11 and 25 Aug. Conventional fungicides were applied five times: Revus 8 fl oz/A plus K-Phite 1 qt/A on 3 Aug, 17 Aug, and 1 Sep, and Presidio 4 fl oz/A plus K-Phite 1 qt/A on 11 and 25 Aug. All applications were made using a tractor-mounted boom sprayer equipped with twinjet (TJ60-11004VS) nozzles spaced 17 in. apart that delivered 72 gal/A at 50 psi and 2.3 mph. Plots were evaluated for Phytophthora blight symptoms on 24, 28, and 31 Aug. At each assessment, all plants within the plot were inspected for Phytophthora symptoms and recorded as a percentage of the total plants.

An intensive rainstorm on 18 Aug with 3.28 in. rain likely provided favorable conditions for Phytophthora blight. Symptoms were first observed in this experiment on 24 Aug. Wilt caused by crown rot was the primary symptom seen. No treatment was able to significantly reduce the incidence of Phytophthora blight when compared to the untreated control. The rotation of conventional pesticides was numerically the most effective treatment with 34% of plants affected compared to 57% in the control plots and 51% in the plots treated with biopesticides, but there was a lot of variability among plots. Incidence of affected plants for these treatments ranged from 3% to 64%, 13% to 76%, and 20% to 81%, respectively.

This project supported by NYS Department of Agriculture & Markets.

Identification of pathotypes of the cucurbit downy mildew pathogen occurring on Long Island
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

Cucumber, acorn and butternut squashes, cantaloupe, watermelon and giant pumpkin (*Cucurbita maxima*) were grown in a sentinel plot at LIHREC to determine when the different pathotypes of the cucurbit downy mildew pathogen were successfully dispersed to Long Island. The pathotypes differ in ability to infect the different cucurbit crop types. This pathogen is not known to be surviving in the absence of living host plant tissue; however, it produces spores capable of long-distance movement by wind. Successful dispersal to LI occurs when there is a source of spores (affected cucurbit crops in another region) and conditions are favorable for dispersal (wind currents moving from affected crops to LI at night or during overcast days when spores will be protected from solar radiation), and also for deposition of spores and then for infection (rain is ideal as it moves spores out of the wind currents down to plants and infection occurs when leaves are wet or humidity is high). This can occur any time during the growing season. With knowledge of when downy mildew is occurring on LI and which cucurbit crop types are at risk, growers can target their applications of fungicides with specific activity for downy mildew (oomycete) pathogens. Sentinel plots at LIHREC are being done every growing season as part of the national forecasting program for cucurbit downy mildew (http://cdm.ipmpipe.org/). There are similar sentinel plots at universities throughout the eastern USA each year.

To ensure leaf tissue for infection was present throughout the growing season, seedlings were transplanted into plots at two times, on 12 June and 10 July. The first planting of cucurbits were seeded in a greenhouse on 19 May, and the second on 20 June. Each cucurbit crop type in each planting was grown in a plot with 3 rows of at least 5 plants at 24-inch spacing. Seedlings were transplanted into beds after incorporating controlled release fertilizer, laying drip tape, then covering beds with black plastic mulch. Insecticides and fungicides with targeted activity for powdery mildew were applied: Luna Experience 6 fl oz/A on 11 Jul and 26 Jul, Proline 8 fl oz/A plus Assana XL 9.6 fl oz/A on 19 Jul, Torino 3.4 fl oz/A on 3 Aug, Quintec 6 fl oz on 14 Aug, and Proline 8 fl oz/A on 22 Aug. Champ Flowable 1.3 pt/A was also applied on 3 Jul to help control bacterial leaf spot. Leaves were examined routinely for symptoms of downy mildew.

Downy mildew was first found on 31 July in cucumber, which is the cucurbit type always affected first at this location, and in cantaloupe on 9 Aug. Neither observation was preceded by reports from commercial crops thus these were the first known occurrences on LI in 2017. On 24 July there was predicted high risk at the national forecasting program website for the pathogen to be successfully dispersed to LI from affected cucumber crops in upstate NY when conditions would be favorable for infection. One week is typical latent period between infection and symptom appearance. Thus this is likely when the pathogen that infected cucumber. There were a few days earlier starting on 1 July when high risk was also predicted but did not result in successful dispersal.

Date of first symptoms and cucurbits affected has varied a lot over the years on LI. None of the other cucurbit crop types developed symptoms and there were no reports of downy mildew on these crops in other plantings on LI in 2017, therefore, only pathotypes able to infect cucumber and cantaloupe were dispersed to LI in 2017. Situation was the same in 2016. In contrast, all crop types became infected in 2013 and 2015, whereas only cucumber was affected in 2014. Previous first occurrences at LIHREC were 27 Aug 2008, 27 July 2009, 7 Sept 2010, 1 Aug 2011, 17 July 2012, 22 July 2013, 2 Sept 2014, 10 Aug 2015, and 8 Aug 2016.

This project is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Hatch under NYC-153409.

Evaluation of cucumber varieties resistant to downy mildew
Investigators: Margaret T. McGrath, Sandra R. Menasha, and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

The purpose of this experiment was to evaluate cucumber varieties for their ability to suppress downy mildew when used as the sole management program. The following varieties were evaluated by comparing to Straight Eight: Citadel, Bristol, Diamondback, DMR 401, Marketmore 76, Speedway, SV4719CS, and SV3462CS. All are slicing types except Citadel, which is suitable for marketing as a fresh market pickle.

The field was plowed on 11 Apr and prepared for planting on 9 Jun. Controlled release fertilizer (N-P-K, 15-5-15) was broadcast and incorporated into the soil at 675 lb/A (101 lb/A N). Beds were formed, a single line of drip tape was laid over the top, and beds were covered with black plastic mulch in one pass. Holes were punctured through the plastic at 2 ft spacing on 25 Jul. Admire Pro insecticide was applied to the open holes at 10.5 fl oz/A on 26 Jul using a backpack sprayer. Strategy 3 pt/A, Sandea 0.5 oz/A and Roundup PowerMax 22 oz/A were applied prior to transplanting for weed control on 26 Jul using a tractor-mounted sprayer. Cucumbers were seeded in the greenhouse on 5 Jul, and transplanted into the field on 27 Jul. During the season, weeds were controlled by cultivating and hand weeding as needed. The primary source of initial inoculum in this area is considered to be long-distance wind-dispersed spores from affected plants. Plots consisted of one 18-ft row spaced 68 in. apart containing 9 plants. The 6-ft area between plots was not planted. A completely randomized design with four replications was used. Plots were inspected for downy mildew symptoms on 11 and 28 Aug, and 6 and 14 Sep. At each assessment, disease severity was estimated for the entire plot canopy as well as 9 randomly selected symptomatic leaves in each plot. Area Under Disease Progress Curve (AUDPC) values were calculated from 11 Aug through 14 Sep. Yield and fruit quality assessments were taken on 6, 15, and 21 Sep. All fruit was sorted by marketability and weighed per plot.

Downy mildew was first observed in this experiment on 10 Aug, just two weeks after transplanting, in all plots. Disease pressure was very high and symptoms developed quickly, which resulted in severely limited yield and high percentage of misshapen, unmarketable fruit in most varieties in the experiment. Most of the varieties produced less than one marketable fruit per plant throughout the season. Only Citadel, Bristol, and DMR 401 had significantly lower disease severity ratings across all measurements compared to the susceptible variety Straight Eight. These three varieties were also the highest yielding, both in marketable and total fruit. In terms of both yield and disease resistance, DMR 401 was far and away the most successful variety in this experiment. It produced more than twice the fruit of the next highest yielding variety in both marketable and total fruit. AUDPC for the entire canopy was significantly negatively correlated with marketable fruit per plant (Corr = -0.7723, $P<0.0001$).

Mature fruit were collected from each variety and evaluated for overall appearance and size. Only DMR 401, Diamondback, and Marketmore 76 were given above average grades for appearance, 8, 7, and 6 out of 9 respectively. DMR 401 and Diamondback also produced the largest fruit by weight.

This report is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Hatch under NYC-153409 and also funded by the Friends of Long Island Horticulture Grant Program.

Fungicide sensitivity of cucurbit downy mildew pathogen population on Long Island in 2017

Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

Knowing whether fungicide resistance is impacting efficacy of fungicides is critical for determining which fungicides to use to manage downy mildew in cucurbit crops. This pathogen already has developed resistance to several fungicides and is expected to continue to do so. A seedling bioassay was used to examine fungicide sensitivity in a cucurbit downy mildew pathogen population.

The bioassay was conducted twice. Cucumber seedlings (cv Silver Slicer) at about the 2-leaf stage were sprayed with various fungicides at full and half label rates with a backpack sprayer operated at 30 psi and 50 gpa. Next day the four groups of seedlings (replications) were put in different areas of a field experiment to evaluate cucumber varieties for resistance to downy mildew (see previous report). No fungicides had been applied in the experiment. Seedlings were left there for two days for infection to occur, then the plants were kept in a greenhouse until symptoms developed. For the first bioassay seedlings were treated on 25 Aug and rated on 1 and 7 Sep. Before the second rating plants were put in plastic bags over night to promote sporulation. The second bioassay conducted four weeks later was unsuccessful suspected due to the fact downy mildew had caused extensive leaf death in the experiment by that time thus there were no longer enough spores being produced.

The most effective fungicides (both doses) were Bravo Ultrex (best), Zing!, Ranman, Zampro, and Previcur Flex. For most ratings there were no significant differences among these, but some shifting in rankings among the last three. Forum and Curzate were effective at the first rating. Presidio, Revus, and Quadris were ineffective including when applied at the full label rate. It is important to note that there had been no fungicides applied to exert selection pressure for resistant isolates in the field.

This project is supported by the National Institute of Food and Agriculture Crop Protection and Pest Management Applied Research and Development Program (award number 2015-70006-24277).

Fungicide sensitivity of cucurbit powdery mildew pathogen isolates on Long Island in 2016
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

Fungicide resistance can be a major constraint to effectively managing powdery mildew in cucurbit crops. Fungicides that are most effective for managing powdery mildew (because they are mobile and thus can redistribute from where deposited on upper leaf surfaces to the lower surface where powdery mildew develops best) are also more prone to the pathogen developing resistance (because they typically have single site mode of action). The pathogen, *Podosphaera xanthii*, has a long history of developing resistance, being the first pathogen to have been documented to have done so in the USA. Resistance to benomyl (FRAC Code 1), the first at-risk fungicide registered for this use, was detected in 1967. The next chemical class registered for cucurbit powdery mildew was the DMI (demethylation inhibitor) fungicides (FRAC Code 3). Bayleton, the first fungicide in this group labeled for cucurbit powdery mildew, was registered for this use in the USA in April 1984. Just two years later there were the first reported control failures documented through university fungicide efficacy experiments. QoI (quinone outside inhibitor) fungicides (FRAC Code 11) were the next chemical class developed for this disease. Quadris was registered in the USA in spring 1999. Control failures were reported from several states throughout the USA in 2002, and resistance was detected. Pristine, the first SDHI (FRAC Code 7) fungicide, was registered in August 2003. Resistance was detected on LI in 2008. Quintec, the first FRAC Code 13 fungicide, was registered in 2007. Resistance was detected on Long Island in 2015.

The objective of this study was to determine fungicide sensitivity of pathogen isolates (i.e. individuals) by testing them in the laboratory on treated leaf disks. Isolates of *Podosphaera xanthii* were obtained on 28 Sept and 4 Oct 2016 from three research fields and three commercial plantings, respectively. Most isolates came from pumpkin. This was near the end of the growing season when fungicide programs for powdery mildew were generally complete. Isolates were maintained on leaf tissue on agar media in Petri dishes (culture plates) until tested in 2017. Sixty isolates were tested.

For the leaf disk bioassay, pumpkin seedlings at the cotyledon leaf stage (about seven-days-old) were sprayed with various fungicide doses in a laboratory fume hood, the treated plants were left there to dry overnight, then disks were cut from the cotyledons and placed on water agar in sectioned Petri plates. Each plate has four sections thus there were three treatments per plate plus a nontreated control. Each plate was used to test one isolate. Six disks with the same treatment were placed in each section. Disks were inoculated by transferring spores from culture plates to each disk center. Then plates were incubated at room temperature under constant light. Amount of pathogen growth on the disks was assessed after 10 days of incubation when the control treatment usually had good growth of the pathogen, with white sporulating pathogen growth covering an average of about 50% of leaf disk area. The percent leaf disk area with symptoms of powdery mildew was recorded for each disk and averaged for each treatment. An isolate was considered to be insensitive (resistant) to a particular fungicide concentration if it was able to grow and produce spores on at least half of the disks. Due to limitations in the number of isolates and fungicide doses that can be done in each bioassay, the procedure was conducted multiple times over many weeks to obtain information on sensitivity to several fungicides.

Boscalid (FRAC 7) resistance was detected in 43% of isolates, which was almost the same as 2015 (41%). 37% and 3% of isolates were resistant to 40 and 200 ppm quinoxyfen (FRAC 13). 20% and 3% were resistant to 40 and 120 ppm myclobutanil (FRAC 3). The most resistant isolate came from plot treated with only Quintec in the fungicide efficacy experiment: it was resistant to boscalid, 120 ppm myclobutanil, and 200 ppm quinoxyfen (Quintec would be ineffective), documenting use of one fungicide can select for isolates resistant to it and other fungicides not used. Also, boscalid-resistant isolates were more common in fungicide-treated than untreated plots (50-100% vs 14%).

