

# The Penn State Extension Tree Fruit Team Annual Report

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Each November, the USDA requires Penn State Extension to summarize annual Extension activity and the impact that activity has had on the agricultural community. Teams within each Extension unit report their activities from October 1 of the previous year through September 30 of the current year, which is then compiled into a unified whole for delivery to the USDA.

Presented here is the core text of the tree fruit team's 2019-2020 contribution to this report, edited slightly since contextual clues in the longer original form have been omitted. It is hoped that this report will give a fuller sense of the breadth of activities and depth of content developed by the team to benefit the tree fruit industry in Pennsylvania.

The programs and projects described below were either a product of the entire team or were developed by specific cadres of faculty, researchers, and educators. Where appropriate, primary team members were identified by name, though that does not necessarily imply that team members not listed did not contribute to that project.

Also included in this reduced activity report is the complete catalog of peer-reviewed publications, reference works, *Pennsylvania Fruit News* and *Fruit Times* articles, invited talks, and articles published in the popular press. Omitted are the countless smaller online articles, tweets, and other forms of educational content delivered by the specialists and educators to the industry throughout the year.

A significant portion of the programs conducted throughout 2019-2020 would not be possible without the support and feedback of the industry, especially from the State Horticultural Association of Pennsylvania. The team thanks SHAP for their continued involvement in helping the team to maintain such a high level of quality programming.

And, as usual, recommendations for how Extension can continue to improve for the 2020-2021 annual reporting cycle are always welcomed. Contact your local Extension educator or email Daniel Weber at [daniel.weber@psu.edu](mailto:daniel.weber@psu.edu) to share any recommendations.

A version of this summary may also be found at <https://agsci.psu.edu/research/extension-centers/frec/resources/team-reports>.

## Tree Fruit Team Impacts: Research, Training and Outreach

### Global Overview of Extension Products and Contacts

The tree fruit team reported 442,665 contacts with professional and non-professional growers, packers, processors, market owners, orchard workers, agents from affiliated industries, members of the press, and the general public. Of these, 3,816 were associated with the 37 unique workshops, conferences, webinars, and dinners created by the team. The remaining 438,849 contacts were due to personal contacts (on-site visits, participation in external events, etc.), access to the 1-800 PENN IPM hotline, educational video views, and viewing of content on [extension.psu.edu](http://extension.psu.edu). (Some of these are detailed below.) While the number of reported contacts exceeded the 2018-2019 total by 54,886, the team took a significant hit when travel and meeting restrictions were instituted in March to combat the spread of the coronavirus.

### Winter Commercial Tree Fruit Schools

Evaluations conducted at the winter commercial tree fruit schools revealed the impact educational programming has on the tree fruit industry: 97% of attendees rated Penn State educational programming as economically valuable when considering improvements in disease control (99.9% rated valuable), insect control (98%), and physiological management (94%). When assessing the cash value of this education, attendees equated it to \$396 in profit per acre. Based on conservative estimates of acreage under production as reported by the respondents (23,237 acres), this equates to a \$9,203,696 increase in profit due to Extension research and educational programming across the entire state of Pennsylvania.

The annual winter fruit schools were held in nine regions across the state. Each meeting featured a series of 30- or 45-minute talks by Penn State Extension faculty and specialists. While there was some variation in content depending upon location, each school featured up to six 30-minute talks that awarded one Pennsylvania Department of Agriculture (PDA) pesticide renewal category credit per talk and up to two 30-minute talks by safety experts from the Pesticide Education Program for a total of two PDA core credits.

Over 318 people attended these events. (This number is based off the number of surveys returned to us at each event; the total number of attendees is actually higher. An estimated 25% of the people attending annually refuse to fill out surveys for a variety of personal reasons.) Assuming 75% of the attendees claimed PDA credits, this equates to 1,431 category and 477 core credits awarded to growers.

### Virtual Twilight Meetings

In late April and early May, Extension typically hosts ten spring orchard (“twilight”) meetings throughout Pennsylvania and surrounding states. Due to the coronavirus, these meetings were cancelled. In their place, four “virtual” twilight meetings spaced at two-week intervals in May and one in early July were created to service the entire state. The standard format of three PDA category credit-bearing talks delivered by specialists was followed, but in place of the usual orchard tour, a member of the Pesticide Education team provided a core credit talk. These four webinars were watched by 163 unique individuals, with 64 individuals (40%) attending multiple meetings.

### Website Traffic Report

The Extension website ([extension.psu.edu](http://extension.psu.edu)) currently hosts 821 different products (articles, conference announcements, courses, videos, etc.) which received 486,403 requests for content. Products created in 2020 represented 17% of content currently online (136 products), and 8% of all document requests (38,226 requests). *Fruit Times* news articles and alerts represent 56% of those products (76 articles) and 52% of all requests for information (19,935). These statistics highlight the importance of the *Fruit Times* newsletter to growers during the season. Spanish-language content includes 16 articles, the most created specifically for the Latinx audience in the last five years.

### Professional Society Involvement

From 2019-2020, Dr. Kari Peter was the Vice President of the American Phytopathological Society. She is the current sitting President through 2021. Maria Gorgo earned the Dr. William Henson Diversity Achievement Award. The College of Agricultural Sciences recognized Maria for her success in promoting diversity in Pennsylvania Agriculture and Penn State Extension programming.

## **Team Goal 1: Advanced Integrated Pest and Cultural Management**

### **Evaluating Fungicides and Bactericides in Field Trials Under Pennsylvania Environmental Conditions on Apples and Stone Fruit (Peter)**

During the 2020 season, Penn State pathologists interacted with 13 agrochemical companies and IR-4 to perform the following: 64 different programs, examining 36 products, were evaluated to manage apple scab, powdery mildew, rust, Marssonina blotch, sooty blotch and flyspeck, fruit rots, and the influence on fruit finish; 25 programs, examining 19 products, were evaluated to manage fire blight; 10 programs, examining 10 products, were evaluated to manage brown rot on peach; 8 programs, examining 8 products, were evaluated to manage bacterial spot on peach/nectarine; and 3 programs, examining 3 products, were evaluated to manage cherry powdery mildew. The 2020 field season was an extremely challenging year weather-wise and this influenced evaluations. Approximately 40 apple programs show promise for managing apple scab; fire blight program evaluations were inconclusive due to lack of disease caused by the unseasonably cold spring; 5 programs showed promise controlling bacterial spot; all programs managed bitter rot and cherry powdery mildew. A total of \$134,000 was awarded to work on this research. This was supported by USDA National Institute of Food and Agriculture and Smith-Lever Appropriations under Project #PEN04694 and Accession #1018736; the New Hampshire Specialty Crop Block Program; and the Washington Tree Fruit Commission.

### **Determining the Epidemiology and Management of Prevalent Pre- and Postharvest Apple Fruit Rot Pathogens (Peter)**

To understand the epidemiology of bitter rot, a total of 500 fungal isolates were collected throughout Pennsylvania, Ohio, Maryland, Delaware, and Virginia, and were identified to species. Further research showed the most predominant species, *Colletotrichum fiorinae*, causing bitter rot was found to be primarily a leaf endophyte in the environment. This is a very interesting discovery but provides challenges for management of bitter rot on apple in the orchard. This data illustrates the problem of identifying the period most critical for management of bitter rot, as spores appear to be consistently available throughout the season. A total of \$36,000 was awarded to support this research. This was supported by USDA National Institute of Food and Agriculture and Smith-Lever Appropriations under Project #PEN04694 and Accession #1018736; the State Horticultural Association of Pennsylvania; the NSF Graduate Student Fellowship Program; and the NE SARE Graduate Student Grant Program.

### **Rapid Apple Decline (Peter)**

A Rapid Apple Decline (RAD) summit was facilitated on December 4, 2019. RAD is a destructive phenomenon with unknown cause or causes, resulting in sudden, simultaneous losses of hundreds or thousands of trees in a single season in an orchard. Losses exceeding 70% of all trees in a single block have been documented. The summit included 90 attendees (70 in-person; 20 by video conference) representing academia, Extension, federal and state research labs, the fruit industry, the chemical industry, nursery owners/managers, and crop consultants from Pennsylvania, Maryland, Virginia, North Carolina, New Jersey, New York, Massachusetts, Ohio, Michigan, Washington, and fruit-producing regions of Canada. The purpose of the summit was to get a scope of what is going on with the issue of young dwarf apple trees suddenly dying in large numbers, research being conducted, field observations, and how to proceed moving forward with further research.

