1. Full name of your Program Work Team (PWT):

   **Greenhouse Horticulture Program Work Team**

2. Please identify your PWT’s greatest accomplishments over the past year.

The Greenhouse Horticulture PWT provides Cornell Extension programming to producers of greenhouse bedding plants, flower crops and greenhouse vegetable crops across New York. There are 1,124 floriculture producers in NYS producing $211 million a year in wholesale value. There are 435 greenhouse and high tunnel vegetable producers in NYS producing an annual wholesale value of $27 million (USDA 2012 Census of Agriculture). These operations support more than 7,000 employees.

**Advisory Board**

Stakeholders from different facets of the greenhouse industry form a 14-person Advisory Board that meets twice a year with the PWT to help with planning and evaluation of applied research and extension programs at Cornell.

- Mark Adams        Mark Adams Greenhouse
- Karl Auwaerter    Bayport Flowers
- Mike Bouton       Clark Foundation
- Phil Brennessel   Express Seed
- Peter Ferrante    Walkill View Farm and Greenhouse
- Marty Gottleib    Smartpots
- Don Horowitz      Wittendale's Florist
- Margaret Kelly    Department of Ag and Markets
- Elise Lobdell     The Plant Keeper
- Mike Mitchell     Griffin
- George Schaefer   Schaefer's Gardens
- Mike Weber        Weber Greenhouses
- Mark Yadon        Mischler's Florist and Greenhouse
- George Zerrillo   Zerrillo Greenhouses

During 2016, the Advisory Board met with the PWT on March 31-April 1 in Rochester, arranged by Walt Nelson. The group toured Grossman’s Garden and Home, Genrich’s Florist and Greenhouses, and The Garden Factory on March 31. The business meeting on April 1 included updates from Ag and Markets, Farm Bureau, NYS IPM, NYS Flower Industries, and Cornell and CCE faculty, and planning for the 2015 Floriculture Field Day, spring conference calls and fall meeting.
The Fall 2016 meeting was organized by Lily Calderwood in Rensselaer County and visited Cedar Farm Wholesale cut flowers, Maple Lane Nursery and Behn’s Best Perennials. The business meeting was held at CCE Rensselaer County. Mark Yadon accepted the nomination as the new president of the Advisory Committee. There were updates from Farm Bureau (Mark Adams), Ag and Markets (Margaret Kelly), the NY Flower Industries Research Fund (Karl Auwaeter), NY Farm Viability Institute (Peter Ferrante) and NYS IPM (Elizabeth Lamb). All participated in a discussion on stakeholder issues such as insect pests. The spring meeting will be planned for Ithaca. Spring calls will be in early April and early June in the middle of the week. Some topics for the August 2017 Floriculture Field Day are: the future of genetically modified organisms in ornamentals, water use – rain gardens/parking lots, recycling plastics for large and small growers, and a panel discussion on what retailers and landscapers want from growers, and for Bluegrass Lane – fairy gardens (Kent Lobdell), deer resistant plants, and container vegetables.

Phone conferences with growers and CCE/Cornell faculty were held on March 29 and June 7 to discuss the spring season and any current issues (pests, diseases, cultural, etc.). Notes of the discussion were emailed to all the PWT and advisory committee members following the call. This 2-date system is a useful way to identify problems early in the growing season, with potential time to correct them, and to provide feedback after the initial spring season.

**Stakeholder programs**

The educational goals of the PWT were addressed at the Floriculture Field Day (August 11, 104 attendees, additional information below) on campus. Several educational programs led by PWT members included: Nursery and Bedding Plant Schools held in the Buffalo area (January 12, 80 attendees), Long Island (January, 90 attendees), the Capital District (January 26, 85 attendees), and the Hudson Valley (January 27, 52 attendees). PWT members also presented at the Long Island Ag Forum, (January 14-15, 50 attendees), and in a greenhouse track at the Empire State Producers Expo (January 19, 25 attendees).

The 9th IPM In-depth was held July 28. Forty-three greenhouse growers and managers participated. Attendees participated in hands-on activities on pest mites, alternatives to liquid feed fertilizers, and plant viruses.

Colleagues on Long Island (LI) hosted several events including The NY Leader’s Forum – a unique annual tradition that brings together NYS leaders from all segments of ornamental horticulture (March 10, 48 attended), the Long Island Horticulture Research and Extension Center (LIHREC) open house (July 9, 200+ attending, the most popular lecture was on flower arranging with 40 attending) and the LIHREC Plant Science Day (Sept 14, 160 attended tours). They also hosted a greenhouse tour for academics from several states that collaborate in a national greenhouse diagnostic list-serve and
information source (e-Gro electronic grower resource online) on April 12-13, and the joint annual meeting for USDA multi-state groups NE-1335 (resource management in commercial greenhouses) and NC-1186 (water management and quality for ornamental crops).