This project is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Hatch under NYC-153409.

Fungicide sensitivity of cucurbit powdery mildew pathogen population on Long Island in 2017
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

Knowing whether fungicide resistance is impacting efficacy of fungicides is critical for determining which fungicides to use to manage powdery mildew in cucurbit crops. This pathogen already has developed resistance to several fungicides and is expected to continue to do so. A seedling bioassay was used to examine fungicide sensitivity in a cucurbit powdery mildew pathogen population.

Pumpkin seedlings (cv. Gold Challenger) were treated on 11 Sep. One, two, or three fungicide doses were used depending on whether resistance had been detected previously. Four replications of seedlings were put for a day (12 Sep) next to plots in an experiment that had been sprayed weekly with single-site mode of action fungicides targeting powdery mildew (8/7 Vivando 15 oz/A, 8/14 Torino 3.4 oz/A, 8/21 Procure 8 oz/A, 8/28 Vivando 15 oz/A, 9/5 Procure 8 oz/A, and 9/11 Quintec 6 oz/A). This location was selected because of the selection pressure for resistant pathogen isolates. There were two additional groups of seedlings with select treatments put in another experiment that received a similar fungicide program and in an experiment where no targeted fungicides were applied. Severity was rated on 21 Sep.

Severity was much lower on the water control plants put in the first experiment, where powdery mildew was being very effectively controlled, compared to the other control plants (mean of 7% versus 75%), reflecting low inoculum levels. Results were similar for all experiments. Topsin M (FRAC Code 1), Flint (11), and Endura (7) were ineffective. Resistance to these are considered common. Rally (3) was effective at both rates tested (highest and lowest label rates); it was anticipated the lowest rate might be ineffective because of resistance. Vivando (U8), Torino (U6), and Luna Privilege (7) were effective at all rates tested (label, half, and quarter rates; hi, low and quarter of hi rates for Luna Privilege). Efficacy of Torino and Luna Privilege is in contrast to their poor control when tested alone on field-grown pumpkin plants at LIHREC (see following report) suggesting that resistance development was successfully managed to these fungicides with the fungicide program used in the field where the bioassay was conducted. Quintec at all rates tested was phytotoxic causing leaves to turn yellow and then die.

This project is supported by the National Institute of Food and Agriculture Crop Protection and Pest Management Applied Research and Development Program (award number 2015-70006-24277).

Evaluation of fungicides for powdery mildew on pumpkins
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

The primary objective of this study was to evaluate the efficacy of several fungicides with mobility that enables them to move to the lower surface of leaves where powdery mildew develops best. They have single-site mode of action, which puts them at risk for resistance development. The following products were tested: Pristine, Torino, Luna Sensation, Quintec, Procure, and Vivando. The experiment was conducted in an area where in previous years strains of the pathogen were detected with resistance to FRAC code 1, 7, 11, and 13 fungicides and moderate resistance to FRAC code 3 fungicides.

The field was plowed on 11 Apr. Urea fertilizer (46-0-0) was applied on 14 Apr at 163 lb/A (75 lb/A N). Mustard biofumigant cover crop was seeded at 10 lb/A by drilling on 14 Apr. Caliente 199 was planted in one half of the field and Caliente Rojo in the other. On 15 Jun the mustard was flail chopped, immediately incorporated by disking, and followed by a cultipacker to seal the soil surface. Overhead irrigation was then immediately applied to the field to help seal the soil surface and initiate fumigation. Pumpkins were planted with a vacuum seeder at approximately 24-in plant spacing on 5 Jul. The powdery mildew susceptible variety Gold Challenger was planted. The seeder applied fertilizer in two bands about 2 in. away from the seed. Controlled-release fertilizer (N-P-K, 15-5-15) was used at 675 lb/A (101 lb/A N). Strategy 3 pt/A, Sandea 0.5 oz/A, and Roundup PowerMax 22 oz/A were applied prior to seedling emergence for weed control on 7 Jul using a tractor mounted sprayer. During the season, weeds were managed by cultivating and hand weeding as needed. Initial moisture for seed was provided using overhead irrigation. Drip tape was laid down along each row of pumpkin seedlings on 21 Jul. The following fungicides were applied throughout the season to manage Phytophthora blight (caused by *Phytophthora capsici*): Presidio 4 fl oz/A plus K-Phite 1 qt/A on 27 Jul, Omega 1 pt/A plus K-Phite 1 qt/A on 3 Aug, Omega 1 pt/A on 14 Aug, Forum 6 fl oz/A on 21 Aug, Ranman 2.75 oz/A on 28 Aug, Presidio 4 fl oz/A on 4 Sep, Forum 6 oz/A on 11 Sep, Ranman 2.75 fl oz/A on 18 Sep, Omega 1 pt/A on 25 Sep, and Ranman 2.75 fl oz/A on 2 Oct. The primary source of initial inoculum in this area is considered to be long-distance wind-dispersed spores from affected plants. Plots were three 15-ft rows spaced 68 in. apart. The 20-ft area between plots was also planted to pumpkin. A randomized complete block design with four replications was used. Treatments were applied five times on a 7-day IPM schedule (starting after disease detection) beginning on 8 Aug using a tractor-mounted boom sprayer equipped with twinjet (TJ60-11004VS) nozzles spaced 17 in. apart that delivered 72 gal/A at 50 psi and 2.3 mph. Plots were inspected for powdery mildew symptoms on upper and lower leaf surfaces on 4, 17, 23, and 28 Aug; and 5, 11, 18, and 25 Sep. At each assessment, nine young, nine mid-aged, and nine old leaves (selected based on leaf physiological appearance and position in the canopy) were rated in each plot, except at the first assessment when 45 old leaves were examined and the last when five leaves were rated. Powdery mildew colonies were counted; severity was assessed by visual estimation of percent leaf area affected when colonies could not be counted accurately because they had coalesced and/or were too numerous. Colony counts were converted to severity values using the conversion factor of 30 colonies/leaf = 1% severity. Average severity for the entire canopy was calculated from the individual leaf assessments. Area Under Disease Progress Curve (AUDPC) values were calculated from 5 through 25 Sep. Defoliation was assessed on 2, 9, and 16 Oct. Fruit quality was evaluated in terms of handle (peduncle) condition for mature fruit without rot on 3, 9, and 16 Oct. Handles were considered good if they were green, solid, and not rotting.

Powdery mildew was first observed in this experiment on 4 Aug in 17 of the 32 plots on less than 1% of the leaves examined. The fungicides Pristine (FRAC code 7+11), Torino (U6), and Luna Sensation (7+11) failed to control powdery mildew on the underside of leaves beginning with the assessment on 11 Sep. Although not statistically significant, plants treated with these fungicides did have 23%, 19%, and 30% less severe powdery mildew than untreated control based on AUDPC values, respectively. Failure of Luna Sensation was surprising because in laboratory bioassays isolates resistant to boscalid, FRAC 7 active ingredient in Pristine, exhibited sensitivity to fluopyram, FRAC 7 active ingredient in Luna Sensation. All of the fungicide treatments provided better control of powdery mildew on upper leaf surface, except that Pristine and Torino were not effective at the last assessment. Quintec (13), Procure (3), and Vivando (U8), providing 54%, 72%, and 80% control based on AUDPC, respectively, all preformed as well as the grower recommended treatment of a rotation of Vivando, Quintec, and Torino, 71% control. Despite poor powdery mildew control on lower leaf surfaces, Pristine performed well in terms of preserving handle quality, 74% good handles on 16 Oct, as did Procure, 90% good handles, and Vivando, 95% good handles. Typically, the more effectively powdery mildew is controlled, the longer leaves remain alive, and the slower vines die and thus the longer until pumpkin handles shrivel and rot. This was best exemplified by Vivando. Luna Sensation and Torino were the least effective of all the fungicide treatments tested in this experiment: they provided inadequate control on the lower side of the leaf and failed to preserve fruit handle quality through 16 Oct. Their poor control in this experiment is in contrast to their efficacy in the seedling bioassay conducted in another experiment at LIHREC (see previous report) suggesting that resistance development was successfully managed to these fungicides with the fungicide program used in the field where the bioassay was conducted. No phytotoxicity was observed with any fungicides.

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Evaluation of Halloween pumpkin varieties resistant to powdery mildew
Investigators: Margaret T. McGrath, Sandra R. Menasha and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

The purpose of this experiment was to evaluate pumpkin varieties for their ability to suppress powdery mildew when used as the sole management program and also combined with a fungicide program for powdery mildew. The following varieties were evaluated compared to Gold Challenger: Bayhorse Gold, Eagle City Gold, Eureka F1, Magnum F1, Millionaire, Progress, and Skidoo Gold. Focus was on recently released varieties. Millionaire is an edible ornamental spaghetti-type squash.

The field was plowed on 11 Apr. Urea fertilizer (46-0-0) was applied on 14 Apr at 163 lb/A (75 lb/A N). Mustard biofumigant cover crop was seeded at 10 lb/A by drilling on 14 Apr. Caliente 199 was planted in one half of the field and Caliente Rojo in the other. On 15 Jun the mustard was flail chopped, immediately incorporated by disking, and followed by a cultipacker to seal the soil surface. Overhead irrigation was immediately applied to the field to further seal the soil surface and initiate fumigation. Controlled release fertilizer (N-P-K, 19-10-9) at 525 lb/A (101 lb/A of N) was broadcast over the bed area and incorporated on 4 Jul. Beds were formed, drip tape was laid, and beds were covered with black plastic mulch on 5 Jun. A waterwheel transplanter was used to make planting holes in the plastic and apply insecticide (Admire Pro) prior to seeding. Two pumpkin seeds were placed by hand into the soil for each hole on 6 Jul. After emergence plants were thinned to 1 plant per hole. Plots were three adjacent rows each with four plants spaced 48 in. apart. Rows were spaced 68 in. apart. To separate plots and provide a source of inoculum, two plants of a powdery mildew-susceptible zucchini squash variety (Spineless Beauty) were planted between each plot in each row. Weeds were managed by applying Strategy 3 pt/A, Sandea 0.5 oz/A and Roundup PowerMax 22 oz/A to soil between the mulched beds on 7 Jul using a tractor-mounted sprayer. Additionally, hand weeding was done as needed. During the season, water was provided as needed via drip irrigation. The following fungicides were applied throughout the season to manage Phytophthora blight (caused by *Phytophthora capsici*): Presidio 4 fl oz/A and K-Phite 1 qt/A on 27 Jul, Omega 1 pt/A and K-Phite 1 qt/A on 3 Aug, Omega 1 pt/A on 14 Aug, Forum 6 fl oz/A on 21 Aug, Ranman 2.75 oz/A on 28 Aug, Presidio 4 fl oz/A on 4 Sep, Forum 6 oz/A on 11 Sep, Ranman 2.75 fl oz/A on 18 Sep, Omega 1 pt/A on 25 Sep, and Ranman 2.75 fl oz/A on 2 Oct. The experiment that received a fungicide program for additional control of powdery mildew was sprayed with a tractor-drawn sprayer at weekly intervals starting at first observation of symptoms. The program was: Vivando 15 oz/A on 7 Aug, Torino 3.4 oz/A on 14 Aug, Procure 8 oz/A on 21 Aug, Vivando 15 oz/A on 28 Aug, Procure 8 oz/A on 5 Sep, Quintec 6 oz/A on 11 Sep, and Vivando 15 oz/A on 18 Sep. Plots were inspected for powdery mildew symptoms on upper and lower leaf surfaces on 10, 15, 22 and 30 Aug, and 7, 13, and 22 Sep. At each assessment, nine young, nine mid-aged, and nine old leaves (selected based on leaf physiological appearance and position in the canopy) were rated in each plot, except at the last assessment when five leaves were rated. The primary source of initial inoculum in this area is considered to be long-distance wind-dispersed spores from affected plants. Powdery mildew colonies were counted; severity was assessed by visual estimation of percent leaf area affected when colonies could not be counted accurately because they had coalesced and/or were too numerous. Colony counts were converted to severity values using the conversion factor of 30 colonies/leaf = 1% severity. Average severity for the entire canopy was calculated from the individual leaf assessments. Area Under Disease Progress Curve (AUDPC) values were calculated from 30 Aug through 22 Sep. Defoliation was assessed on 20 and 26 Sep. Fruit quality was evaluated in terms of handle (peduncle) condition for mature fruit without rot on 2, 9, and 17 Oct. Handles were considered good if they were green, solid, and not rotting. Pumpkin weights were taken on 17 Oct by weighing 5 pumpkins per plot and averaging results.