### **Surveying Commercial Orchards and Nurseries for Exotic and Emerging Pathogens (Peter)**

Surveys of exotic orchard pathogens found no Plum pox virus (3,500 samples), exotic *Erwinia*, or phytoplasmas in higher fruit production areas in southcentral Pennsylvania. To address the concern of rapid

apple decline, studies began evaluating the influence of herbicides on newly planted trees; soil mapping was conducted in approximately 5 locations in Adams county where decline has been observed; Ambrosia beetles were monitored in several locations (both declining and healthy orchards) and two species were identified; and apple trees singly-infected with the newly described apple luteovirus 1 virus were planted (approximately 200 trees). A total of \$249,000 was awarded to support work on these research and extension activities. This was supported by USDA National Institute of Food and Agriculture and Smith-Lever Appropriations under Project #PEN04694 and Accession #1018736; the State Horticultural Association of Pennsylvania; the PA Specialty Crop Block Grant Program; and the USDA APHIS Plant Protection Act 7721 (formerly known as the Farm Bill Sec 10007).

#### **Dr. Tree Fruit and Don Podcast (Peter, Seifrit)**

This year saw the creation of an educational podcast the “Dr. Tree Fruit [Kari] and Don [Seifrit] Podcast.” The podcast focuses on providing timely commercial tree fruit production advice for beginning industry professionals and seasoned growers. Educators from Penn State Extension and faculty from Penn State University’s horticulture, entomology, and plant pathology departments drop in to give insights and observations about what is going on in the orchards. At the time of writing, there are seven episodes available. The podcast has received international attention with over 400 listens/downloads from the US and international listeners and was played on both mobile and desktop platforms. The podcast can be accessed through many major podcast feeds (e.g. iTunes) and is also accessible at <https://extension.psu.edu/drtreefruit>.

#### **Spotted Lanternfly Educational Videos (Seifrit, Krawczyk)**

The invasive spotted lanternfly (*Lycorma delicatula*) has become a serious pest in southeastern Pennsylvania and is working its way west- and northwards towards the state’s prime fruit and vegetable growing regions. Three videos were produced dealing with lanternfly management during this program year. Their viewership totaled 986 unique hits. These videos were similarly well-received to previous digital spotted lanternfly outreach efforts. Further video projects are planned for the coming program year.

#### **Peach Rootstock Trials (Schupp, Weber, Seifrit, Esslinger, Muza, Pollock, Elkner)**

In 2020 Penn State researchers established ten demonstration orchards for the evaluation of three new peach dwarfing rootstocks. Prior research conducted by Penn State suggests these rootstocks have commercial potential for the establishment of pedestrian, high-density production peach orchards. These plantings were funded through a grant from the Pennsylvania Peach and Nectarine Research Program. Twelve grower cooperators representing diverse communities from across Pennsylvania received approximately 120 trees each (approximately 30 of each the three dwarfing rootstocks Controller 6, 7, and 8 and one control, Krymsk 86) at no cost in exchange for collaborating with extension educators and specialists in the evaluation of production efficiency, fruit quality and potential socio-economic benefits on these half-acre, on-farm trials.

#### **Apple Fruit Color-Enhancing Technologies (Schupp, Weber)**

The Provide Agro company loaned Penn State one of only three Fruit Tec REDpulse pneumatic defoliators east of the Mississippi for preliminary testing. This device uses high-pressure pulses of air to remove leaves from the outer canopy of apple trees in order to increase sunlight penetration and thereby improve coloration on red-fruited varieties for which consumers are willing to pay a premium. This initial test lasted three months and resulted in preliminary data to be discussed at the Mid-Atlantic Fruit & Vegetable

Convention in 2021. Three in-person workshops attended by 27 people were scheduled during August to demonstrate the technology.

#### **Orchard Management Courses See Record Registrations (Crassweller, Baugher)**

Online course usage surged in 2020 due to people in Pennsylvania being quarantined in late March, and due to Penn State's decision to reduce or eliminate course fees for a vast swath of online educational content. A total of 2,972 people registered for the two orchard management courses, with 63% (1,870) and 34% (1,020) unique course registrations occurring in April and May, respectively, when these courses were freely accessible. This period accounted for 97% of the overall registrations. Of those 2,972 registrations, 2,113 actually began taking the courses after registering. This level of interest suggests that an effort should be made to increase their visibility, and enhance price competitiveness, to increase their utilization throughout the year.

#### **Rootstock and Cultivar Evaluations (Crassweller, Schupp)**

As apple rootstocks continue to be developed to address shortcomings of existing rootstock lines, these rootstocks must be evaluated for suitability in under typical growing conditions in Pennsylvania before recommending them to growers. In 2020, a new multi-state rootstock trial was established with 'Buckeye Gala' on twelve different rootstocks including new selections from New Zealand that show potential for Pennsylvania growers (NZ.1, NZ.2, and NZ.5). This research is supported by a \$19,494 grant award by the State Horticultural Association of Pennsylvania. This was the fifth year of the six-year program.

#### **Effects of Maintenance of Training Systems to a Hedgerow (Crassweller, Smith)**

When training apple trees, growers seek an optimal balance between optimal yields of high-quality fruit which generate the highest profits and labor expenses associated with maintaining the trees and harvesting the fruit. Hedging is one method to simplify pruning and training needs, improve light penetration to the canopy, and reduce labor during harvest. In the third of five years of this research project, hedging Jonagold and Fuji trees was more time efficient, but frost damage reduced yields in 2020 making interpretation of the results difficult. This work is supported by a \$13,969 continuing grant awarded by the State Horticultural Association of Pennsylvania.

#### **Third Generation Apple System Trials (Crassweller, Smith)**

Similar to the hedging research discussed above, multiple additional training systems have been under evaluation at Penn State to observe their effectiveness. In 2019, it was observed that tall spindle trees were more productive than either biaxial trained systems. This is the third year of a five-year research program funded for \$14,110 through the State Horticultural Association of Pennsylvania.

#### **Extending the Cornell Carbohydrate Model (Crassweller)**

The Cornell carbohydrate model has been developed to provide growers with access to statistical models to forecast optimal thinning times based on regional weather data and stage of apple tree development. As part of this research, bi-weekly carbohydrate model results for multiple locations in Pennsylvania were evaluated during chemical thinning season for apples. Results were communicated to growers via the *Fruit Times* newsletter. Support for this multi-year project derives from the grant "Extending Cornell Carbohydrate Model to Pennsylvania Growers for Determining Apple Tree Response to Chemical Thinners" awarded in 2020 by the State Horticultural Association of Pennsylvania for \$1,750.

#### **Bitter Pit Prediction Modelling Research Collaboration (Baugher)**

Bitter pit in Honeycrisp apple has caused packout losses totaling over \$1 million to Pennsylvania fresh-market producers in some years. The ability to predict the development of bitter pit in time to apply a

remedy would benefit Pennsylvania growers greatly. Penn State participated in a multi-state project to predict bitter pit three weeks prior to harvest using a passive model developed by Chris Watkins, Cornell University. For fruit sampled from six Pennsylvania orchard blocks the passive model was 92% accurate in predicting bitter pit. A second year of research is underway.

#### **Pesticide Sprayer Calibration: (Pollock, Seifrit, Weber):**

For a small fee, Extension educators will travel to an orchard to calibrate spraying equipment. Calibration is an important component of yearly equipment maintenance for growers as it ensures that the expected amounts of compounds are being applied during operation. Over-application wastes expensive chemical products with no added benefit (and perhaps some environmental damage), while under-application results in poor control and the fostering of resistance in diseases, insects, and weeds. This year, 36 different sprayers were calibrated, resulting in \$1,800 in profit. Tools are being developed to estimate the economic benefits received following calibration.

### **Team Goal 2: Precision, Automated, and Labor-saving Technologies and Engineering**

#### **Green Fruit Removal Dynamics and Robotic Green Fruit Thinning System (He)**

A preliminary study was conducted to investigate the advisability of targeted green fruit thinning by comparing chemical thinning and manual selective thinning. Selective fruit thinning can minimize the variations of chemical thinning but requires manual labor and appropriate training – an added expense to growers. This three-year, \$422,955 USDA-NIFA-AFRI grant will investigate the forces required to remove green fruit and the development of an appropriate robotic mechanism for mechanized fruit thinning. This work was supported by the USDA National Institute of Food and Agriculture and Smith-Lever Appropriations.