**2016 Floriculture Field Day**

A primary activity of the Greenhouse Horticulture PWT is organizing Cornell’s annual Floriculture Field Day, held on August 9, 2016 in Ithaca and attended by over 100. Based on our industry member input, the morning program theme was responding to consumer needs and industry trends. Morning speakers at the 2016 Floriculture Field Day were:

- Carol Miller, Editor, *Greenhouse Grower Retailing* and *American Farm Marketer*: Garden Retail is Changing: It’s Time to Adapt and Prosper
- Connie Schmotzer, Consumer Horticulture Educator, Pennsylvania State University: Bees, Bugs, Blooms: Creating Pollinator Friendly Landscapes
- Chris Logue, Director, Department of Ag and Markets Plant Industry Section, *Updates from the NYS Department of Agriculture and Markets*
- Dr. Paul Curtis Department of Natural Resources, Cornell: Methods for Managing Deer Damage to Plants
- Dr. Mark Bridgen, Long Island Horticulture Research and Education Center, Cornell: Plants that deer do not eat

The afternoon program highlights viewing of landscape plant performance trials at the Bluegrass Lane research facility. With PWT support funds a demonstration of mixed edible (vegetable/herb) and ornamental containers was showcased. Growers report continued increase in the edibles category and liked the creative combinations with ornamentals. Nine annual trial beds were sponsored by companies. Advisory board members continue to state that viewing plant performance in New York conditions is highly important for selecting the crops and varieties they carry.

Afternoon ‘walkabout’ tours included:

- Alternatives to invasive plants, Brian Eshenaur, NYS Integrated Pest Management
- Deer Resistant Plants and Pollinator Friendly Plants, Mark Bridgen, LIHREC and Elizabeth Lamb, NYS IPM
- Mixed Flower and vegetable containers, Cheni Filios, Product Line Manager-Vegetables,
- PanAmerican Seed
- Annual and substrate trials, Kendra Hutchins, Trials Manager, Horticulture/SIPS

Pollinator and deer resistant plant lists available at [http://www.greenhouse.cornell.edu/index.html](http://www.greenhouse.cornell.edu/index.html) and photo gallery at [https://blogs.cornell.edu/hort/2016/08/10/100-attend-floriculture-field-day-2/](https://blogs.cornell.edu/hort/2016/08/10/100-attend-floriculture-field-day-2/)
Based on the 44 responses to the Field Day evaluation, 48% had never attended a Field Day before, while 25% had attended 5 or more previous Field Days. Ninety-seven percent said they were leaving the program with information they intended to apply in their operation. The most common remarks were:

• Providing lists for deer resistant plants and pollinator friendly plants was very much appreciated
• Knowing about, marketing, and educating consumers about pollinators and pollinator friendly plants and gardens was useful
• Understanding deer management and learning, marketing and educating consumers about deer ‘resistant’ plants appreciated
• Having a better understanding of the diversity of consumer populations and how they could be marketed to and attracted to stores was useful
• Ag inspectors were seen as a resource
• Partnering with Master Gardeners to promote issues like pollinators was something they would try

Kathy Pufahl Memorial Container Design Contest
Field Day also included the annual Kathy Pufahl Memorial Container Design Contest, a forum for learning and horticultural inspiration. Winners and winning entries can be viewed at http://www.greenhouse.cornell.edu/container_contest/fieldday_2016.html