Powdery mildew was first observed on 10 Aug in all plots in both experiments, on 1% of leaves sampled. As expected, disease pressure was higher in the variety assessment with no fungicides applied for powdery mildew control. In the absence of fungicide applications for powdery mildew, Progress was the only pumpkin variety able to significantly reduce powdery mildew severity on both leaf surfaces based on AUDPC values when compared to the susceptible variety Gold Challenger with 37% control on the upper leaf surface and 51% control on the lower leaf surface. Skidoo Gold, Eureka F1, and Magnum F1 were able to suppress powdery mildew relative to Gold Challenger on the lower leaf surface only, providing 49%, 43%, and 28% control respectively. No variety was significantly distinguishable from other varieties in % defoliation, pumpkin weight, or fruit quality, with the exception of Millionaire having less defoliation than Magnum F1. In the second experiment, the same pumpkin varieties were assessed for powdery mildew resistance with a fungicide program for powdery mildew. Disease levels were very low, as expected, especially on the upper leaf surface. Due to the low levels of disease on the upper leaf surface there were no significant differences between any of the varieties in those measurements. Powdery mildew was more severe on the lower leaf surface where Progress, Millionaire, Magnum F1, and Eureka F1 all performed significantly better than the susceptible variety Gold Challenger based on AUDPC. Those varieties had 97%, 88%, 88%, and 87% control respectively. There were no significant differences between pumpkin varieties in this experiment when compared based on defoliation ratings or fruit handle quality. When looking at fruit size, only varieties Progress and Millionaire produced consistently smaller fruit than other varieties, which is expected based on the characteristics of these. Also, fruit were larger in the treated experiment than the untreated experiment. Larger fruit size in the second experiment may be due to the fungicide program improving powdery mildew control.

Mature fruit from the fungicide-treated experiment were collected and evaluated for overall fruit appearance and handle quality. All of the varieties received the highest possible score for handle quality, 9 out of 9. Bayhorse Gold scored the highest based on fruit appearance with a perfect score of 9, Magnum F1 had the lowest score: 7. The rest of the varieties all had scores of 7.5 or 8 out of 9. Overall all of the varieties produced high quality fruit.

This report is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Hatch under NYC-153409 and also funded by the Friends of Long Island Horticulture Grant Program.

Evaluation of management programs without chlorothalonil for powdery mildew in pumpkin
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

The purpose of this experiment was to examine means to reduce use of chlorothalonil-based fungicides because of concern about their potential impact on bees. Two alternative multi-site mode of action fungicides, Tritek and Microthiol Disperss, were evaluated on a pumpkin variety resistant to powdery mildew, Bayhorse Gold, as well as a susceptible variety, Gold Challenger. They were compared to Bravo Ultrex used alone and as part of a fungicide program for powdery mildew. Both alternatives are approved for organic production.

The field was plowed on 11 Apr. Urea fertilizer (46-0-0) was applied on 14 Apr at 163 lb/A (75 lb/A N). Mustard biofumigant cover crop was seeded at 10 lb/A by drilling on 14 Apr. Caliente 199 was planted in one half of the field and Caliente Rojo in the other. On 15 Jun the mustard was flail chopped, immediately incorporated by disking, and followed by a cultipacker to seal the soil surface. Overhead irrigation was immediately applied to the field to further seal the soil surface and initiate fumigation. Pumpkins were planted with a vacuum seeder at approximately 24-in. plant spacing on 5 Jul. The seeder applied fertilizer in two bands about 2 in. away from the seed. Controlled-release fertilizer (N-P-K, 15-5-15) was used at 675 lb/A (101 lb/A N). Strategy 3 pt/A, Sandea 0.5 oz/A, and Roundup PowerMax 22 oz/A were applied prior to seedling emergence for weed control on 7 Jul using a tractor mounted sprayer. During the season, weeds were managed by cultivating and hand weeding as needed. Initial moisture for seed was provided using overhead irrigation. Drip tape was laid down along each row of pumpkin seedlings on 21 Jul. The following fungicides were applied throughout the season to manage Phytophthora blight (caused by *Phytophthora capsici*): Presidio 4 fl oz/A and K-Phite 1 qt/A on 27 Jul, Omega 1 pt/A and K-Phite 1 qt/A on 3 Aug, Omega 1 pt/A on 14 Aug, Forum 6 fl oz/A on 21 Aug, Ranman 2.75 oz/A on 28 Aug, Presidio 4 fl oz/A on 4 Sep, Forum 6 oz/A on 11 Sep, Ranman 2.75 fl oz/A on 18 Sep, Omega 1 pt/A on 25 Sep, and Ranman 2.75 fl oz/A on 2 Oct. Plots were three 15-ft rows spaced 68 in. apart. The 20-ft area between plots was also planted to pumpkin. A randomized complete block split plot design with four replications was used with variety as the whole plot factor and treatment as the split plot factor. Natural inoculum was relied on. Treatments were applied six times on a 7-day IPM schedule (starting after disease detection) beginning on 8 Aug using a tractor-mounted boom sprayer equipped with twinjet (TJ60-11004VS) nozzles spaced 17 in. apart that delivered 72 gal/A at 50 psi and 2.3 mph. Plots were inspected for powdery mildew symptoms on upper and lower leaf surfaces on 7, 14, and 21 Aug, and 1, 8, and 14 Sep. At each assessment, nine young, nine mid-aged, and nine old leaves (selected based on leaf physiological appearance and position in the canopy) were rated in each plot, except the first two assessments when 50 old leaves were examined. Powdery mildew colonies were counted; severity was assessed by visual estimation of percent leaf area affected when colonies could not be counted accurately because they had coalesced and/or were too numerous. Colony counts were converted to severity values using the conversion factor of 30 colonies/leaf = 1% severity. Average severity for the entire canopy was calculated from the individual leaf assessments. Area Under Disease Progress Curve (AUDPC) values were calculated from 21 Aug through 14 Sep. Defoliation was assessed on 29 Sep and 5 Oct. Fruit quality was evaluated in terms of handle (peduncle) condition for mature fruit without rot on 5 and 11 Oct. Handles were considered good if they were green, solid, and not rotting.

Powdery mildew was first observed in this experiment on 7 Aug in 46 of the 48 plots on less than 2% of the leaves examined. Variety did not have a significant effect on any of the measurements taken this season, indicating the resistant variety did not contribute to management of powdery mildew, which is in contrast with a similar experiment conducted in 2016. There also were no significant variety by treatment interactions. Microthiol Disperss was as effective as Bravo Ultrex across all measurements of severity as well as defoliation and fruit handle quality, which are measures of the impact of powdery mildew. Tritek effectively managed powdery mildew, but not quite as well on upper leaf surfaces as Bravo Ultrex or Microthiol Disperss; however, it was effective for powdery mildew on lower leaf surfaces while Bravo Ultrex was ineffective. Obtaining control on lower surfaces with contact fungicides is important for managing resistance to single-site mode of action fungicides, which are inherently more effective due to their ability to move through leaves to the lower surface. However, obtaining adequate coverage with contact fungicides is difficult, especially on large pumpkin leaves. Surprisingly, Tritek was least effective of the three while Microthiol Disperss was best for preserving handle quality. Replacement of Bravo Ultrex, in the grower’s standard fungicide program, which included a rotation of Luna Experience, Vivando, and Torino, with less commonly used Tritek and Microthiol Disperss showed no reduction in effective control of powdery mildew across all measurements, including fruit quality. In fact the grower’s standard replacement treatment provided significantly more control of powdery mildew on the lower leaf surface when compared to the traditional grower’s standard with Bravo Ultrex. These results are promising for growers looking to reduce use of chlorothalonil fungicides due to concerns of potential impact on bees. Chlorothalonil has activity for a broader spectrum of fungal pathogens and thus is a better choice when other diseases are occurring.

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Monitoring late blight occurrence in tomatoes and potatoes on Long Island
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

Late blight is a very destructive disease of tomatoes and potatoes that has been occurring more regularly on Long Island since 2009, albeit irregularly in terms of location and date of initial occurrence. Growers need to know when late blight is present in the region to be able to effectively manage this disease with judicious use of fungicides, especially products with targeted activity that they would not otherwise need to apply. Additionally there is need to monitor the pathogen for appearance of new genotypes able to overcome resistant varieties with the Ph-2 and Ph-3 genes that have been providing effective control of the pathogen genotypes present since 2009.

Monitoring for late blight occurrence was conducted in coordination with the CCE-Suffolk IPM Program. Potato and tomato crops were scouted weekly for diseases and insect pests at several farms participating in the IPM Program. The information obtained contributes to the national monitoring program, which maps reports at USABlight.org.

A sentinel plot with Mt Fresh Plus (susceptible to late blight) and Mt Magic (Ph-2 and Ph-3 genes conferring resistance) was maintained at LIHREC. Tomatoes were seeded in the greenhouse on 29 May. Controlled release fertilizer (N-P-K, 19-10-9) at 525 lb/A (101 lb/A of N) was broadcast over the bed area and incorporated on 26 Jun. Beds were formed, drip tape was laid, and beds were covered with black plastic mulch on 27 Jun. A waterwheel transplanter was used to make planting holes in the plastic and apply insecticide (Admire Pro) prior to seeding. Weeds were managed by applying Strategy 3 pt/A, Sandea 0.5 oz/A and Roundup PowerMax 22 oz/A to soil between the mulched beds on 27 Jun using a tractor-mounted sprayer. Tomato plants were transplanted into the field on 30 Jun. Stakes and trellis line for plant support were put out on 18 Jul, and additional line was added three more times throughout the growing season. No fungicides were applied.

Late blight was found on 18 Sept in the sentinel plots and another experiment at LIHREC. Symptoms were only in Mt Fresh and at very low levels (<1%). Reports were received of suspected cases in nearby commercial crops that appeared in late Aug. There were no reports from gardeners. The source of the outbreak was not determined. Late blight was not found on LI in 2015 or 2016.

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Monitoring occurrence of basil downy mildew on Long Island
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

Basil was grown in an observational planting to determine when downy mildew started to develop in the area. The goals were the same as for the sentinel planting of cucurbit crops for monitoring downy mildew affecting those crops and the sentinel planting of tomato for late blight (see other reports): 1) to be able to inform growers when first symptoms were found so they knew when the disease is likely to occur in their crop and 2) to obtain information that adds to knowledge about occurrence of this important disease. The pathogens for all of these diseases produce spores that are dispersed by wind, potentially long distances for some.

Basil was seeded in the greenhouse on 16 Jun. Controlled release fertilizer (N-P-K, 19-10-9) at 525 lb/A (101 lb/A of N) was broadcast over the bed area and incorporated on 26 Jun. Beds were formed, drip tape was laid, and beds were covered with black plastic mulch on 27 Jun. Weeds were managed by applying Strategy 3 pt/A, Sandea 0.5 oz/A and Roundup PowerMax 22 oz/A to soil between the mulched beds prior to transplanting using a tractor-mounted sprayer. A waterwheel transplanter was used to make planting holes in the plastic and apply insecticide (Admire Pro) prior to seeding. Basil plants were transplanted into the field on 17 Jul. No fungicides were applied. Leaves were examined routinely for symptoms of downy mildew.

Downy mildew was first seen in the observational planting on 4 Aug following rain. No symptoms were found on 31 Jul, which was the previous time the plants were examined. Growers were informed through the Long Island Fruit and Vegetable Update, a weekly newsletter. There was limited increase in symptoms through 14 Aug, then downy mildew developed very rapidly. On 21 Aug leaves had started to turn brown and drop off plants, those remaining were generally yellow, and almost all leaves had some sporulation on the underside rendering them unmarketable. Downy mildew has continued to appear at LIHREC during the first 2.5 weeks in August. Previous first observations were 10 Aug 2010, 19 Aug 2011, 16 Aug 2012, 6 Aug 2013, 18 Aug 2014, 10 Aug 2015, and 15 Aug 2016.

This project is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Hatch under NYC-153409.

Development of a vegetable disease identification website
Investigator: Margaret T. McGrath
Location: Long Island Horticultural Research and Extension Center

The goal of this project started in Oct 2014 was to develop a photo gallery web site that would be useful for growers and extension educators, the primary intended audience, as well as gardeners. Numerous photographs had been taken since 1988 of diseases and disorders occurring on Long Island affecting vegetable crops, herbs, and strawberry. This is a potentially valuable resource that needed to be shared.

The web site (http://blogs.cornell.edu/livegpath/gallery/) now has 61 pages with a total of 539 photos plus information about many of the diseases/disorders including their management. It targets the Long Island area but has broader utility. There are links to Vegetable MD Online, another successful Cornell web site geared for production agriculture. The web site has frequently been referenced in weekly newsletter articles in the Long Island Fruit and Vegetable Update. Some of the diseases posted in the Photo Gallery were selected to provide readers of the newsletter with photographs to accompany the symptom descriptions in an article. The webpages at this Photo Gallery web site have each been linked at a webpage of another, popular Cornell web site: http://vegetablemdonline.ppath.cornell.edu/PhotoPages/PhotoGallery.htm. The expected outcome is to better enable growers, crop scouts, and extension staff to diagnosis diseases that are occurring, and to educate them about these diseases and their management. Accurate diagnosis is important for successful management, which increases crop productivity and profitability. It is anticipated that gardeners will also find the web site useful, therefore the content was written to be suitable for a wide audience. An additional observed impact is that others are finding the photographs useful and have been making requests to use them primarily in extension bulletins and presentations. An unanticipated utility of the web site has been for responding to questions about diseases by providing a link when the information is included on one of the webpages. Google analytics summaries for the photo gallery lists 24,070 users and 29,914 page views in 2017, which is considered a very high number by Cornell Communications Specialist, Craig Cramer. Another measure of success is that several requests were received to use images posted in the photo gallery by extension staff and scientists, including from outside the U.S., which documents that the web site is not only being found but that the content is useful to others.