#### **Sensor-Based Precision Irrigation System for Tree Fruit and Vegetable Crops (He)**

A soil moisture-based irrigation system was tested in a research orchard and four commercial apple orchards. Irrigation events were scheduled based on the soil moisture data that was accessed remotely. The system enabled one of the cooperators to adjust irrigation schedules to conserve water and the energy required to operate the system. Additionally, a new precision irrigation system was developed with a long-range wide area network (LoRaWAN) internet of things platform. The system controls irrigation valves remotely and may be automated to operate independently based on sensor readings. This system was tested in a tomato field and a peach orchard. This project is supported by a three-year, \$199,936 Northeast SARE grant.

#### **Sensor-Based Automated Irrigation Webinars (He, Weber)**

The Northeast SARE grant supported a series of three educational workshops held in May. These workshops introduced attendees to irrigation principles, automation principles, existing technology that can be deployed and what that technology measures, and how to deploy these systems in the field for orchards, vineyards, and vegetable and greenhouse/high-tunnel production. Originally planned as in-person workshops, these three webinars attracted 115 unique viewers, 20 of which attended two or more meetings, from across the state and surrounding region.

#### **An Intelligent Spraying System for Tree Fruit Crops Pest Management: Technology Enhancement, Evaluation, and Outreach (He)**

A series of tests were conducted in 2019-2020 to measure the apple tree canopy structure and density using a 3D Lidar sensor. The canopy density maps generated from the sensor provide structural information for precision pesticide spraying in the orchard. An intelligent sprayer with targeted spraying was tested at the Fruit Research and Extension Center and will be further evaluated in the orchards in 2021 for significant pest

management. Continuing work for this three-year, \$199,839 USDA-NIFA-CPPM grant will refine the canopy measurement system and improve the intelligent sprayer's pest management capabilities in production orchards. This work was supported by the USDA National Institute of Food and Agriculture and Smith-Lever Appropriations.

#### **Advancing Robotic Approaches to Pollination for Improved Yield and Quality in Fruit Crops (He)**

The project aims to develop a robotic system for selective pollination for apple trees. An algorithm is being developed to detect and identify apple blossoms at a suitable stage of development for successful pollination. This three-year, \$358,253 USDA-AMS grant will also develop a robotic pollination end-effector to successfully apply pollen to the receptive stigma. This research is supported by the USDA Agricultural Marketing Service.

#### **Precision Crop Load Management for Apples (He)**

This four-year, \$347,002 USDA-NIFA-SCRI sponsored project aims to develop robotic solutions for improved tree fruit yield and quality. The principal focus has been robotic branch pruning for apple trees. A novel cutting end-effector was designed and integrated with a cartesian manipulator. This device has been successfully cutting branches up to 25 mm diameter at wide range of orientations. To reach the appropriate branches, an algorithm was developed to create a collision-free path for pruning with a six degrees of freedom robotic manipulator. Initial trials of this system should begin in 2021. This work was supported by the USDA National Institute of Food and Agriculture and Smith-Lever Appropriations.

#### **Integrated Design of Sensing, Networks, and Cooperative Control of Multi-Vehicle Systems for Preventing Frost and Freeze Damage to Flowers and Buds of Fruit Trees (He)**

The two frost/freezing events that resulted in significant losses for Pennsylvania growers in 2020 demonstrate the need for adequate frost control/prevention methods or mechanisms. An NSF-CPS grant has provided funding towards the development of an autonomous ground vehicle-based heating system that can be deployed in orchards in advance of frost events. This research is in its initial stages of development: a propane heater was used to increase the tree canopy temperature in the spring season and air temperatures within the tree canopy were measured with a series of thermal sensors placed in a tree row. The goal of this \$843,329 NSF-CPS research is to develop a system whereby sensors deployed throughout the orchard will provide thermal data for directing the movement of an autonomous ground vehicle with a mounted heating system during a frost event. If successful, these systems will target areas most at risk completely autonomously, without grower intervention save to monitor the fuel levels of the vehicles.

#### **A Harvest-Assist System for Tree Fruit Growers: Performance Analysis, Workforce Development, and Product Enhancement (He, Weber)**

This three-year, \$95,874 Pennsylvania Department of Agriculture-funded project aims to introduce a harvest-assist system to Pennsylvania tree fruit growers with field trails and system enhancement. In preliminary trials in Michigan conducted in the fall of 2019, this system demonstrably increased per-worker harvest efficiency. Based on the improvements observed, these systems are projected to save growers labor costs through reduced crew sizes and more rapid harvest of crops. This system was to be tested in Pennsylvania in 2020, to determine whether or not similar performance gains are to be observed under the hilly/mountainous terrain found in the state's primary apple growing regions. Due to the COVID-19 pandemic and associated issues with availability of labor and the need to maintain worker safety, the field trial was delayed to the 2021 harvest season when it is hoped conditions will be more favorable for interacting with the operating crews.

### **Team Goal 3: Support for New, Young, Minority, and Underserved Growers and Communities Young Grower Alliance (Seifrit, Weber)**

This year the Young Grower Alliance (YGA) added 11 new individuals to their mailing list, now totaling 401 subscribers. Growers who took part in YGA events value the programming: 7% of growers have estimated the value of that programming as worth between \$50 - \$100 annually; 14% of growers have estimated the value between \$100 - \$500; 28.5% have estimated the value between \$500 - \$2000; finally, an additional 8.5% have estimated that YGA programming is worth more than \$2000 annually. In 2020, the YGA received \$5,000 from SHAP in the form of an Extension project grant, representing the sixteenth year of continuing support from SHAP for this program.

#### **YGA Fall Tour (Seifrit, Weber)**

The YGA sponsors at least two tours of regional farms, nurseries, or other industry-related businesses annually. In the fall of 2019, 49 people attended the “Diversification in a Horticultural Business” hosted by three Adams County area businesses. A post-event evaluation revealed that 17 respondents (n=32) were first-time attendees of a YGA event, and a large contingent of participants originated from out of state, demonstrating the impact these events have on not only Pennsylvania growers but growers throughout the region. The “young” in YGA was borne out by the results of this evaluation: 60% (18 of 31 responses) have fewer than five years of involvement in full-time horticultural production, with 22% (7) reporting less than one year. The audience was diverse with respect to industry representation: 50% of the attendees reported working in crop production-allied positions such as management and marketing.

#### **COVID-19 and YGA Programming (Seifrit, Weber)**

COVID-19 negatively impacted YGA programming in 2020. A YGA-sponsored international trip to Interpoma 2020, scheduled for early November in Bolzano, Italy, was cancelled due to restrictions on international travel and out of concern for the safety of YGA members. The cancellation of this trip was a blow to the 20+ members who had expressed interest in attending. Those who have attended Interpoma previously report that it provides unique insights into industry trends, and helps international growers evaluate cutting edge production technology. Funds devoted the trip, some provided through a grant from the State Horticultural Association of Pennsylvania, will be held in reserve for the next opportunity once normal international travel resumes.

#### **The Pennsylvania Farm Show Educates the Truly Young Grower (Seifrit)**

Penn State Extension, alongside industry professionals, constructed the AgExplore Learning Booth station, which serviced over 500 visitors – mostly school children – within its first day of opening. Unfortunately, exact attendance is impossible to determine due to the handouts printed (500 copies of a single item) running out within the first day and being resupplied on-demand throughout the length of Farm Show.

#### **Tree Fruit Training and Self-Paced Learning Resources in English and Spanish (Baugher, Gorgo)**

Extension educators have produced videos, on-line courses, and other tools to assist growers in their employee training efforts. Young and beginning growers will also find the resources useful for self-paced learning. A focus for 2019-20 was orchard safety. Visit <https://extension.psu.edu/tree-fruit-training-and-self-paced-learning-resources-in-english-and-spanish> for this program.

#### **Penn State Extension Latinx Outreach Strategic Planning (Baugher, Gorgo, Seifrit, Weber)**

Team members assisted with the coordination of a Penn State Extension Latinx Outreach Strategic Planning Meeting in 2019. The goal was “to help Latinx growers achieve quality agricultural production,



experience satisfaction in their workplaces, and enjoy a high quality of life.” Planners brought together Latinx leaders for a morning focus group to discuss the needs of the community and their understanding of the role of Extension. For the rest of the day, the leaders were joined by Penn State Extension faculty, staff, and students who are committed to Latinx community engagement. Educators presented information on Penn State Extension needs assessments and programming efforts, along with the importance of promoting diversity in the College of Agricultural Sciences. For the remainder of the two-day meeting, breakout groups explored 1) Values and Identities in Extension/Latinx Interactions, 2) Needs of Latinx Communities, and 3) Extension Strategies for Engaging and Providing Programming for Latinx Communities. An Executive Summary with proposed actions steps was developed by College-wide review in 2020.