Research projects

• Continuing evaluation and development of ethephon-based plant growth regulators for height control in bulb crops
• Development of a flower bud ruler to time flowering of hybrid lily crops
• Research on cold duration, PGRs, and cultural factors to turn Pineapple Lily (Eucomis) into a profitable new potted plant crop
• Yearly annual plant variety trial on Long Island
• Use of beneficial nematodes for control fungus gnats and Western flower thrips. Evaluating new species/strains of nematodes and how irrigation method impact nematode effectiveness.
• A new project to determine more detailed guidelines on optimal release methods for predaceous mites for biocontrol of Western flower thrips.
• Outdoor performance and visual appeal of mixed ornamental/edible containers.
• Trial comparing 15 different retail potting mixes for patio tomatoes in containers.
• Energy efficiency and plant growth with greenhouse supplemental lighting with high pressure sodium (HPS) lamps versus new light-emitting-diode (LED) lamps.
• Investigation of production strategies to optimize growth of high-value microgreens while reducing input costs (seed, substrate, fertilizer, energy)
• Using ultraviolet-C light as a plant growth regulator in greenhouses. Research is demonstrating that UV-C light can reduce plant height and increase branching without the use of chemical growth regulators. In some species, the time to flower is also reduced.
• The effect of nitrogen fertilization on aphid population development and biological control.
• Evaluation of biopesticides for disease management in greenhouse ornamentals and vegetables
• Plant safety testing of foliar fungicides.
• Efficacy of new fungicides for botrytis management.
• Efficacy of various plant growth regulators (pgrs) on the branching and quality of osteospermum.
• Enhancing efficacy of biological control for greenhouse insect pests with insect-killing fungi for managing whitefly as an alternative to neonicotinoid insecticides.
• Screening and breeding Impatiens for downy mildew resistance
• Seed germination studies of Vitex agnus castus
• In vitro mutation breeding and micropropagation of Vitex agnus
• Energy efficiency and plant growth with greenhouse supplemental lighting with high pressure sodium (HPS) lamps versus new light-emitting-diode (LED) lamps.
• A simulation tool to compare energy costs for hydroponic plants grown in a CEA greenhouse versus a vertical/warehouse farm.
• Development of novel greenhouse crops including: microgreens, kale, swiss chard, and dwarf tomatoes.

Websites, Social Media and Print Resources
The PWT’s websites, www.greenhouse.cornell.edu and www.longislandhort.cornell.edu, continue to be used as sources of information for growers and educators. The greenhouse.cornell.edu website received 28,000 page views by more than 11,000 users from January to December 2016. The most visited pages are on greenhouse energy grants, nutrient & fertilizer management, and pests.

Videos of 2016 Floriculture Field Day speakers are available at https://blogs.cornell.edu/hort/2016/08/10/100-attend-floriculture-field-day-2/

The NYS IPM website had a major overhaul in 2016. The NYS IPM ornamentals web pages are at https://nysipm.cornell.edu/agriculture/ornamental-crops with the associated Twitter feeds @ornamentalipm and @iknwplnts, and Ornamental Crops IPM Blog

Bulb crop research results are available online at http://www.flowerbulbs.cornell.edu/ and on CD.
The Greenhouse IPM Update list-serve currently has 550 members from New York and the Northeast Region. Pest Alert emails – for such pests as chrysanthemum white rust, sudden oak death, and lantern fly – go out as needed to provide timely information to growers.


Brian Eshenaur now coordinates the Environmental Impact Quotient project for NYS IPM. The Environmental Impact Quotient (EIQ) provides growers with data regarding the environmental and health impacts of their pesticide options so they can make better informed decisions regarding their pesticide selection. EIQ information is available at https://nysipm.cornell.edu/eiq

Numerous articles were prepared for LI Hort News, Greenhouse IPM Notes, Hudson Valley Horticulture Newsletter, Capital District Growing Trends Newsletter and other extension newsletters, the Ornamentals IPM e-Newsletter and for national trade magazines. Catlin, Daughtrey, Gilrein, and Mattson are working with a national team of floriculture researchers to produce e-Gro Alert, an electronic resource for greenhouse growers (http://e-gro.org/alert.php).


**External funding sources**
The USDA/ARS, the American Floral Endowment, the Gloeckner Foundation, the Post/Schenkel Foundation, Friends of Long Island Horticulture, Hatch, Northeast IPM, NY Farm Viability Institute, NYS Flower Industries Research and Education Fund, NYSERDA, EPA, NIFA, NE-SARE, NYS IPM, and various horticultural industries provided external funding for the Cornell Greenhouse Horticulture Program members in 2015.

**Service to the industry**
Members of the PWT and Advisory Board provide service to the industry in many ways. In addition to their working directly with a large number of NYS growers, identifying problems and solutions, and analyzing samples, they are active in state, national and international programs. They are members of the Northeast Greenhouse Conference Planning Board, academic reviewers for the New England Floriculture Grants Program and other organizations, and collaborate closely with New York State Flower Industries (NYSFI), the Long Island Ag Stewardship program and the Long Island Flower Growers Association through joint projects.

**Impacts**
Efficacy and plant safety trials of fungicides will provide growers with information to make sound
disease management decisions.

Research on the several LEDs compared to High Pressure Sodium lamps for greenhouse supplemental lighting has found that the best performing LEDs can reduce energy use by 40% while maintaining crop quality. However, high initial cost of LEDs is still a barrier for horticultural lighting.

Sixteen of the 22 who had previously attended a Floriculture Field Day said they had implemented something they had learned in their business operations. The most common techniques listed were adopting biocontrol, adding new varieties, marketing and retail practices, and using the updates on plant disease and insect pests.