This report is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Smith Lever.

Comparison of winter hardy cover crops for reduced-till organic cabbage
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

The goal of this experiment was to examine various combinations of winter hardy cover crops for use in reduced-till crop production. An actively growing ground cover may provide early spring weed control and the straw mulch following chopping may provide weed control, but the residue could interfere with any shallow tillage done. The addition of various winter hardy legumes may also provide additional fertility benefits. Four different cover crop combinations were planted; rye, rye plus hairy vetch, rye plus crimson clover, and rye plus Austrian winter pea. An additional rye cover crop treatment with an amendment of bloodmeal fertilizer applied as a side-dress (an additional 60 lb/A N) in early August was also evaluated.

The experiment consisted of the 5 treatments described above organized in a randomized complete block design with 4 replications. Cover crops were seeded on 26 Sep 2016 after disking the field. Cover crop biomass was determined on 23 May by cutting plant tissue at ground level in two 0.25 m^2 quadrants in each plot. Cover crop leaf tissue was sorted, dried, and weighed for each quadrant. 'Farao' Cabbage were seeded on 24 May in 128-cell trays and placed in the greenhouse. On 20 Jun a Perfecta cultivator was run through all plots to manage weeds (shallow cultivation) followed by an Unverferth zone builder to perform deep zone tillage where rows would be planted in all plots. Cabbage was transplanted into the field using a four-person cabbage transplanter on 21 Jun. During the season, water was initially provided by in row drip line irrigation. Weeds were controlled by cultivation and hand weeding throughout the growing season. Between row weeds were controlled with a hillside cultivator early in the season before cabbage plants became too big to fit the implement. Hand weeding was used to control both in row and between row weeds throughout the growing season. Flea beetles were a significant problem, insecticides were applied to control this pest; Entrust 80W 1.5 oz/A on 27 July, Mycotrol ESO 1 qt/A and Entrust 80W 1.5 oz/A on 24 Aug. Cabbage were harvested in 20-foot sections from the middle row of each plot on 12 Sep. Cabbage plants were counted and weighed as well as cabbage heads. Five cabbage plants from each plot were randomly selected for additional measurements including wet weight of the entire plant. An inch thick wedge of the cabbage heads of these plants was removed, dried in a drying oven, then weighed; the cabbage frame was also dried and weighed.

There were no significant differences between the cover crop treatments in terms of cover crop yield or weed control. The rye and vetch cover crop combination produced significantly more total cover crop biomass, 4.7 dry tons per acre, almost double the next highest treatment, 2.2 dry tons, but this difference did not translate to more effective weed control in the fall after planting or throughout the growing season. There were no significant difference between cover crop treatments in total fall weed biomass or total time spent hand weeding the experiment throughout the growing season. There were also no significant differences among the cover crop treatments in yield parameters.

Project funded by USDA Organic Research and Extension Initiative.

Investigation of ground cover tarps in organic reduced tillage beets
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

The goal of this experiment was to investigate the use of ground cover tarps for early season weed control. Reducing the need for early season tillage before and after planting can save growers money and improve soil structure. A research trial was established how different durations of ground cover tarping as well as tillage before planting affected weed control and over all crop yield. Four different durations of cover tarping were used: No tarping at all, three weeks before planting, six weeks before planting, and overwinter, which ended up being 19 weeks before planting on Long Island. These treatments were combined with two different tillage regimes prior to planting; no tillage at all or shallow tillage (approximately 2-3 inches) with a rototiller prior to planting.

The experiment consisted of the 8 treatments described above organized in a randomized complete block design with 4 replications. A cover crop of organic oats (100 lb/A) was seeded on 16 Sep 2016 after disking the field. Oats were used because they winter kill. The first cover tarp treatment was placed in the field on 19 Jan 2017 and secured by placing cinderblocks on top. The second cover tarp treatment was placed in the field on 11 Apr and secured by burying the tarp edges. The third cover tarp treatment was placed in the field on 2 May and secured by burying the tarp edges. All of the tarps were removed from the field 1 Jun. Immediately following tarp removal plots were assessed for percent ground coverage by weeds and oat residue. Soil samples were also taken on 1 Jun to measure soil moisture and nitrogen. Plots that received tillage were prepared for planting on 2 Jun by running a rototiller over the planting area at approximately 2 inch depth. Fertilizer was applied to all plots in the form of Pro-Gro granular fertilizer (5-3-4) at a rate of 1000 lb/A. ‘Red Ace’ Beets were directly seeded into the ground using a vacuum seeder at a rate of approximately 15 seed per foot. Drip-tape irrigation was placed in beet plots on 14 Jun. Plots were divided into two sections: one to be weeded periodically by hand throughout the growing season and one that was not weeded at all. Weeding started on 15 Jun. Weed biomass was taken in all plots prior to harvest on 28 Jul and dry weight was recorded. Beets were harvested by pulling 2 meters of beet row by hand from both sections of each plot on 1 Aug through 3 Aug. Beets were processed and sorted after harvest by separating beets from greens and sorting the beets by size class, the four size classes being 0 = smaller than 1 inch in diameter, 1 = between 1 inch and 1.75 inches, 2 = between 1.75 inches and 3 inches, and 3 = greater than 3 inches in diameter. Total yield including beet greens was also recorded for each plot.

There were no significant differences in yield data between tarp treatments in the weeded portions of the plots likely due to high variability across all treatments, however numerical trends suggested that yield was improved the longer the tarps were left out in the field, the overwinter tarp treatment produced the most total fresh weight, 2539 grams per plot, total marketable weight, 1259 grams per plot, and largest average beet weight, 21 grams. Also, in the weeded plots, tillage had a statistically significant effect only on the total marketable beet weight, tilled plots produced 1124 grams per plot compared to 625 grams per plot in the untilled plots. In the unweeded plots results were more conclusive: tarping had a significant effect on total fresh weight, with significantly higher yields in the overwinter tarp treatment than the no tarp treatment, 1620 grams per plot and 350 grams per plot respectively. Also, in the unweeded plots, both total fresh weight and total marketable weight were significantly affected by tillage, with the rototilled plot yielding more than the non-tilled plots, 1799 grams per plot compared to 816, and 508 grams per plot compared to 174, respectively. The weed pressure measurements were both significantly affected by tarp treatments, all of the tarped plots required significantly less time weeding, 0.23 man hours per plot for the six week and 3 week tarp treatments and 0.26 man hours per plot for the overwinter tarp treatment, compared to the no tarp plots, 0.61 man hours per plot. There was also a significant interaction between tarp treatment and tillage for both weed pressure measurements, but not for any yield measurements. The six week tarp treatment also had significantly less total weed biomass at the end of the season compared to the no tarp treatment, 100 dry grams per plot and 208 dry grams per plot respectively. Tillage also had a significant effect on overall time spent hand weeding, an average of 0.38 man hours per plot was spent weeding the non-tilled plots compared to 0.26 hours in the tilled plots. Overall it appears that ground cover tarps can be useful in controlling weeds, especially early in the season. The tarps did not have a clear effect on yield. It is still not clear if the amount of time the tarps are covering the ground is important in terms of weed control or yield, but the trends recorded in this experiment suggest that longer could be better.

Project funded by USDA Organic Research and Extension Initiative.

Utility of tillage radish and deep zone tillage for producing peas organically with reduced tillage
Investigators: Margaret T. McGrath and Zachary F. Sexton
Location: Long Island Horticultural Research and Extension Center

The goal of this experiment was to examine tillage (forage) radish grown as a winter-kill cover crop for preparing soil for reduced-till crop production. The long, large tap root of tillage radish has potential to disrupt compacted soil layers and thus has potential to be used in place of deep zone tillage equipment. Additionally, the channels left after the roots decompose enable subsequent vegetable crop roots to grow through compacted layers. Three different cover crop treatments were planted; oats, tillage radish, and oats combined with tillage radish. Plus there was an unplanted control. These cover crop systems were also tested with two different tillage regimes implemented before seeding peas; shallow conventional tillage alone or combined with deep-zone strip tillage in the planting row. This was done to compare tillage radish to deep zone tillage and to determine if there was benefit to using both.

The experiment consisted of the 8 treatments described above organized in a completely randomized split plot design with 4 replications. Tillage regime was the whole plot factor and cover crop was the split plot factor. Cover crops were seeded on 15 Sep 2016 after disking the field. Biomass was determined on 11 Nov by cutting plant tissue at ground level and pulling radishes in two 0.25 m^2 quadrants in each plot. Oat, radish and weed leaf tissue was separated, dried, and weighed for each quadrant. Length of radish roots above and below ground was measured, and then the roots were dried and weighed. On 10 Apr 2017 weeds were assessed by estimating percent of surface area covered by weed growth in each plot, then a Perfecta cultivator was run through all plots to manage weeds (shallow cultivation) followed by an Unverferth zone builder to perform deep zone tillage in the strip till plots. Corn gluten meal fertilizer (8-0-3) was spread on the field at a rate of 375 lb/A prior to planting. 'Sugar Ann' peas were seeded on 12 Apr at 0.5-inch spacing, During the season, water was provided by overhead irrigation. Weeds were controlled by cultivation and hand weeding throughout the growing season. A total of 25 man hours were spent hand weeding the experiment over the entire growing season. Peas were harvested in 10 foot sections from the middle two rows of each plot on 22 Jun through 6 Jul. Pods were removed from plants and sorted based on marketability, immature and severely blemished pods were separated out, then plants and pods were dried and weighed.

Snap pea biomass and yield were not significantly affected by cover crop and tillage regime. Tillage did significantly affect total stand count at harvest, with more plants per acre under conventional tillage production, 139281 plants per acre, compared to deep zone tillage, 106899 plants per acre. Cover crop did not significantly affect any of the yield measurements. Cover crop was highly significant when looking at its effect on weed pressure both in the fall and spring. All three of the cover crop treatments, oats, radish, and oats and radish effectively suppressed weeds in the early spring, 28%, 26%, and 22% weed coverage respectively, compared to the no cover crop treatment, 63%. Oats, radish, and oats and radish also reduced the weed pressure at harvest in the fall: dry weight of weeds removed was 17, 14, and 18 lb/A, compared to 338 lb/A for the no cover crop treatment. Plots were weeded while the pea crop was growing as experiment focus was on impact of reduced tillage practices on yield, thus impact of weeds on yield was not examined. In conclusion, this experiment documented that spring snap peas can be grown successfully without compromising yield using reduced tillage practices in an organic production system. Benefit of cover crops for managing weeds before crop seeding was documented.

Project funded by USDA Organic Research and Extension Initiative.

Potato variety trial evaluation and development
Investigators: Sandra Menasha, Anastasia Yakaboski, Sharon Graziano, Rosemarie Andrews and George Prechtl
Cooperators: W. De Jong, G. Porter, K. Haynes and D. Douches
Location: Long Island Horticultural Research and Extension Center

The experiments conducted in 2017 are part of an ongoing program evaluating promising potato clones grown under Long Island conditions from the Cornell Breeding Program, Maine Breeding Program, USDA Breeding Program, Michigan Breeding Program, and from the NE1231 Northeast Regional Potato Participatory Group. Resistance to both races of the golden nematode, the Ro1 and Ro2 strain, is a high priority. Fifty-five potato clones and named varieties were evaluated in replicated experiments conducted at the Long Island Horticulture Research and Extension Center, Riverhead, NY. Forty-seven clones were included in a non-replicated observational trial.

Advanced Cornell White-skinned Clones: Marcy, NY151, and BNC182-5 were the three highest yielding varieties in the trial at 447 cwt/A, 446 cwt/A and 422 cwt/A, respectively. Purple Soul was the lowest yielding variety in the trial at 191 cwt/A due in part to the high percentage of growth cracks. Norwis produced the largest tubers in the trial. Spartan Splash, a specialty type potato, produced the smallest tubers. Reba had hollow heart in 43% of the tubers cut and Norwis had 13% internal heat necrosis. External defects were lowest in Spartan Splash and BNC182-5 and internal defects were lowest in NY141 and Purple Soul. BNC182-5 had the highest specific gravity at -1.078.

Intermediate White-skinned Clones: B3084-3 and BNC177-5 were the two highest yielding varieties in the trial with marketable yields at 497 cwt/A and 475 cwt/A, respectively. Reba, the standard, yielded 417 cwt/A. N35-3 and N44-7 were the two lowest yielding varieties in the trial at 263 and 264 cwt/A, respectively. B3083-4 and B3083-11 produced the largest tubers while N35-3 were the smallest. Hollow heart was greatest in Reba occurring in 50% of the tubers cut. Internal heat necrosis was very low to absent in all the varieties evaluated. External defects in B3083-4 and BNC264-1 were both at 12% with about half due to misshapes. AF4157-6 and NDAF102629C-4 has very low levels of external defects. Specific gravity was greatest in N24-2 at -1.079.