#### **Mid-Atlantic Fruit and Vegetable Convention Spanish Session (Baugher, Seifrit, Gorgo, Peter)**

For the 11th year, a full day of sessions in Spanish was conducted during the Mid-Atlantic Fruit and Vegetable Convention. Presentations were interactive and included: 1) Classroom Practicum on Fruit Pests, Diseases, and Beneficials, 2) Lab Practicum on Assessing Soil Health, 3) Equipment Safety Demonstration, 4) Applied Pruning Techniques – Long Pruning vs. Short Pruning for High Density Apple Plantings, and 5) Understanding the Basic Principles of Blossom/Fruitlet Thinning and the Reasons and Benefits of Early Crop Load Management. There were 40 participants, and 26 completed a post-program survey, including 21 from PA, 3 from MD, 1 from NJ, and 1 from VA. Planned adoptions included practices for managing crop load in tree fruit, pruning fruit trees, early pathogen/pest detection, soil health evaluation, and equipment safety. Forty-seven percent said that the farms where they work could increase profits from what they learned at this session. Participants said that extension programs have improved their horticultural skills, taught them to use new IPM practices, led to the improvement of the quality of produce harvested, taught them to use better pesticide management strategies, and led them to use new practices to increase food safety.

#### **Winter Commercial Fruit School Concurrent Session in Spanish (Baugher)**

Forty-five adult learners participated in a half-day commercial fruit school session in Spanish. Thirty participants completed a post-program survey. Seventy percent indicated the farm where they work could increase its profits through the implementation of new practices introduced during the workshop. Practices included early detection of insects and diseases in orchards and preventing the introduction of spotted lanternfly.

#### **Webinars on Protecting Agricultural Employee Health during COVID-19 (Baugher, Weber, Gorgo)**

In cooperation with agricultural employee health providers, Penn State Law, and farm human resource managers, the tree fruit and community vitality teams conducted five live webinars on best practices to protect agricultural employee health, employer compliance with agricultural employee legal requirements, and modifications to seasonal employee housing during COVID-19. The five webinars were attended by 331 uniquely identifiable individuals, with 63 individuals attending two or more webinars. Secretary of Agriculture Russell Redding led the final forum on July 30th, and recorded webinars and handouts are on-line. In a follow-up evaluation conducted in October, twenty-three people responded, expressing that the potential increase in revenue due to what they learned ranged from \$5,000 to over \$50,000 for each of their operations.

#### **Resources to Protect Agricultural Employee Health During COVID-19 (Baugher, Gorgo)**

The tree fruit team coordinated a collaborative effort to develop new posters and pamphlets in English and Spanish to communicate best practices and health services for agricultural employee protection from COVID-19. The new resources address Key Point #6 of the CDC and U.S. Department of Labor interim

guidance for agricultural workers and employers: “Basic information and training about infection prevention should be provided to all farmworkers in languages they can understand.” The educational materials are downloadable from the Penn State Extension website, and print copies were distributed by agricultural employee health providers, produce auctions, and extension educators.

#### **Latinx Agricultural Network Facebook Page (Gorgo, Baugher)**

The Penn State Extension tree fruit team is a leader in the Latinx Agricultural Network, which has been developing innovative educational formats in Spanish for providing timely resources to life sustaining ag businesses. Team members coordinate a new *Penn State Extension Agricultura en Español* Facebook page with the mission of providing science-based information on agricultural production, food safety, and workplace safety and a new hotline in Spanish for reporting timely crop recommendations. Total Facebook reach during the first five months was over 130,000. The post with the greatest reach (2,477 on June 26) was *Penn State Extension – Your Source for Agriculture Information / Penn State Extension – Su Fuente de Información sobre la Agricultura*. This article outlined how to access Penn State Extension’s many resources online with links to important agricultural topics.

#### **Pennsylvania Farm Employers’ Listserv (PFEL) Discussion Group (Baugher, Weber, Gorgo)**

Penn State Tree Fruit Team educators cooperated with the Penn State Center for Agricultural and Shale Law to create a Pennsylvania Farm Employers’ Listserv (PFEL) discussion group. The PFEL is an email networking and resource-sharing group specifically tailored to agricultural labor issues for those with human resources responsibilities at agricultural operations. In this forum, farm employers exchange information and resources to better prepare them to do their jobs confidently and efficiently, keep up on the latest news and developments, and learn how to best comply with legal requirements from state and federal laws and agencies. The list currently has 73 registered users.

#### **Meeting Plain Community Needs (Ford, Esslinger, Elkner, Seifrit, Muza, Weber)**

As meeting restrictions instituted to stifle the spread of the novel coronavirus curtailed in-person programming, many members of the estimated 54 plain communities in Pennsylvania were left without resources they depend upon to receive annual training and education, pesticide renewal credits, and updates on current growing conditions. A conservative estimate by knowledgeable Extension educators places the number of Amish tree fruit growers in the state at around 400 individuals, with an additional 250 growers who are part of the Mennonite, Old Order Mennonite, or German Baptist sects. Educator site visits indicate that the average size of an individual tree fruit orchard is just over five acres, suggesting that there are over 3250 acres of tree fruit under cultivation by members of the various plain communities. If fruit is not sold directly on the premises, these growers will most likely sell their produce in one of the 16 Pennsylvania auction houses, resulting in an estimated \$6,000,000 in sales.

The challenges associated with addressing the educational needs of communities that eschew mass communication technologies are not insignificant. The meetings restrictions also highlighted the shortcoming of over-reliance on face-to-face communication to address not only educational concerns, but legal ones as well, particularly in the form of awarding Pennsylvania Department of Agriculture pesticide applicator license renewal credits. What follows are descriptions of several (among many) efforts made to reach the plain communities after the COVID-19 meeting restrictions were put into place.

#### **Direct Plain Community Support (Ford, Esslinger, Elkner, Seifrit, Muza, Weber)**

Fifteen one-on-one orchard visits were conducted in Mifflin and Juniata Counties with Amish producers, with additional numbers of undocumented visits in other regions of the state. These Amish growers cannot

own or utilize computers, smart phones, or other technologies that are frequently relied upon by Extension for disseminating information across the State. One-on-one farm visits are frequently conducted at these orchards to diagnose insect/mite, disease, or cultural problems that may impact fruit quality and overall farm profitability. Programmatic impact is often difficult to quantify, but each grower indicated a willingness to implement the educator's recommendations. Subsequent repeat visits to some of these Amish producers indicated that the producers had pruned out fire blight infections, tested for nematodes, and explored nematode management options.

#### **A Field Guide to Tree Fruit Disorders, Pests, and Beneficials (The Tree Fruit Team & Pesticide Education)**

During strategic planning sessions addressing pandemic priorities, the team identified the need for a full color pocket guide to assist growers in identifying and managing tree fruit diseases, pests, and physiological disorders. The guide provides field support during times when Extension educators cannot conduct site visits due to COVID-19 and can serve as a science-based reference for sustainable management recommendations provided remotely. The effort was supported by a PDA-USDA NIFA Specialty Crop Block Grant for underserved horticultural producers. Educators delivered copies of the guide to produce auctions and also have copies available for mailing to growers with an interest in learning basic orchard scouting principles. In some cases, key leaders were provided copies of the publication to distribute to growers in their communities where Extension may not have a pre-existing relationship. This work was supported by the USDA National Institute of Food and Agriculture and Smith-Lever Appropriations.

#### **Auction House Educational Kiosks**

Multiple teams at Penn State produce "hardcopy" educational content which is made available at the sixteen auction houses via kiosks. This includes posters detailing common disease or insect pests, cultural recommendations, etc. To help spread information about public safety and the coronavirus, bulk copies of the resources to protect agricultural health were distributed free of charge to these locations by educators.

#### **The Revised 1-800 PENN IPM Hotline (Weber, Peter, Krawczyk, Crassweller)**

The 1-800 PENN IPM (integrated pest management) hotline was created in the late 1990s for callers to listen to pre-recorded messages regarding current growing conditions and disease/insect pressure outlooks. This service was utilized most heavily by the plain community. The tree fruit team led the way in expanding the capacity of this service by creating a dedicated tree fruit menu with dedicated message boxes for entomology, pathology, and horticulture/physiology (among others). Other disciplines of the horticulture team using this service revised their system to mirror the new configuration. Launched in June, by the end of September messages recorded by the tree fruit team were listened to 237 times, with 2,260 messages played throughout the entire system. At 90 seconds apiece, this is nearly 6 hours' worth of educational content delivery from the tree fruit team and 56 hours across all disciplines.