NE1231 White-skinned Clones: NY158, NY161, and Superior were the top yielding varieties in the trial with marketable yields of 538, 487, and 486 cwt/A, respectively compared to the standard Atlantic which yielded 440 cwt/A. AF5280-5 had the lowest marketable yields at 334 cwt/A. Yukon Gold produced the largest tubers in the trial and AF5280-5 the smallest. Internal defects were greatest in NY158 and Yukon Gold with hollow heart in 70% and 68% of the tubers cut, respectively. Internal heat necrosis was greatest in Atlantic. AF5280-5 had no internal defects. Yukon Gold exhibited external defects in 16% of the tubers, mainly due to PVYntn. Specific gravity was highest in AF5040-8 at -1.081 followed by NY158 at -1.076.

Yellow-skinned Clones: Of the seven lines evaluated in the trial, AF5450-7 had the highest marketable yields at 487 cwt/A followed by Vivaldi at 430 cwt/A. Marketable yields of the standard, Yukon Gold, were 318 cwt/A. Natascha had the lowest marketable yields in the trial at

274 cw/A. Yukon Gold produced the largest tubers in the trial and NDAF113458-2 the smallest tubers. Natascha were the most attractive, followed by Vivaldi and NDAF113458-2. Internal and external defects were greatest in Yukon gold with hollow heart in 70% of the tubers cut and PVYntn is 15% of the tubers. Natascha had misshapes in 7% of the tubers and NY161 had hollow heart in 30% of the tubers cut. Internal and external defects were very low in NDAF113458-2, Vivaldi and AF5450-7. AF5450-7 had the highest specific gravity at -1.069.

<u>Red and Purple-skinned Clones:</u> NY164, MSW343-2R and BNC420-2 had the highest marketable yields in the trial at 343, 326, and 313 cwt/A, respectively. The standard Chieftain had marketable yields of 280 cwt/A. MSZ109-5RR and AF4659-12 were the lowest yielding varieties in the trial but both were specialty types bred to produce more “B” size potatoes. MSW343-2R produced the largest tubers in the trial and MSZ109-5RR the smallest. Dark Red Norland had hollow heart and brown center in 28% of the tubers cut and BNC420-2 had hollow heart in 23% of the tubers cut. Internal heat necrosis was greatest in MSX324-1P at 18%. AF4659-12 and NY136 (Strawberry Paw) had misshapes in 12-13% of the tubers. Overall internal and external defects were lowest in B2152-17 and MSV235-2PY. Specific gravity was greatest in MSV235-2PY and MSX324-1P which were both -1.070.

Evaluation of reduced nitrogen rates on potato yield and quality
Investigators: Sandra Menasha, Anastasia Yakaboski, Sharon Graziano, Rosemarie Andrews, and George Prechtl
Location: Long Island Horticultural Research and Extension Center

Varieties identified as having high productivity and quality at reduced nitrogen (N) rates could easily be embraced by the industry as a best management practice. The goal of the trial was to evaluate and then identify potato varieties that can maintain yield goals at lower N rates.

A trial was established at the Long Island Horticulture Research and Extension Center in Riverhead, NY in a Haven loam soil. Five potato varieties were evaluated at three different N rates. Potato varieties consisted of two standard varieties (Reba and Marcy) and three more recently named varieties (Waneta, NY140 and NY141). Nitrogen rates were 120, 160 and 200 lbs N/A. All plots received 1000 lbs/A of 10-10-10 fertilizer banded at planting 2” to the side and below the seed piece. On June 9, plots were sidedressed by hand with 20, 60 or 100 lbs N/A as ammonium nitrate (34-0-0) and then cultivated in. Potatoes were vine-killed on August 23 and harvested on October 16 from 2 center rows in each plot.

There were no significant differences in yield in each of Reba, Waneta, Marcy and NY141 when grown at the three N rates evaluated. Marketable yields were significantly greater in NY140 when grown at 200 lbs N/A compared to 120 lbs N/A. However, marketable yields of NY140 at 160 lbs N/A did not significantly differ from yields when grown at 120 or 200 lbs N/A. Therefore, results indicate that NY140 will require a higher N rate per A in order to maintain yields and reduce economic risk while marketable yields of Reba, Waneta, Marcy, and NY141 can be maintained when grown at lower N rates (120 or 160 lbs N/A vs 200 lbs N/A). Multiple years of field research is needed to confirm these preliminary results before making any N reduction recommendations.

Brussel sprout variety trial
Investigators: Sandra Menasha, Anastasia Yakaboski, Sharon Graziano, Rosemarie Andrews and George Prechtl
Location: Long Island Horticulture Research and Extension Center

Brussel sprouts are an important crop on Long Island and acreage has seen a 10-15% increase over the past few years. Variety performance can differ greatly by region, state and even by regions within a state. Determining which varieties perform well under Long Island's growing conditions will benefit the local industry by minimizing risk. Thirteen Brussel sprout varieties were evaluated for their performance and quality. Data on marketable yield and sprout quality were recorded and analyzed.

The trial was established at the Long Island Horticulture Research and Extension Center, Riverhead, NY on a Haven Loam soil. The experiment was arranged as a randomized complete block design with four replications. Treatment plots were 1 row wide by 20 ft long. Rows were spaced on 34" centers and plants were spaced 24" apart within the row. Transplants were field set by hand on July 13. Sprouts were harvested from the center 8 plants in each plot, as they reached maturity, starting on October 19 and ending on November 15. No data is available for Red Bull as this variety did not produce harvestable sprouts during the span of the trial.

The highest yielding varieties in the trial were Confident, Dagan, Divino and Marte.
The variety Nelson had the lowest marketable yields and the highest unmarketable yields due to rot. Dimitri and Cobus produced the smallest sprouts in the trial and Nelson and Divino the largest. Alternaria leaf spot was greatest in Gustus and Cobus. The hardest to pick varieties were Dimitri and Nautic while Dagan and Divino were the easiest however, all other varieties were still fairly easy to pick. Sprouts of Capitola were slightly flat, Divino were somewhat oblong to round and both Confident and Diablo were slightly ruffled. The top three favorites in the trial in regard to appearance, yield and ease to pick were Dagan, Divino and Marte.

Evaluation of nitrogen rate on yield and quality of SH2 sweet corn varieties
Investigators: Sandra Menasha, Anastasia Yakaboski, Sharon Graziano, Rosemarie Andrews and George Prechtl
Location: Long Island Horticulture Research and Extension Center

Differences exist among varieties such as taste, yield, and nitrogen (N) requirements. A trial was conducted to determine variety specific N application rates for six commonly grown sweet corn varieties on Long Island.

The trial was established at the Long Island Horticulture Research and Extension Center, Riverhead, NY in a Haven loam soil. Six common SH2 bicolor sweet corn varieties; Obsession, Aces, Anthem XR, Snack Pack, 7143, and 2472 XR were evaluated at two N rates; 100 and 150 lbs/acre (A). The trial was arranged as a randomized complete block design with 4 replications. Prior to planting, 500 lbs/A 10-10-10 fertilizer was broadcast applied and incorportaed. Sweet corn was direct-seeded on May 19 using a 2-row Monosem vacuum seeder. On June 5, plots were sidedressed by hand with urea (46-0-0) applied at either 50 lbs N/A or 100 lbs N/A depending on treatment. To evaluate plant growth, leaf samples were collected 3 times at set

stages of development on July 6, July 12, and August 1 for % tissue N. Ears were harvested from the center 2 rows of each plot on August 1, 4 and 9.
Results from the trial did not show a significant advantage in marketable yield for the varieties evaluated when grown at the higher N rate of 150 lbs/A compared to the lower N rate of 100 lbs/A except in Aces where 16 dozen ears/A more were produced at 150 lbs N/A compared to 100 lbs N/A. Quality characteristics, such as tip cover, tip fill, and ear length were not significantly different based on N rate/A but diameter, flavor and % Brix were for some varieties. Ear diameter was significantly increased at the higher N rate of 150 lbs/A for the varieties Obsession and 7143. Flavor rated significantly better at the lower N rate of 100 lbs N/A in the variety Obsession as did % Brix. Tissue N levels (% N) on all three sampling dates were within the adequate range for each variety at both N rates. At harvest, although % tissue N levels tested significantly higher at the higher N rate of 150 lbs/A in most varieties, it did not translate to greater yields. At least a second year of data will be needed to statistically affirm these preliminary results which indicate that of the varieties evaluated, Obsession, Anthem XR, Snack Pack, 7143 and 2472 XR can be grown at the lower N rate of 100 lbs N/A and maintain yield goals and crop quality.

Evaluation of controlled release nitrogen fertilizer in cantaloupe production
Investigators: Sandra Menasha, Anastasia Yakaboski, Sharon Graziano, Rosemarie Andrews and George Prechtl
Location: Long Island Horticulture Research and Extension Center

Controlled release nitrogen fertilizers (CRNF) were developed to minimize nitrogen (N) leaching by increasing crop nitrogen use efficiency. There is limited research available on CRNF performance in vegetable crop production. The goal of the trial was to evaluate the performance of a 90-day release CRNF blend compared to soluble nitrogen fertilizer at different N rates and blend ratios in cantaloupe production.

The trial was established at the Long Island Horticulture Research and Extension Center in Riverhead, NY in a Haven loam soil. Two fertilizer programs, a soluble N program and a CRNF program were evaluated at two N rates; 80 and 120 lbs/A. The CRNF programs were evaluated at two blend ratios; 60:40 and 80:20. The 60:40 blend contained 60% of the total N as controlled release N in the form of ESN (44-0-0) and the remaining 40% as soluble N in the form of monoammonium phosphate (MAP, 11-52-0) and ammonium sulfate (AS, 21-0-0) . The 80:20 blend contained 80% of the total N as controlled release N in the form of ESN (44-0-0) and the remaining 20% as soluble N in the form of MAP and AS. The soluble fertilizer programs received 50 lbs N/A from a 10-10-10 blend and the remaining 30 or 70 lbs N/A, depending on the treatment, from AS. Phosphorus and potassium levels were standardized across all treatments. Fertilizer was applied prior to planting in all programs.

The experiment was arranged as a randomized complete block design with four replications. Treatment plots were 1 bed wide by 20 ft long. Beds were spaced on 68” centers and transplants were spaced 24” apart within the bed. ‘Astound’ cantaloupes were seeded into 36-cell trays on May 3 and allowed to harden prior to field planting. Fertilizer was hand applied in a broadcast fashion over each plot and incorporated with a rototiller. Immediately after, rows were fitted with black plastic mulch and drip irrigation. Transplants were field planted on June 2 with a waterwheel transplanter. Cantaloupes were harvested 6 times on August 1, 7, 10, 14, 17 and 22. Data on marketable yield, % Brix, and fruit length and width was collected and analyzed.

Results from the trial did not show any significant differences in early season yields (first 3 harvests on 8/1, 8/7 and 8/10) or total marketable yields among the fertilizer programs evaluated. N source and N rate did not have a significant effect on yield or any other fruit quality characteristic measured such as % Brix. These results suggest that CRNF is a viable N source option for cantaloupe production and production can be maintained at the lower, 80 lbs N/A rate. Further research will be needed to validate these preliminary results.

Evaluation of controlled release nitrogen fertilizer in romaine lettuce production
Investigators: Sandra Menasha, Anastasia Yakaboski, Sharon Graziano, Rosemarie Andrews and George Prechtl
Location: Long Island Horticulture Research and Extension Center

The goal of this trial was to evaluate the performance of 45 and 90-day controlled release nitrogen fertilizers (CRNF) compared to soluble nitrogen fertilizer at different nitrogen (N) rates and ratios in 'Green Towers' Romaine lettuce production.

The trial was established at the Long Island Horticulture Research and Extension Center in Riverhead, NY in a Haven loam soil. One soluble and three CRNF programs consisting of a 45-day controlled release nitrogen as D45 (44-0-0) and 90-day controlled release nitrogen as either Polyon (44.5-0-0) or ESN (44-0-0) were evaluated. The soluble and CRNF programs were assessed at two N rates; 100 and 150 lbs/A. The CRNF programs were evaluated at two ratio blends; 80:20 and 60:40. The 80:20 blends contained 80% of the total N as controlled release either as D45, Polyon or ESN depending on treatment and the remaining 20% as soluble N from monoammonium phosphate (MAP, 11-52-0) and ammonium sulfate (AS, 21-0-0). The 60:40 blends contained 60% of the total N as controlled release either as D45, Polyon or ESN depending on treatment and the remaining 40% as soluble N from MAP and AS. The CRNF treatments received 100 lbs/A phosphorus (P) as MAP and 100 lbs/A potassium (K) from potassium sulfate (0-0-50) as well as the total N all at planting. At planting, the soluble N treatments were fertilized with a 10-10-10 commercial blend applied at 1000 lbs/A for a total of 100 lbs each of N, P, and K. The soluble treatment at 150 lbs N/A received a sidedress application of 50 lbs N/A as calcium nitrate (15.5-0-0) 3 weeks after transplanting on June 9.