Over 3,500 copies of a targeted mailing flier were mailed to members of the plain community and delivered to the auction houses. An additional 100 per Extension office were printed to be distributed to growers directly. A 45% increase in callers to the tree fruit line was observed following this advertising campaign.

#### **The Pennsylvania Farm Show Reaches the Public and Raises Funds for Research (Seifrit, Weber, Baugher)**

During the 2019-2020 program year, the Tree Fruit team committed serious manpower efforts to the production of the Pennsylvania Farm Show, specifically the Pennsylvania Apple Exhibition sales booth, Food Court Stand, and AgExplore Learning Station. Extension helps coordinate volunteers, assists in the production the educational content, and oversees the fruit judging competition for the apple exhibit. Additionally,

Extension team members volunteer to assist with the organization and operation of the SHAP sales area. The exhibition floor sales booth and food court sales area grossed over \$140,000 in profits, which is used to fund the annual SHAP research and Extension grant competition.

#### Pilot Project to Assess Testing and Certification Methods to Improve Cross-Cultural Comprehension (Baugher, Gorgo)

A pre-certification short course in Spanish was conducted on December 4 – 5, 2019, and practice exams were administered in both English and Spanish. Program participants completed a post-program survey to provide suggestions on improving cross-cultural comprehension of the exams. Ninety-three percent (n=32) recommended that professional certification exams be offered in both Spanish and English. Participants also shared ideas on making exams in English less confusing for non-native speakers, e.g., providing more clarification for differences between multiple choice answers, avoiding terms with multiple meanings, and making questions more practical. (This program was a cooperative effort of Penn State Extension and The Pennsylvania Department of Agriculture.)

#### Publications and Invited Talks

During this program year, team members were authors or co-authors on 46 peer-reviewed publications and three major reference works relating to this program's focus. The team also provided 58 articles to *Pennsylvania Fruit News* and 76 articles for *Fruit Times*, wrote sixteen articles in Spanish for Pennsylvania's growing Latinx population, and gave 119 invited talks at conferences and workshops throughout the region.

#### Peer-Reviewed Journals

Alford, A., Kuhar, T. P., Hamilton, G. C., Jentsch, P., **Krawczyk, G.**, Walgenbach, J. F., & Welty, C. (2020).

Baseline toxicity of the insecticides bifenthrin and thiamethoxam on *Halyomorpha halys* (Hemiptera: Pentatomidae) collected from the eastern United States. *Journal of Economic Entomology*, 113(2), 1043–1046. <https://doi.org/10.1093/jee/toz361>

Caliskan-Aydogan, O., Yi, H., **Schupp, J. R.**, Choi, D., Heinemann, P. H., & Puri, V. M. (2020). Thermal properties of 'Gala' apples during growing season for predicting harvest time. *Transactions of the ASABE*, 63(2), 305–315. <https://doi.org/10.13031/trans.13417>

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Clifton, E. H., Hajek, A. E., Jenkins, N. E., Roush, R. T., Rost, J. P., & **Biddinger, D. J.** (2020). Applications of *Beauveria bassiana* (Hypocreales: Cordycipitaceae) to control populations of spotted lanternfly (Hemiptera: Fulgoridae), in semi-natural landscapes and on grapevines. *Environmental Entomology*, 49(4), 854–864. <https://doi.org/10.1093/ee/nvaa064>

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#### Peer-Reviewed Journals

- Alford, A., Kuhar, T. P., Hamilton, G. C., Jentsch, P., **Krawczyk, G.**, Walgenbach, J. F., & Welty, C. (2020). Baseline toxicity of the insecticides bifenthrin and thiamethoxam on *Halyomorpha halys* (Hemiptera: Pentatomidae) collected from the eastern United States. *Journal of Economic Entomology*, 113(2), 1043–1046. <https://doi.org/10.1093/jee/toz361>
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- Castro, J., & **Peter, K. A.** (2019). Investigating sources for postharvest apple rot fungi in the field and packhouse: Conceptual framework and preliminary results. *Proceedings of the 95<sup>th</sup> Annual Cumberland-Shenandoah Fruit Workers Conference*, 52–56.
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<https://doi.org/10.1016/j.biosystemseng.2020.05.015>
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- Zhang, X., **He, L.**, Karkee, M., Whiting, M. D., & Zhang, Q. (2020). Field evaluation of targeted shake-and-catch harvesting technologies for fresh market apple. *Transactions of the ASABE*, 63(6), 1759–1771. <https://doi.org/10.13031/trans.13779>
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<https://doi.org/10.1016/j.biosystemseng.2020.03.006>

### Major Reference Works

Reference works are major publications dealing with a subject in great detail, typically published in book form. Team members produced three reference works in the last year that have proven to be very popular and have drawn national attention. In the fall of 2020, the American Society for Horticultural Science recognized the *2020-2021 Penn State Tree Fruit Production Guide* as an outstanding and innovative Extension product significantly contributing to the commercial horticultural industry by awarding it the national Educational Materials Award – Extension Division.

**Baughner, T. A., Crassweller, R. M., Ford, T. G., Goodrow, G., Krawczyk, G., Peter, K. A., Seifrit, D., & Weber, D. E. (2020).** *A field guide to tree fruit disorders, pests and beneficials*. The Pennsylvania State University.

**Crassweller, R. M., Krawczyk, G., Peter, K. A., Marini, R. P., Schupp, J. R., Biddinger, D. J., López-Uribe, M., He, L., Heinemann, P., Harper, J. K., Kime, L. F., Kephart, K., Pifer, R. H., Brittingham, M. C., Baughner, T. A., Ford, T. G., Weber, D., Johnson, J., Crow, E., ... Kelley, K. M. (2020).** *Penn State tree fruit production guide: 2020-2021* (R. M. Crassweller, Ed.). Pennsylvania State University.

Hopwood, J., Rajotte, E., Gill, K., Vaughan, M., Lee-Mader, E., May, E., Code, A., Joshi, N., & **Biddinger, D.** (2020). *Managing eastern apple orchards for pollinators and other beneficial insects*. The Pennsylvania State University and The Xerces Society for Invertebrate Conservation.

### Pennsylvania Fruit News

The *Pennsylvania Fruit News* is a publication of the State Horticultural Association of Pennsylvania (SHAP). While not peer reviewed, it is where research reports are published for all SHAP-supported research. References to these articles are given here to represent the “hidden” work of the researchers and educators since there is no place in which to include them and they are certainly not “Popular Media”. There were 58 articles in *Pennsylvania Fruit News* from October 1, 2019, to September 30, 2020.

**Baughner, T. A. (2020).** Protecting essential agricultural business operations and employee health during the COVID-19 pandemic. *Pennsylvania Fruit News*, 100(6), 11.

**Baughner, T. A., Crassweller, R. M., Peter, K. A., Krawczyk, G., Ford, T., Weber, D. E., & Seifrit, D. (2020).** New orchard field guide from the Penn State tree fruit team. *Pennsylvania Fruit News*, 100(8), 13.

**Baughner, T. A., & Gorgo, M. (2019).** Penn State Extension to offer private applicator training in Spanish. *Pennsylvania Fruit News*, 99(9), 21.

**Baughner, T. A., & Gorgo, M. (2020).** Webinar recordings and handouts for protecting agricultural employee health during COVID-19. *Pennsylvania Fruit News*, 100(6), 14.

**Baughner, T. A., Gorgo, M., & Seifrit, D. (2019).** Mario Miranda Sazo to lead interactive trainings during the Spanish session at the Mid-Atlantic Fruit & Vegetable Convention. *Pennsylvania Fruit News*, 99(11), 16.

**Baughner, T. A., Gorgo, M., & Weber, D. E. (2020).** PA Secretary of Agriculture Redding provides guidance on COVID-19 workplace protection. *Pennsylvania Fruit News*, 100(6), 12.

Castro, J., & **Peter, K. A. (2020).** Investigating and understanding different sources for fruit rot fungi in the packhouse and field to better control postharvest decay of stored apple. *Pennsylvania Fruit News*, 100(1), 29–31.

Choi, D., **Schupp, J. R., Baughner, T. A., & He, L. (2020).** Evaluation of effective canopy depths of apple trees for optimal machine sensing performance – Year 2/2. *Pennsylvania Fruit News*, 100(1), 39–41.

**Crassweller, R. M. (2019a).** Changes in regulations in the use of paraquat herbicide products & possible alternatives. *Pennsylvania Fruit News*, 99(9), 12–13.