The experiment was arranged as a randomized complete block design with four replications. Treatment plots were 2 rows wide by 20 ft long. Rows were spaced 34" apart and seeds were planted 10" apart within the row. Immediately prior to planting, fertilizer was hand applied in a broadcast fashion over each plot and incorporated with a rototiller. On May 8, 'Green Towers' romaine lettuce seeds were direct seeded using a Monosem vacuum seeder. On June 9, the soluble fertilizer treatment at 150 lbs total N/A was sidedressed by hand with calcium nitrate (15.5-0-0) at a rate of 50 lbs N/A and incorporated with cultivation. Lettuce was harvested on July 17 from the center 20 plants per plot. Data on marketable yield was collected and analyzed.

Results from the trial did not show any significant differences in the marketable yields among the fertilizer programs evaluated. N source and N rate also did not significantly affect marketable yield suggesting that CRNF is a comparable option to soluble N in regard to production potential. With similar yield results at 100 lbs N/A compared to 150 lbs N/A, growers may be able to use lower N rates per acre and maintain production goals. However, further research is needed to validate these preliminary results before any final conclusions can be made.

Evaluation of controlled release nitrogen fertilizer in kale production
Investigators: Sandra Menasha, Anastasia Yakaboski, Sharon Graziano, Rosemarie Andrews and George Prechtl
Location: Long Island Horticulture Research and Extension Center

The goal of the trial was to evaluate the performance of controlled release nitrogen fertilizers (CRNF) with a 45-day or 90-day release profile compared to conventional soluble nitrogen fertilizer at different nitrogen rates in 'Winterbor' kale production.
The trial was established at the Long Island Horticulture Research and Extension Center in Riverhead, NY in a Haven loam soil. One conventional and three CRNF programs consisting of a 45-day controlled release nitrogen as D45 (44-0-0) or a 90-day controlled release nitrogen as either Polyon (44.5-0-0) or ESN (44-0-0) were evaluated. The conventional and CRNF programs were assessed at two N rates; 100 and 150 lbs/A. The CRNF programs were evaluated as 80:20 blends. The 80:20 blends contained 80% of the total N as controlled release either as D45, Polyon or ESN depending on treatment and the remaining 20% as soluble N from monoammonium phosphate (MAP, 11-52-0) and ammonium sulfate (AS, 21-0-0). The CRNF treatments received 100 lbs/A phosphorus (P) as MAP and 100 lbs/A potassium (K) from potassium sulfate (0-0-50) applied all at planting along with the total N/A. At planting, the conventional treatments were fertilized with a 10-10-10 fertilizer applied at a rate of 1000 lbs/A for a total of 100 lbs each of N, P, and K. The conventional treatment at 150 lbs total N/A received a sidedress application of 50 lbs N/A as calcium nitrate (15.5-0-0) 3 weeks after transplanting on August 11.

The experiment was arranged as a randomized complete block design with four replications. Treatment plots were 2 rows wide by 20 ft long. Rows were spaced 34" apart and plants were spaced 12" apart within the row. Transplants were started in the greenhouse on June 23 and seeded into 72-cell trays. Prior to transplanting, fertilizer was hand applied in a broadcast fashion over each plot and incorporated with a rototiller. Kale transplants were field planted on July 20. On August 11, the conventional fertilizer treatment at 150 lbs total N/A was sidedressed with calcium nitrate (15.5-0-0) at a rate of 50 lbs N/A. Overhead irrigation was supplied to supplement rainfall amounts to equal 1" of water per week. Weeds, insect and diseases were managed according to Cornell Guidelines. Kale leaves were harvested 6 times on August 24, 31, September 8, 18, 28 and October 12 from the center 24 plants in each plot. Data on marketable yield was collected and analyzed.

Results from the trial did show significant differences in marketable yields among the fertilizer programs evaluated. Early season yields were greatest in the conventional program at 150 lbs N/A and were significantly higher than both the ESN 80:20 and Polyon 80:20 programs at 100 lbs N/A. Total yields were greatest in the D45 80:20 program at 150 lbs N/A and were significantly greater than the conventional D45, ESN, and Polyon programs at 100 lbs N/A but did not significantly differ from the conventional, D45, ESN and Polyon programs at 150 lbs N/A. Nitrogen rate showed to have a greater effect on yield than N source as yields were greater in fertilizer programs receiving 150 lbs N/A and statistically similar among the different N sources programs when compared at the same N rate per acre.

Evaluation of alternatives to Chlorpyrifos insecticides for controlling cabbage maggot in brassica vegetables
Investigator(s): Faruque Zaman, Kelly Jackson and Daniel Gilrein
Location: Long Island Horticultural Research and Extension Center

New York is among the top three cabbage-producing states in the US with a value of $59.6M annually for fresh-market alone. The cabbage maggot, *Delia radicum* (L.) is a very destructive pest of brassica vegetables in the United States including New York. Chlorpyrifos, the primary insecticide used for control, is labeled for use in brassica leafy vegetables (Crop Group 5) as well as in radish, rutabaga, and turnip but is currently under review for possible cancellation by EPA. Diazinon is only labeled for control of this pest in specific cole crops. Labels do not allow use for any other Group 5 crop or for use on radish or turnip. Some bifenthrin (e.g. Ruckus LFR, Sniper LFR, Capture LFR) labels allow use on head and stem brassica but not for radish, turnip, or rutabaga. Cyantraniliprole (Verimark) has shown efficacy in a greenhouse-type study but has not yet been able to show a high level of control in outdoor trials. There is an urgent need to find alternate techniques for cabbage maggot control for both organic and conventional production situations. Four conventional insecticides, one entomopathogenic nematode, one OMRI certified insecticide, and an exclusion netting technique were studied under a 2-year term (2018-19) project. In the past season the 1st year of the field study has been completed in the LIHREC farm. Data analysis of the first-year field study has been completed. The infestation level was very high in control blocks, nearly 93% cabbage roots were damaged by cabbage maggot. As expected row cover exclusion netting with Tek-knit net has been provided almost 100% root protection from cabbage maggot damage. Pre-transplant flat treatment with insecticide Verimark has provided 81.25% roots without damage which was close to effectiveness of Lorsban 4E (92.5% root without damage) which is currently the industry standard for cabbage maggot control in brassica crops. The organic option, application of Entrust SC at pre-transplant flat treatment has provided 45% undamaged roots which was provided much lower efficacy then the other three effective treatments have mantioned above. In 2018 field study, we will apply Entrust SC as pre-transplant flat treatment with one or two additional banded application at the base of the plants at two weeks interval, which we believe will improve the effectiveness. The other three treatments: Capture LFR, entomopathogenic nematode *S. feltiae*, and Tolfenpyrad were provided only 20.0%, 16.5%, and 7.5% undamaged roots, respectively. Damage rating (0-10 scale, 0 = no damage, 5 = moderate, 10 = no root or dead plant) information was collected from plants at 5 weeks after transplanting in the field. Data were collected based on severity of the damage by counting the number of feeding tunnels and portion of root damage. As expected, untreated plants had the highest rate of root damage (score 3.3). No root damage was found in plants under row cover exclusion nettings. Among the insecticide treatments, Lorsban 4E treated plants had the lowest rate of root damage (0.17) followed by Verimark (0.31). Plants treated with Entrust SC has received significantly lower rate of root damage (score 1.08) than untreated control. Root damage score for Capture LFR, S. feltiae, and Tolfenpyrad (score 2.8, 2.6, and 3.06 respectively) were not different from untreated control. Information and techniques develop from this project was delivered through a presentation in the 37 Long Island Ag. Forum meeting and a demonstration session in the LIHREC Plant Science day program.

The investigators wish to thank the New York Farm Viability Institute their funding support of this study. Also, many thanks to the LIHREC staff for field assistance.

Diagnoses for 2017

Diagnoses of diseases on greenhouse crops and herbaceous perennials in 2017
Investigators: Margery Daughtrey, Paulina Rychlik and Lynn Hyatt
Location: Long Island Horticultural Research and Extension Center

Greenhouse crops and other non-woody plants accounted for 380 samples in the LIHREC diagnostic lab in 2017, with samples received from various states. Viruses were particularly problematic this year, especially *Tomato spotted wilt virus* (TSWV), which was seen frequently on New Guinea impatiens, common impatiens, begonia, *Zinnia elegans*, *Zinnia marylandica*, and basil. *Impatiens necrotic spot virus* (INSV) was found on nemesia, agastache, cyclamen and *Senecio candicans* 'Angel Wing'. *Tobacco mosaic virus* (TMV) infected supertunia and torenia. *Tomato mild mottle virus* (TMMV) was found on *Digiplexis*. Pythium root rots were frequently detected. *Pythium aphanidermatum* was found on poinsettia, Christmas cactus and chrysanthemum; *P. irregulare* was found on browallia, lavender and lamium; P. *myriotylum* was found on mum; and unspecified *Pythium* spp. were seen on aconitum, colocasia, dahlia, pansy, New Guinea impatiens, calibrachoa and hydrangea. Phytophthora diseases were found on ivy, hibiscus, lavender and lantana and a flood-floor cyclamen crop was affected by *P. tropicalis*. Downy mildew (*Peronospora phlogina*) appeared on *Phlox subulata* in production. The impatiens downy mildew (*Plasmopara obducens*) was seen extensively in the Long Island landscape in 2017, presumably due to infections begun by overwintered oospores in garden soil. Bacteria were problematic on ornamental peppers and ornamental kale and cabbage (*Xanthomonas campestris* pv. *campestris*) and English ivy (*X. hortorum* pv. *hederae*). A widespread problem on hiemalis begonia with *X. axonopodis* pv. *begoniae* became evident at the very end of the year. The leaf spot caused by *Pseudomonas cichorii* on chrysanthemum was also seen. Hiemalis begonia was once again affected by *Fusarium foetens*, which causes a serious wilt disease. Other Fusarium diseases were seen on poinsettia, dahlia, echeverria, and graptoveria, and Fusarium head blight of barley was detected (*Fusarium graminearum*). *Thielaviopsis basicola* caused black root rot on calibrachoa, petunia and pansy crops. Poinsettias and hybrid 'Bounce' impatiens showed stem rot from *Rhizoctonia solani*, while woolly thyme and Irish moss (*Sagina subulata*) both showed Rhizoctonia web blight.
Foliar infections by fungi included some familiar and some unusual causes. Botrytis blight affected angelonia, lupine, hellebore, New Guinea impatiens and begonia. Powdery mildews appeared on cuphea, pansy, sage, and strawberry. An Itersonilia foliage blight was seen on fernleaf dill, poinsettia scab (*Sphaceloma poinsettiae*) appeared on poinsettia, and anthracnose (*Colletotrichum gloeosporioides*) occurred on cyclamen. Rust on aster was caused by *Puccinia asteris*. Both astilbe and hellebore samples were found to have foliar nematode infestations (*Aphelenchoides* spp.).

Diagnoses of diseases of woody plants in nursery and landscape in 2017
Investigators: Margery Daughtrey, Paulina Rychlik and Lynn Hyatt
Location: Long Island Horticultural Research and Extension Center

There were 387 samples of woody plants diagnosed at the LIHREC in 2017, all from southeastern NY and primarily from Long Island. Boxwoods once again predominated: 62 samples were received, with 27 of these positive for the new boxwood blight caused by *Calonectria pseudonaviculata* (syn. *Cylindrocladium pseudonaviculatum*). Another dramatic problem was Dutch elm disease (DED) caused by *Ophiostoma ulmi* on American elm: 13 samples were positive for DED, which is a much higher incidence than ususal. Another common problem was cankering caused by various *Diplodia* species, seen on Mugho pine, Scots pine, Austrian pine, Colorado blue spruce, Blue Atlas cedar, and Leyland cypress, as well as privet. Anthracnoses and leaf spots were seen on birch (*Marssonina betulae* and *Septoria* sp.), Kousa and flowering dogwood (*Discula destructiva*) and European beech (*Discula* sp.), in addition to linden. Rust fungi also took advantage of the rainy spring weather—pear trellis rust (*Gymnosporangium sabinae*) was abundant on callery pear following spore release from telia on *Juniperus chinensis* 'Robusta Green' and possibly other alternate hosts at the end of April. Quince rust affected shadbush and crabapple, and Japanese apple rust (*Gymnosporangium yamadae*) affected crabapple (both have junipers as alternate hosts). There were 3 landscape sightings and one nursery case of *Rose rosette virus* (RRV) in Nassau and Suffolk counties this year; multiflora rose plants with highly stunted and distorted leaves that tested positive for RRV were also found near the affected nursery. Privet leaf spotting from *Alternaria* sp. was extremely common, as was Rhizosphaera needlecast on Colorado blue spruce and Rhabdocline needlecast on Doug fir. Trees popularly used for hedging showed abundant disease problems: Leyland cypress had Seiridium and Diplodia cankers, plus Phyllosticta and Pestalotiopsis needle blights; arborvitae showed Dothiorella (Botryosphaeria) cankers as well as Phyllosticta, Pestalotiopsis and Phomopsis needle blights. Crape myrtle, Boston ivy and Japanese maple all suffered from their respective powdery mildew diseases in a few locations. Verticillium wilt affected magnolia and Japanese maple. There were single instances of azalea leaf gall caused by *Exobasidium vaccinii*, fire blight on callery pear, crown gall on rose, hops downy mildew, Blumeriella leaf spot on Kerria, Cenangium canker on Japanese black pine, *Phytophthora cinnamomi* root rot on skimmia, *P. nicotianae* on *Buddleja*, and Tubakia leaf spot on sweet gum. No new cases of oak wilt were detected on Long Island this year, but trees along the north shore of Nassau and Suffolk counties exhibited a "drippy acorn" phenomenon at the very end of July, from which we isolated a bacterium that appears to be a strong candidate for the causal agent.

Entomology diagnostic lab
Investigator: Daniel Gilrein, Extension Entomologist
Location: Long Island Horticultural Research and Extension Center

The Entomology Diagnostic Lab at LIHREC handles samples and inquiries from commercial entities and public agencies. It received over 287 plant problem and insect identification samples in 2017. Requests come primarily from commercial landscapes, nurseries, greenhouses, vegetable and fruit growers, parks staff, horticulture inspectors, forestry workers, and structural pest management professionals (non-commercial home garden and residential samples are mostly handled by Cornell Cooperative Extension Home Horticulture Diagnostic Laboratories). Inquiries through email, smartphone, and web are now common requesting identification of insects or plant problems from photos. Over 990 additional inquiries by phone, email, website, and in person were made during the year seeking information on pest management and entomological topics, plant problem identification, educational training, research updates, efficacy data, etc.

Following is a partial list of determinations including some noteworthy new or recently established species. Thanks to Dr. Susan Halbert, Florida Dept. of Agriculture and Consumer Services, Gainesville; Dr. Mani Lejuene, Animal Health Diagnostic Center Director, Cornell University - NYS College of Veterinary Medicine, Ithaca; and Jason Dombroskie, Coordinator, Insect Diagnostic Laboratory, Dept. of Entomology, Cornell University, Ithaca; and Dr. Cindy McKenzie and Dr. Aaron Dickey, USDA-ARS, Fort Pierce, Florida for their assistance with determinations.

Landscape and nursery

Jumping bush cricket (*Orocharis saltator*) damage to rhododendron and Schipka laurel; garden spider (*Argiope aurantia*) observed in residential landscape; arborvitae leafminer (*Argyresthia thuiella*) causing severe damage to landscape arborvitae, now a common problem in the area; pointed bullet galls (*Disholcaspis mamma*) on swamp white oak; giant willow aphids (*Tuberolachnus salignus*) on nursery-grown *Salix integra* 'Hakuro-nishiki,' and also observed on landscape willows; *Chrysolina* sp. leaf beetles on nursery Hypericum; dashed gray pinion moth (*Lithophane disposita*) in southern pine beetle trap March 30; woodlouse hunter (spider, *Dysdera crocata*) and *Melöe* sp. blister beetles observed in residential landscapes; Eastern spruce gall adelgid (*Adelges abietis*) damage on landscape Norway spruce; herbicide injury on nursery perennials; a European plant bug (*Rhabdomiris striatellus*) that feeds on oak catkins and new to the US (2016) found in W. Islip area – second report in US; woolly beech leaf aphid (*Phyllaphis fagi*) on landscape European beech; andromeda lace bug (*Stephanitis takeyai*) injury on landscape *Pieris japonica*; tortoise beetles (*Charidotella* sp.) on morning glory vines; elm cockscomb aphid galls (*Colopha graminis*) on 'Jefferson' elm; probable strawberry rootworm (*Paria fragariae*) damage to nursery *Cotoneaster salicifolia*; broadnecked root borer (*Prionus laticollis*) adult (longhorned beetle) found in landscape; lily leaf beetles (*Lilioceris lilii*) damaging garden lilies; gypsy moth (*Lymantria dispar*) damaging forest and landscape trees - third year of high populations in Suffolk; redheaded flea beetle (*Systena frontalis*) damaging nursery plants - now a common nursery pest on woody plants around the mid-Atlantic region; Japanese maple scale (*Lopholeucaspis japonica*), a recently established pest of woody ornamentals; potato leafhopper (*Empoasca fabae*) 'hopperburn' on dahlia and redbud; leopard moth (*Zeuzera pyrina*) in European beech; bead galls caused by eriophyid mites (*Aceria leionotus*) on river birch; Ambrosia beetles attacking bayberry (*Xylosandrus germanus*) and other landscape trees (*X. crassiusculus*); acrobat ants (*Crematogaster* sp.) on landscape plants; 'drippy acorn' syndrome on landscape oaks from around Long Island possibly connected with environmental conditions and/or bacterium *Lonsdalea quercina* subsp. *iberica*; tupelo leafminer (*Antispila nyssaefoliella*) mining tupelo foliage; true katydid (*Pterophylla camellifolia*) from a residential landscape; *Rhopobota* sp. leafminer causing heavy damage to mountain holly in forest area; black oak twiggall wasp (*Zapatella davisae*, formerly *Bassettia ceropteroides*) damaging landscape black oak - outbreak of last several years appears past; hickory leafminer

(*Coptodisca lucifluella*) from landscape hickory; marbled orb weaver spider (*Araneus mamoreus*) in a nursery; twolined chestnut borer (*Agrilus bilineata*) in nursery oaks, a problem seen following years of gypsy moth outbreaks; minute cypress scale (*Carulaspis minima*) in Hinoki cypress and arborvitae; wax scale (*Ceroplastes ceriferus*) on nursery Japanese maple; winter moth (*Operophtera brumata*) adults on Aquebogue property, the second report (landscape) of this damaging invasive species on eastern Long Island - low numbers were trapped in earlier survey but no defoliation has yet been observed.

Greenhouse

Florida fern caterpillar (*Callopistria floridensis*) in greenhouse damaging ferns; drain fly (= moth fly, Psychodidae) in organic greenhouse production; eriophyid (rust) mites (unidentified) damaging *Ficus alii* and brown soft scale (*Coccus hesperidum*) on Ficus in commercial atriums, broad mite (*Polyphagotarsonemus latus*) on *Salvia farinacea*, Surinam cockroach (*Pycnoscelus surinamensis*) causing severe damage to commercial interiorscape plants (*Sanseveria*); thrips injury (*Frankliniella occidentalis*) on greenhouse dahlias; variable reddish Pyrausta (*P. rubricalis*) attacking greenhouse mint plants; tiger moth caterpillars damaging sunflowers and greenhouse orchids; European pepper moth (*Duponchelia fovealis*) damaging Zygocactus.

Vegetables, fruit, and other crops

Seedcorn maggot (*Delia platura*) larvae damaging pea seedlings and garlic bulbs, a problem possibly related to wet spring conditions; hop aphid (*Phoradon humuli*) on commercial hops; slug damage to vegetable plants; morning-glory plume moth (*Emmelina monodactyla*) attacking sweet potatoes; *Edessa* sp. stink bugs on potatoes; dogbane tiger moth (*Cycnia tenera*) resting in sweet corn; Pandorus sphinx (*Eumorpha pandorus*), a minor pest on grape and several related plants; artichoke aphids (*Capitophorus eleagni*) on artichoke;

Structural and others

Western conifer seed bugs (*Leptoglossus occidentalis*) in residence; ground mealybugs (*Rhizoecus* sp.) in container-grown gardenia in a residential atrium; March flies (*Bibio* sp.), European hornet (*Vespa crabro*) found in residence; Virginia creeper sphinx moth (*Darapsa myron*); imported longhorned weevil (*Calomycterus setarius*) invading residence; large milkweed seed bug (*Oncopeltus fasciatus*) on milkweed – several inquiries; rainbow scarab (*Phanaeus vindex*) found in landscape; whitespotted sawyer (*Monochamus scutellatus*); large numbers of flower beetles (*Euphoria sepulcralis*) collecting in a NWS weather station rain gauge; *Orchesella cincta* springtails in a basement; stag beetles, Lucanus sp.; red milkweed beetle (Tetraopes tetraphthalmus) on milkweed; a native longhorn beetle, *Typocerus velutinus velutinus* - larvae feed in decaying hardwood; twice-stabbed stink bug (*Cosmopepla lintneriana*); giant resin bee (*Megachile sculpturalis*) reported to this lab for first time in eastern Suffolk; spicebush (*Papilio troilus*) and giant swallowtail (*P. cresphontes*) butterflies, the latter a rare migrant to Long Island possibly from Florida; citronella ants (*Lasius interjectus*) found in A a home garden; a blister beetle (*Melöe* sp.) found on a residential property; *Plagiorhynchus cylindraceus*, an endoparasitic acanthocephalan found in dead young eastern bluebirds (*Sialia sialis*), blocking the midgut– it is reportedly carried by terrestrial isopods.

Temperature & Rainfall Record, 2017 - LIHREC, Riverhead, NY

January

Day	High	Low	Precip
1	46	38	0.03
2	41	29	0.12
3	44	39	0.52
4	50	40	0.17
5	48	27	0.00
6	33	26	0.12
7	30	21	0.42
8	23	18	0.05
9	23	10	0.00
10	38	11	0.00
11	52	34	0.24
12	57	40	0.35
13	58	39	0.00
14	39	26	0.00
15	38	28	0.09
16	39	24	0.00
17	41	32	0.04
18	42	37	0.40
19	45	35	0.00
20	42	39	0.00
21	48	39	0.03
22	51	40	0.00
23	49	39	0.00
24	41	36	1.28
25	46	35	0.00
26	50	38	0.05
27	46	38	0.00
28	40	31	0.00
29	42	27	0.00
30	38	25	0.00
31	33	22	0.09
	42	**31**	**4.00**

February

Date	High	Low	Precip
1	45	27	0.00
2	43	28	0.00
3	38	26	0.00
4	32	22	0.00
5	43	26	0.00
6	42	35	0.00
7	42	31	0.08
8	59	38	0.00
9	47	20	1.25
10	30	16	0.00
11	41	24	0.00
12	37	27	0.39
13	37	32	0.00
14	37	27	0.00
15	46	29	0.00
16	39	31	0.00
17	38	27	0.00
18	50	27	0.00
19	63	43	0.00
20	59	40	0.00
21	46	28	0.00
22	51	36	0.00
23	57	37	0.00
24	67	48	0.00
25	66	52	0.00
26	56	36	0.00
27	50	27	0.00
28	59	38	0.00
	47	**31**	**1.72**

March

Day	High	Low	Precip	GDD at 50˚F
1	55	50	0.10	2.5
2	58	41	0.00	0
3	41	29	0.00	0
4	35	20	0.00	0
5	32	14	0.00	0
6	43	23	0.00	0
7	50	30	0.02	0
8	58	47	0.05	2.5
9	55	43	0.00	0
10	50	29	0.40	0
11	33	16	0.00	0
12	28	16	0.00	0
13	34	19	0.00	0
14	41	25	2.45	0
15	33	20	0.00	0
16	37	24	0.00	0
17	43	29	0.00	0
18	43	26	0.00	0
19	44	34	0.00	0
20	50	33	0.00	0
21	54	40	0.00	0
22	54	29	0.00	0
23	38	22	0.00	0
24	47	26	0.00	0
25	55	42	0.00	0
26	45	36	0.02	0
27	50	37	0.17	0
28	46	39	0.53	0
29	51	40	0.55	0
30	50	35	0.00	0
31	44	36	0.44	0
	45	**31**	**4.73**	**5**

April

Day	High	Low	Precip	GDD at 50˚F
1	41	36	0.90	0
2	58	38	0.00	0
3	58	37	0.00	0
4	53	42	1.39	0
5	58	41	0.30	0
6	57	39	0.52	0
7	57	42	0.23	0
8	52	39	0.00	0
9	61	34	0.00	0
10	69	43	0.00	6
11	73	49	0.00	11
12	71	47	0.00	9
13	67	45	0.00	6
14	63	42	0.00	3
15	62	38	0.00	0
16	84	53	0.00	19
17	73	60	0.00	17
18	66	47	0.00	7
19	55	39	0.00	0
20	64	44	0.27	4
21	63	46	0.33	5
22	51	45	0.10	0
23	62	44	0.00	3
24	60	37	0.00	0
25	54	48	0.50	1
26	60	48	0.83	4
27	66	51	0.00	9
28	80	56	0.03	18
29	84	57	0.05	21
30	81	51	0.00	16
	63	**45**	**5.45**	**159**

May

Day	High	Low	Precip	GDD at 50˚F
1	69	47	0.00	8
2	75	59	0.20	17
3	70	56	0.00	13
4	61	42	0.00	2
5	60	48	0.87	4
6	64	57	0.00	11
7	60	49	0.02	5
8	55	45	0.00	0
9	58	42	0.00	0
10	59	46	0.00	3
11	62	44	0.00	3
12	63	46	0.00	5
13	62	48	0.39	5
14	64	43	1.18	4
15	64	51	0.03	8
16	76	55	0.00	16
17	82	54	0.00	18
18	92	65	0.00	29
19	89	66	0.00	28
20	83	57	0.00	20
21	68	45	0.00	7
22	64	53	0.34	9
23	67	56	0.09	12
24	69	55	0.10	12
25	67	58	0.28	13
26	71	51	0.42	11
27	70	56	0.00	13
28	69	56	0.00	13
29	64	53	0.34	9
30	62	53	0.00	8
31	69	53	0.04	12
	68	**52**	**4.30**	**318**