- Crassweller, R. M.** (2019a). Editorial views: Planning for the coming year. *Pennsylvania Fruit News*, 99(9), 4–5.
- Crassweller, R. M.** (2019b). Editorial views: 2020 Hershey educational program. *Pennsylvania Fruit News*, 99(10), 2–4.
- Crassweller, R. M.** (2019c). Editorial views: The future of fruit meetings? *Pennsylvania Fruit News*, 99(11), 4.
- Crassweller, R. M.** (2020a). Editorial views: 2020 ! *Pennsylvania Fruit News*, 100(1), 4.
- Crassweller, R. M.** (2020b). Editorial views: Strange beginning to the growing season. *Pennsylvania Fruit News*, 100(2), 4.
- Crassweller, R. M.** (2020c). Editorial views: Zooming to go telecommuting. *Pennsylvania Fruit News*, 100(3), 2–4.
- Crassweller, R. M.** (2020d). Editorial views: 8 weeks & counting. *Pennsylvania Fruit News*, 100(4), 4.
- Crassweller, R. M.** (2020e). Editorial views: The new way of life? *Pennsylvania Fruit News*, 100(5), 4.
- Crassweller, R. M.** (2020f). Editorial views: Mid-summer observations. *Pennsylvania Fruit News*, 100(6), 4.
- Crassweller, R. M.** (2020g). Editorial views: “Bits and Pieces.” *Pennsylvania Fruit News*, 100(7), 4.
- Crassweller, R. M.** (2020h). Editorial views: The new reality at Penn State under Covid-19. *Pennsylvania Fruit News*, 100(8), 4.
- Crassweller, R. M., Kime, L., & Smith, D.** (2020). Orchard architecture effects on yield and economics of two apple cultivars. *Pennsylvania Fruit News*, 100(6), 16.
- Crassweller, R. M., & Olmstead, D.** (2020). Extending Cornell carbohydrate model to Pennsylvania growers for determining apple tree response to chemical thinners for 2019. *Pennsylvania Fruit News*, 100(2), 31.
- Crassweller, R. M., & Smith, D.** (2020a). Conversion of training systems to a hedgerow. *Pennsylvania Fruit News*, 100(1), 37–38.
- Crassweller, R. M., & Smith, D.** (2020b). Third generation apple systems trials. *Pennsylvania Fruit News*, 100(1), 36–37.
- Crassweller, R. M., Smith, D., & Pacy, D.** (2020). 2019 apple rootstock trials at Rock Springs. *Pennsylvania Fruit News*, 100(1), 47–49.
- Ford, T., Gorgo, M., Baugher, T. A., & Weber, D. E.** (2020). COVID-19 resource recommendations. *Pennsylvania Fruit News*, 100(2), 10.
- Gill, C. (2019). Penn State Fruit Research and Extension Center to stay under Harper’s leadership. *Pennsylvania Fruit News*, 99(10), 17.
- Gill, C. (2020). New Ag Engineering fabrication shop ready to enhance Penn State Fruit Research. *Pennsylvania Fruit News*, 100(7), 15.
- Grabenstein, A. (2019). Ground broken for new Ag Engineering shop at Fruit Research and Extension Center. *Pennsylvania Fruit News*, 99(10), 18.

- Harper, J.** (2020). Penn State FREC update. *Pennsylvania Fruit News*, 100(3), 14.
- He, L., Choi, D., Schupp, J. R., & Baugher, T. A.** (2020). A sensor-based irrigation test system for apple orchards (final report). *Pennsylvania Fruit News*, 100(1), 24–26.
- He, L., Schupp, J. R., Choi, D., & Weber, D. E.** (2020). Branch and fruit accessibility for mechanical operations with various tree canopies (Year 1 Report). *Pennsylvania Fruit News*, 100(1), 22–24.
- Imgrund, J., & **Baugher, T. A.** (2019a). Respirator fit testing will be available at MAFVC. *Pennsylvania Fruit News*, 99(9), 15.
- Imgrund, J., & **Baugher, T. A.** (2019b). Respirator fit testing will be available at MAFVC. *Pennsylvania Fruit News*, 99(11), 17.
- Johnson, J., Pollock, R., & Branstetter, K. (2020). 2019 evaluation of spray deposition for effective pest control and air blast sprayer calibration for PA growers. *Pennsylvania Fruit News*, 100(2), 33.
- Krawczyk, G.,** Peterson, H., Rice, H., & Winzeler, E. H. (2020). Insecticide treated nets as an alternative tool to manage Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål.). *Pennsylvania Fruit News*, 100(1), 20–22.
- LaJeunesse, S. (2019). Dana Choi, Assistant Professor of Agricultural and Biological Engineering. *Pennsylvania Fruit News*, 99(9), 17.
- Marini, R. P.** (2020). Are apples blooming earlier than in the past? *Pennsylvania Fruit News*, 100(8), 17–20.
- Marini, R. P.,** & Demchak, K. (2020). Soil amendments for blueberry plant establishment and variety trial. Progress report for the fifth and final year of requested funds. *Pennsylvania Fruit News*, 100(1), 41–43.
- Martin, P., Pierce, K., Thomas, C., Krawczyk, T., Lehman, B., & **Peter, K. A.** (2020). Completing the picture: Characterizing bitter rot fungal isolates in the lab and field. *Pennsylvania Fruit News*, 100(1), 33–35.
- Mulhollem, J. (2020). Novel cutting mechanism devised for automated, aobotic apple tree pruning systems. *Pennsylvania Fruit News*, 100(7), 22–23.
- Peter, K. A.** (2020). Investigating the role of viruses and other causes in Rapid Apple Decline. *Pennsylvania Fruit News*, 100(1), 31–33.
- Peter, K. A.,** McNellis, T., Lehman, B., & Sinn, J. (2020). Optimizing fire blight control alternatives: Non-antibiotic blossom protection and full season shoot blight management. *Pennsylvania Fruit News*, 100(1), 27–29.
- Peter, K. A.,** & **Seifrit, D.** (2020). Dr. Tree Fruit and Don podcast. *Pennsylvania Fruit News*, 100(7), 19.
- Peterson, H., & **Krawczyk, G.** (2020). Utilizing the samurai wasp as a potential control tool against brown marmorated stink bug. *Pennsylvania Fruit News*, 100(1), 16–18.
- Schupp, J. R.** (2020). Blossom thinning Pennsylvania apples using the pollen tube growth model. *Pennsylvania Fruit News*, 100(1), 46–47.

- Schupp, J. R., He, L.,** Winzeler, H. E., Schupp, M. A., & Clowney, M. (2020). Improving orchard performance with terrain analysis using drone technology and geographical information systems. *Pennsylvania Fruit News*, 100(1), 45–46.
- Schupp, J. R.,** Schupp, M. A., & Winzeler, H. (2020). Effect of rootstock & tree density on growth & yield of Coralstar peach trees. *Pennsylvania Fruit News*, 100(8), 20.
- Schupp, J. R.,** Winzeler, H. E., & Schupp, M. A. (2020). Effect of rootstock and in-row tree spacing on performance of Coralstar peach trees. *Pennsylvania Fruit News*, 100(1), 49–50.
- Seifrit, D., Weber, D. E., & Baugher, T. A.** (2020). The next generation of fruit growers—Building leadership and coalitions. *Pennsylvania Fruit News*, 100(2), 27.
- Seifrit, D., Weber, D. E., & Schupp, J. R.** (2020). High density pear tours. *Pennsylvania Fruit News*, 100(2), 28.
- Sommer, H. J., & **Crassweller, R. M.** (2020). Buy-and-fly orchard management using unmanned aircraft (UA). *Pennsylvania Fruit News*, 100(2), 22–23.
- Walsh, C. S., Bissett, A. E., Hunt, K. W., **Baugher, T. A., Weber, D. E., & Young, N. J.** (2020). Monitoring and utilizing fruit maturity to improve harvest decisions of new apple cultivars and reduce storage disorders of Honeycrisp. *Pennsylvania Fruit News*, 100(2), 24–26.
- Weber, D. E.** (2019). The Ag Issues Breakfast featuring guest speaker Secretary Russell C. Redding. *Pennsylvania Fruit News*, 99(11), 10.
- Weber, D. E., & Crassweller, R. M.** (2020). Vote for the 2021 Mid-Atlantic tree fruit speakers and topics. *Pennsylvania Fruit News*, 100(4), 24.
- Weber, D. E., & Gorgo, M.** (2020). Penn State Extension and the COVID-19 crisis. *Pennsylvania Fruit News*, 100(2), 13–14.
- Weber, D. E., He, L., & Huang, M. J.** (2020). Preliminary evaluation of the ‘Cyclone’ harvest-assist platform. *Pennsylvania Fruit News*, 100(2), 29–30.
- Winton, S., Lamo, T., **Baugher, T. A., & Seifrit, D.** (2019). Cultivate leadership: Sowing seeds of success in your specialty crop enterprise. *Pennsylvania Fruit News*, 99(11), 17.

#### Invited Talks and Conference Presentations

The following is a list of professional presentations given by members of the tree fruit team. The informational content of these talks, and the effort that goes into preparing them deserve to be noted in an annual program summary. There were 119 invited talks.

- Biddinger, D. J.** (2020a, January 27). *Pesticide stressors of bees*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Biddinger, D. J.** (2020b, January 27). *Pollination services in tree fruit*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Biddinger, D. J.** (2020c, February 18). *Can you rely on wild bees for pollination of your tree fruit*. Lancaster & York Counties Winter Commercial Tree Fruit School, Lancaster, PA.



- Biddinger, D. J.** (2020d, February 18). *Secondary pest control in apple – Rosy apple aphid, San Jose scale, woolly apple aphid, and mites*. Lancaster & York Counties Winter Commercial Tree Fruit School, Lancaster, PA.
- Biddinger, D. J.** (2020e, February 18). *Spotted lanternfly control & update*. Lancaster & York Counties Winter Commercial Tree Fruit School, Lancaster, PA.
- Biddinger, D. J.,** Leach, H., Zhu, F., Urban, J. M., & Hajek, A. (2019, November 17). *Controlling spotted lanternfly with insecticides and biopesticides in fruit crops and possible impacts on pollinators and other non-target insects*. 2019 Entomological Society of America Annual Meeting, St. Louis, MO.
- Biddinger, D. J.,** Rajotte, E., & Leach, H. (2020, March 9). *Challenges of integrated pest management (IPM) in high value commodities*. 90<sup>th</sup> Eastern Branch Entomological Society of America Annual Meeting, Blacksburg, VA.
- Castro, J., & **Peter, K. A.** (2019, December 5). *Investigating sources for postharvest apple rot fungi in the field and packhouse: Conceptual framework and preliminary results*. Cumberland-Shenandoah Fruit Workers Conference, Winchester, VA. <http://csfwc.grapepathology.org/2019-95th-meeting>
- Castro, J., & **Peter, K. A.** (2020, January 30). *Sources of apple rot fungi in packing houses*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Crassweller, R. M.** (2019a, December 10). *Herbicide Weed Control Strategies in Orchards*. New England Vegetable & Fruit Conference, Manchester, NH.
- Crassweller, R. M.** (2019b, December 10). *How to Raise Fruit in a Changing Climate*. New England Vegetable & Fruit Conference, Manchester, NH.
- Crassweller, R. M.** (2020a, January 29). *What do we know about the Geneva rootstocks?* Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Crassweller, R. M.** (2020b, February 11). *Identifying and avoiding herbicide injury and the uses of burndown herbicides*. Central Susquehanna Winter Commercial Tree Fruit School, Mifflinburg, PA.
- Crassweller, R. M.** (2020c, February 11). *Updates on fruit cultivars and rootstocks – Good and bad points*. Central Susquehanna Winter Commercial Tree Fruit School, Mifflinburg, PA.
- Crassweller, R. M.** (2020d, February 12). *Identifying and avoiding herbicide injury and the uses of burndown herbicides*. Northeast Winter Commercial Tree Fruit School, Dupont, PA.
- Crassweller, R. M.** (2020e, February 12). *Updates on fruit cultivars and rootstocks – Good and bad points*. Northeast Winter Commercial Tree Fruit School, Dupont, PA.
- Crassweller, R. M.** (2020f, February 13). *Identifying and avoiding herbicide injury and the uses of burndown herbicides*. Southeast Region Winter Commercial Tree Fruit School, Leesport, PA.
- Crassweller, R. M.** (2020g, February 13). *Updates on fruit cultivars and rootstocks – Good and bad points*. Southeast Region Winter Commercial Tree Fruit School, Leesport, PA.
- Crassweller, R. M.** (2020h, February 17). *Identifying and avoiding herbicide injury and the uses of burndown herbicides*. Adams County Winter Commercial Tree Fruit School, Biglerville, PA.

- Crassweller, R. M.** (2020i, February 17). *Updates on fruit cultivars and rootstocks – Good and bad points.* Adams County Winter Commercial Tree Fruit School, Biglerville, PA.
- Crassweller, R. M.** (2020j, February 18). *Identifying and avoiding herbicide injury and the uses of burndown herbicides.* Lancaster & York Counties Winter Commercial Tree Fruit School, Lancaster, PA.
- Crassweller, R. M.** (2020k, February 18). *Updates on fruit cultivars and rootstocks – Good and bad points.* Lancaster & York Counties Winter Commercial Tree Fruit School, Lancaster, PA.
- Crassweller, R. M.** (2020l, February 19). *Evaluation of Asian Pear Cultivars.* 2020 Ontario Fruit and Vegetable Convention, Niagara Falls, Ontario, Canada.
- Crassweller, R. M.** (2020m, February 19). *Identifying and avoiding herbicide injury and the uses of burndown herbicides.* Franklin County Winter Commercial Tree Fruit School, St. Thomas, PA.
- Crassweller, R. M.** (2020n, February 19). *Updates on fruit cultivars and rootstocks – Good and bad points.* Franklin County Winter Commercial Tree Fruit School, St. Thomas, PA.
- Crassweller, R. M.** (2020o, February 20). *How to Produce Apples in a Changing Climate.* 2020 Ontario Fruit and Vegetable Convention, Niagara Falls, Ontario, Canada.
- Crassweller, R. M.** (2020p, February 20). *Orchard Nutrition for Achieving Optimum Yields.* 2020 Ontario Fruit and Vegetable Convention, Niagara Falls, Ontario, Canada.
- Crassweller, R. M.** (2020q, February 25). *Identifying and avoiding herbicide injury and the uses of burndown herbicides.* Appalachian Fruit Region Winter Commercial Tree Fruit School, Osterburg, PA.
- Crassweller, R. M.** (2020r, February 25). *Updates on fruit cultivars and rootstocks – Good and bad points.* Appalachian Fruit Region Winter Commercial Tree Fruit School, Osterburg, PA.
- Crassweller, R. M.** (2020s, February 26). *Identifying and avoiding herbicide injury and the uses of burndown herbicides.* Erie County Winter Commercial Tree Fruit School, North East, PA.
- Crassweller, R. M.** (2020t, February 26). *Updates on fruit cultivars and rootstocks – Good and bad points.* Erie County Winter Commercial Tree Fruit School, North East, PA.
- Crassweller, R. M.** (2020u, February 27). *Identifying and avoiding herbicide injury and the uses of burndown herbicides.* Western Region Winter Commercial Tree Fruit School, Wexford, PA.
- Crassweller, R. M.** (2020v, February 27). *Updates on fruit cultivars and rootstocks – Good and bad points.* Western Region Winter Commercial Tree Fruit School, Wexford, PA.
- Crone, M., **Biddinger, D. J.**, & Grozinger, C. (2019, November 17). *Manipulating pollen micronutrient ratios to improve honey bee (Apis mellifera) resilience to pesticide stress.* 2019 Entomological Society of America Annual Meeting, St. Louis, MO.
- Elkner, T. E.** (2020, February 18). *Protecting water resources during pesticide mixing and loading.* Lancaster & York Counties Winter Commercial Tree Fruit School, Lancaster, PA.
- Esslinger, C. J.** (2020, January 29). *Pesticide knowledge challenge.* Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.