June

Day	High	Low	Precip	GDD at 50˚F
1	77	55	0.00	16
2	76	52	0.02	14
3	70	48	0.00	9
4	70	53	0.00	12
5	62	57	0.45	10
6	60	52	0.16	6
7	69	50	0.00	10
8	70	47	0.00	9
9	77	54	0.00	16
10	84	58	0.00	21
11	87	63	0.00	25
12	91	68	0.00	30
13	93	68	0.00	31
14	89	68	0.10	29
15	78	56	0.00	17
16	70	59	1.58	15
17	73	63	0.05	18
18	79	66	0.00	23
19	79	71	0.00	25
20	80	68	0.47	24
21	83	66	0.00	25
22	80	62	0.02	21
23	82	70	0.00	26
24	84	70	1.63	27
25	82	62	0.00	22
26	78	59	0.00	19
27	77	59	0.17	18
28	77	54	0.00	16
29	78	60	0.00	19
30	80	67	0.00	24
	78	**60**	**4.65**	**577**

Temperature & Rainfall Record, 2017 - LIHREC, Riverhead, NY

July

Day	High	Low	Precip	GDD at 50˚F
1	78	70	0.00	24
2	87	68	0.00	28
3	87	67	0.00	27
4	86	68	0.00	27
5	84	64	0.00	24
6	80	63	0.00	22
7	76	67	1.12	22
8	84	66	0.08	25
9	82	67	0.00	25
10	83	63	0.00	23
11	85	72	0.00	29
12	87	71	0.02	29
13	91	72	0.00	32
14	80	62	0.66	21
15	82	65	0.03	24
16	84	68	0.00	26
17	84	67	0.00	26
18	85	70	0.00	28
19	87	72	0.40	30
20	91	69	0.00	30
21	88	70	0.00	29
22	80	70	0.07	29
23	82	68	0.05	25
24	77	60	1.22	19
25	69	61	0.00	15
26	79	59	0.00	19
27	77	58	0.00	18
28	82	68	0.00	25
29	79	66	0.00	23
30	81	63	0.00	22
31	85	60	0.00	23
	83	**66**	**3.65**	**769**

August

Day	High	Low	Precip	GDD at 50˚F
1	87	63	0.00	25
2	85	69	0.00	27
3	83	68	0.00	26
4	83	70	0.02	27
5	80	71	0.19	26
6	78	65	0.00	22
7	75	59	0.17	17
8	77	64	0.07	21
9	81	62	0.00	22
10	84	62	0.00	23
11	80	61	0.00	21
12	77	61	0.25	19
13	82	70	0.00	26
14	82	62	0.00	22
15	78	66	0.42	22
16	84	65	0.00	25
17	82	66	0.00	24
18	79	67	3.28	23
19	85	72	0.13	29
20	84	70	0.00	27
21	83	63	0.00	23
22	85	72	0.00	29
23	82	72	0.20	27
24	79	58	0.00	19
25	78	65	0.00	22
26	76	58	0.00	17
27	78	57	0.00	18
28	76	58	0.00	17
29	73	62	0.00	18
30	74	59	0.87	17
31	79	60	0.00	20
	80	**64**	**5.60**	**701**

September

Day	High	Low	Precip	GDD at 50˚F
1	72	55	0.00	14
2	68	52	0.00	10
3	73	56	0.57	15
4	78	58	0.00	18
5	79	67	0.00	23
6	77	67	0.52	22
7	72	61	1.13	17
8	72	52	0.00	12
9	70	58	0.00	14
10	72	59	0.00	16
11	73	59	0.00	16
12	76	53	0.00	15
13	79	57	0.00	18
14	81	68	0.00	25
15	82	65	0.00	24
16	80	67	0.00	24
17	79	64	0.00	22
18	74	66	0.00	20
19	71	67	0.37	19
20	74	68	0.26	21
21	73	70	0.00	22
22	75	65	0.00	20
23	83	67	0.00	25
24	87	62	0.00	25
25	85	62	0.00	24
26	82	65	0.00	24
27	82	67	0.00	25
28	80	69	0.00	25
29	73	56	0.00	15
30	65	51	0.14	8
	76	**62**	**2.99**	**578**

October

Day	High	Low	Precip	GDD at 50˚F
1	65	53	0.00	9
2	71	53	0.00	12
3	70	48	0.00	9
4	71	46	0.00	9
5	79	61	0.00	20
6	78	64	0.00	21
7	79	64	0.00	22
8	73	68	0.09	21
9	73	70	0.25	22
10	76	67	0.00	22
11	75	58	0.00	17
12	68	57	0.15	13
13	69	53	0.00	11
14	66	59	0.56	13
15	72	62	0.00	17
16	69	53	0.00	11
17	57	45	0.00	1
18	69	43	0.00	6
19	68	51	0.00	10
20	69	55	0.00	12
21	74	52	0.00	13
22	76	47	0.00	12
23	75	53	0.00	14
24	75	65	0.25	20
25	69	62	0.84	16
26	63	54	0.38	9
27	62	42	0.00	2
28	66	45	0.00	6
29	65	60	1.25	13
30	65	48	3.24	7
31	58	46	0.00	2
	70	**55**	**7.01**	**392**

November

Day	High	Low	Precip
1	57	36	0.00
2	73	51	0.00
3	72	58	0.00
4	68	47	0.00
5	59	49	0.06
6	66	58	0.02
7	62	45	0.00
8	48	41	0.60
9	56	35	0.00
10	51	30	0.00
11	38	25	0.00
12	47	26	0.00
13	47	38	0.03
14	44	40	0.00
15	49	40	0.00
16	56	42	0.45
17	51	42	0.00
18	55	27	0.00
19	61	44	0.40
20	44	38	0.00
21	57	36	0.00
22	55	44	0.77
23	45	34	0.00
24	51	27	0.00
25	56	33	0.00
26	51	44	0.00
27	48	35	0.00
28	30	30	0.00
29	61	44	0.00
30	54	31	0.00
	54	**39**	**2.33**

December

Day	High	Low	Precip
1	52	43	0.03
2	46	32	0.00
3	50	34	0.00
4	51	32	0.00
5	59	37	0.02
6	59	39	0.76
7	45	34	0.00
8	40	31	0.00
9	37	32	0.21
10	40	32	0.16
11	40	32	0.00
12	52	31	0.08
13	43	21	0.00
14	31	22	0.14
15	30	13	0.00
16	37	20	0.15
17	37	28	0.00
18	46	28	0.02
19	55	36	0.00
20	50	40	0.00
21	40	31	0.00
22	46	29	0.00
23	55	34	0.42
24	54	36	0.09
25	39	34	0.32
26	34	25	0.00
27	25	19	0.00
28	21	11	0.00
29	20	11	0.00
30	21	11	0.08
31	22	12	0.00
	41	**28**	**2.48**

Long Island Horticultural Research & Extension Center, 1997-2017 High & Low Temperatures and Precipitation, 20 yr Ave.

Maximum and Minimum Temperatures

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	20-yr avg.
Jan (max)	40	46	43	40	38	45	33	31	38	47	44	42	34	38	35	44	41	37	36	42	42	40
(min)	25	32	27	22	24	32	22	19	24	32	30	29	21	25	23	30	29	20	23	27	31	26
Feb (max)	47	46	45	44	42	48	35	40	42	41	34	43	44	38	42	47	39	38	31	45	47	42
(min)	31	32	30	28	27	31	23	27	26	27	22	28	28	28	25	32	27	24	15	28	31	27
Mar (max)	50	51	50	54	44	51	50	49	44	48	48	48	48	53	49	57	45	46	44	55	45	49
(min)	32	36	33	36	31	35	31	32	28	33	31	33	32	38	33	40	32	27	27	37	31	33
Apr (max)	60	61	62	59	62	62	57	60	63	62	56	62	61	65	59	62	60	59	59	59	63	61
(min)	40	41	41	40	41	45	39	42	42	43	40	43	43	45	44	44	41	40	45	41	45	42
May (max)	68	74	72	71	72	69	66	72	66	68	73	68	68	74	71	72	70	70	76	69	68	70
(min)	48	52	51	51	52	50	48	51	47	51	52	48	52	53	53	55	50	52	54	50	52	51
Jun (max)	81	77	83	81	80	78	76	77	81	77	79	80	73	81	79	78	78	79	77	79	78	79
(min)	58	60	62	61	63	60	59	59	61	62	61	63	58	64	61	61	61	60	61	60	60	61
Jul (max)	87	85	89	81	80	85	82	82	84	84	82	84	80	87	86	85	86	82	83	85	83	84
(min)	65	66	69	64	63	67	66	65	67	69	66	67	64	70	68	68	71	67	68	68	66	67
Aug (max)	82	86	83	81	84	84	83	82	85	82	82	79	83	83	82	83	80	81	84	86	80	83
(min)	64	66	66	65	68	67	69	66	69	67	65	63	68	67	66	67	65	64	67	69	64	66
Sep (max)	76	79	77	76	75	76	75	78	79	73	77	75	74	77	76	75	74	77	81	78	76	76
(min)	58	61	61	59	59	61	61	60	62	58	60	61	58	62	63	60	57	60	63	63	62	60
Oct (max)	66	65	66	66	66	63	63	64	63	64	70	63	62	65	65	66	67	66	65	67	70	65
(min)	48	51	48	48	50	50	47	49	51	48	56	47	47	50	51	52	51	52	49	51	55	50
Nov (max)	51	55	59	52	59	52	56	56	58	57	52	51	56	54	59	50	53	52	59	56	54	55
(min)	38	40	42	39	42	39	42	40	42	45	39	39	45	40	43	38	37	37	43	41	39	40
Dec (max)	45	50	47	40	50	42	45	46	41	51	42	47	43	38	50	47	45	46	55	44	41	45
(min)	31	34	32	25	37	29	31	31	29	37	30	31	30	28	35	36	30	35	42	32	28	32
Average Max	**63**	**65**	**65**	**62**	**63**	**63**	**60**	**61**	**62**	**63**	**62**	**62**	**61**	**63**	**63**	**64**	**62**	**61**	**63**	**64**	**62**	**62**
Average Min	**45**	**48**	**47**	**45**	**46**	**47**	**45**	**45**	**46**	**48**	**46**	**46**	**46**	**48**	**47**	**49**	**46**	**45**	**46**	**47**	**47**	**46**

Precipitation

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	20-yr avg.
January	3.52	5.82	7.58	3.54	3.78	2.65	2.81	2.27	4.29	5.20	3.75	2.89	3.49	2.07	6.92	2.81	2.07	2.94	3.98	3.12	4.00	3.79
February	2.24	4.90	3.91	1.80	2.17	1.24	5.02	2.89	2.76	2.54	2.50	5.38	1.52	5.32	3.38	0.91	6.64	4.82	2.37	4.13	1.72	3.25
March	4.94	6.88	5.47	4.58	10.42	3.87	6.07	3.77	3.74	0.58	6.11	5.33	2.43	13.39	2.25	1.04	3.17	6.11	4.88	3.42	4.73	4.91
April	3.43	6.29	1.84	5.95	1.62	3.40	5.36	6.58	3.85	5.06	7.16	3.63	5.45	2.55	4.51	3.34	1.88	3.41	1.53	2.74	5.45	4.05
May	2.52	6.83	3.51	4.21	6.42	4.56	5.47	2.96	3.45	6.52	1.51	2.87	4.75	3.16	3.39	4.21	2.36	5.06	0.40	3.66	4.30	3.91
June	1.89	6.72	0.80	4.24	6.08	4.73	8.33	0.88	1.20	5.83	3.37	3.88	6.43	1.63	6.10	5.44	9.92	2.47	5.02	1.23	4.65	4.33
July	2.53	3.16	3.67	4.70	3.43	1.20	2.81	3.33	1.36	3.79	3.63	3.67	4.82	3.46	2.35	4.35	3.07	2.24	1.24	2.89	3.65	3.11
August	3.97	2.28	8.18	2.42	4.86	3.09	2.80	3.94	1.48	5.48	2.60	3.76	2.01	2.02	10.61	3.25	2.43	2.42	2.14	2.36	5.60	3.70
September	1.20	3.03	5.31	3.92	2.98	5.92	5.90	6.97	3.46	3.66	1.51	8.34	2.39	2.87	6.88	3.72	2.62	1.86	2.84	2.71	2.99	3.86
October	1.81	2.35	3.79	0.46	1.97	4.92	5.05	2.04	20.32	5.53	1.84	3.18	5.78	3.32	6.74	2.17	0.19	5.43	3.27	3.78	7.01	4.33
November	5.99	2.06	1.96	3.72	0.53	6.21	3.37	4.46	3.93	6.17	2.94	3.07	4.39	2.89	4.37	2.07	2.88	5.74	2.39	2.74	2.33	3.53
December	4.16	1.14	2.56	3.65	2.24	4.43	4.46	4.13	4.27	2.00	4.69	7.51	7.96	3.63	3.12	6.29	5.63	5.94	4.82	3.36	2.48	4.21
Average	**3.18**	**4.29**	**4.05**	**3.60**	**3.88**	**3.85**	**4.79**	**3.69**	**4.51**	**4.36**	**3.47**	**4.46**	**4.29**	**3.86**	**5.05**	**3.30**	**3.57**	**4.04**	**2.91**	**3.01**	**4.08**	**3.92**