- Ford, T. G.** (2020, January 30). *Water quality and pesticide*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Gorgo, M.** (2020, January 29). *Demostración sobre la seguridad con equipos y maquinarias – Sala Azteca; Seguido de tiempo libre para visitar la exposición*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Harper, J. K.** (2020a, February 12). *Managing risk: Understanding your options in fruit production*. Northeastern Winter Commercial Tree Fruit School, Dupont, PA.
- Harper, J. K.** (2020b, February 13). *Managing risk: Understanding your options in fruit production*. Berks County Winter Commercial Tree Fruit School, Leesport, PA.
- Harper, J. K.** (2020c, February 17). *Managing risk: Understanding your options in fruit production*. Adams County Winter Commercial Tree Fruit School, Biglerville, PA.
- Harper, J. K.** (2020d, February 17). *What's new at FREC?* Adams County Winter Commercial Tree Fruit School, Biglerville, PA.
- Harper, J. K.** (2020e, February 19). *Managing risk: Understanding your options in fruit production*. Franklin County Winter Commercial Tree Fruit School, St. Thomas, PA.
- Harper, J. K.** (2020f, February 25). *Managing risk: Understanding your options in fruit production*. Appalachian Region Winter Commercial Tree Fruit School, Osterburg, PA.
- Harper, J. K.** (2020g, February 26). *Managing risk: Understanding your options in fruit production*. Erie County Winter Commercial Tree Fruit School, North East, PA.
- He, L.** (2020a, January 29). *Precision irrigation technologies for specialty crops*. Mid-Atlantic Fruit and Vegetable Convention, Hershey, PA.
- He, L.** (2020b, February 13). *Updates on precision agriculture program: Intelligent spraying and sensor-based irrigation*. Southeastern Region Winter Commercial Tree Fruit School, Leesport, PA.
- He, L.** (2020c, February 17). *Updates on precision agriculture program: Intelligent spraying and sensor-based irrigation*. Adams County Winter Commercial Tree Fruit School, Biglerville, PA.
- He, L.** (2020d, February 19). *Updates on precision agriculture program: Intelligent spraying and sensor-based irrigation*. Franklin County Winter Commercial Tree Fruit School, St. Thomas, PA.
- He, L.** (2020e, May 19). *Applying sensor-based irrigation for tree fruit orchards*. Irrigation Technology for Commercial Fruit, Vegetable, and Container Crop Production.
- He, L.** (2020f, July 9). *Irrigation with soil moisture sensors*. 2020 Penn State Extension Spring Orchard Meeting.
- He, L.** (2020g, October 21). *Sensing, data, and robotics in specialty crop production*. ICDS Virtual Symposium 2020.
- Krawczyk, G.** (2020a, January 28). *Brown marmorated stink bug – What's new*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Krawczyk, G.** (2020b, February 11). *Psylla borers and scales – Old but still important culprits*. Central Susquehanna Winter Commercial Tree Fruit School, Mifflinburg, PA.

- Krawczyk, G.** (2020c, February 11). *The 2020 Penn State Tree Fruit Production Guide update*. Central Susquehanna Winter Commercial Tree Fruit School, Mifflinburg, PA.
- Krawczyk, G.** (2020d, February 12). *Psylla borers and scales – Old but still important culprits*. Northeastern Winter Commercial Tree Fruit School, Avoca, PA.
- Krawczyk, G.** (2020e, February 12). *The 2020 Penn State Tree Fruit Production Guide update*. Northeastern Winter Commercial Tree Fruit School, Avoca, PA.
- Krawczyk, G.** (2020f, February 13). *Psylla borers and scales – Old but still important culprits*. Southeastern Winter Commercial Tree Fruit School, Leesport, PA.
- Krawczyk, G.** (2020g, February 13). *The 2020 Penn State Tree Fruit Production Guide update*. Southeastern Winter Commercial Tree Fruit School, Leesport, PA.
- Krawczyk, G.** (2020h, February 17). *Psylla borers and scales – Old but still important culprits*. Adams County Winter Commercial Tree Fruit School, Biglerville, PA.
- Krawczyk, G.** (2020i, February 20). *Area-wide management of BMSB: the Republic of Georgia experience*. BMSB SCRI SAP Meeting, Sacramento, CA.
- Krawczyk, G.** (2020j, February 25). *IPM and the use of the new Penn State Fruit Production Guide*. Appalachian Region Winter Commercial Tree Fruit School, Osterburg, PA.
- Krawczyk, G.** (2020k, February 25). *Psylla borers and scales – Old but still important culprits*. Appalachian Region Winter Commercial Tree Fruit School, Osterburg, PA.
- Krawczyk, G.** (2020l, February 26). *IPM and the use of the new Penn State Fruit Production Guide*. Erie County Winter Commercial Tree Fruit School, North East, PA.
- Krawczyk, G.** (2020m, February 26). *Psylla borers and scales – Old but still important culprits*. Erie County Winter Commercial Tree Fruit School, North East, PA.
- Krawczyk, G.** (2020n, February 27). *IPM and the use of the new Penn State Fruit Production Guide*. Western Region Winter Commercial Tree Fruit School, Wexford, PA.
- Krawczyk, G.** (2020o, February 27). *Psylla borers and scales – Old but still important culprits*. Western Region Winter Commercial Tree Fruit School, Wexford, PA.
- Krawczyk, G.** (2020p, March 6). *Spotted lanternfly—US experience with another invasive pest*. Department of Agriculture, Water and Environment, Biosecurity Plant Division, Canberra, Australia.
- Krawczyk, G.** (2020q, April 30). *Monitoring and management of insect and mite pest – Early spring update*.
- Krawczyk, G.** (2020r, May 14). *Monitoring and management of insect and mite pest – Mid-May update*. Penn State Extension Virtual Twilight Meeting.
- Krawczyk, G.** (2020s, May 28). *Monitoring and management of insect and mite pest – Late spring update*. Penn State Extension Virtual Twilight Meeting.
- Krawczyk, G.** (2020t, July 9). *Monitoring and management of insect and mite pest – Summer update*. Penn State Extension Virtual Twilight Meeting.

- Krawczyk, G.**, Rice, H., & Winzeler, E. H. (2020, January 8). *Spotted lanternfly, Lycorma delicatula—A potential new invasive pest of grapes and fruit*. Orchard Pests and Disease Management Conference, Portland, OR.
- Krawczyk, G.**, Winzeler, E. H., Rice, H., Leach, H., & Urban, J. M. (2020, March 3). *Spotted lanternfly, Lycorma delicatula (Hemiptera: Fulgoridae)—New invasive pest species in United States*. International Symposium on Limiting the Global Spread of Contaminant Pests, Sydney, Australia.
- Leach, H., **Biddinger, D. J.**, & Urban, J. M. (2019, November 17). *Spotted lanternfly damage and phenology in fruit crops*. 2019 Entomological Society of America Annual Meeting, St. Louis, MO.
- Leach, H., **Biddinger, D. J.**, & Urban, J. M. (2020, March 9). *Spotted lanternfly from detection to major pest: Biology, spread, & control*. 90<sup>th</sup> Annual Mtg of the Eastern Branch Entomological Society of American, Blacksburg, VA.
- López-Uribe, M. M.**, **Biddinger, D. J.**, & Sklarva, M. (2020, January 27). *Hands-on identification workshop supported with dissecting microscopes*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Marini, R. P.** (2020, January 30). *Verification & modification of bitter pit model*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Martin, P. L., & **Peter, K. A.** (2020, January 28). *Completing the picture: Characterizing bitter rot fungi isolates in the lab & field*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Martin, P., & **Peter, K. A.** (2019, December 6). *Quantification of Colletotrichum fioriniae in the forest suggest its main ecological role is that of a leaf endophyte*. Cumberland-Shenandoah Fruit Workers Conference, Winchester, VA. <http://csfwc.grapepathology.org/2019-95th-meeting>
- Moural, T., Phan, N., Rajotte, E., **Biddinger, D. J.**, & Zhu, F. (2019, November 17). *Mechanisms of comparative toxicity in bees*. 2019 Entomological Society of America Annual Meeting, St. Louis, MO.
- Peter, K. A.** (2020a, January 30). *Fire blight management update: The latest for controlling blossom blight and shoot blight*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Peter, K. A.** (2020b, January 30). *The ins & outs of fire blight: A healthy review*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Peter, K. A.** (2020c, February 11). *Understanding different pathogens in the orchard: Bacteria, fungi, and viruses – Oh my!* Central Susquehanna Winter Commercial Tree Fruit School, Mifflinburg, PA.
- Peter, K. A.** (2020d, February 12). *Understanding different pathogens in the orchard: Bacteria, fungi, and viruses – Oh my!* Northeast Winter Commercial Tree Fruit School, Dupont, PA.
- Peter, K. A.** (2020e, February 13). *Understanding different pathogens in the orchard: Bacteria, fungi, and viruses – Oh my!* Southeast Region Winter Commercial Tree Fruit School, Leesport, PA.
- Peter, K. A.** (2020f, February 17). *Understanding different pathogens in the orchard: Bacteria, fungi, and viruses – Oh my!* Adams County Winter Commercial Tree Fruit School, Biglerville, PA.
- Peter, K. A.** (2020g, February 18). *Understanding different pathogens in the orchard: Bacteria, fungi, and viruses – Oh my!* Lancaster & York Counties Winter Commercial Tree Fruit School, Lancaster, PA.

- Peter, K. A.** (2020h, February 19). *Understanding different pathogens in the orchard: Bacteria, fungi, and viruses – Oh my!* Franklin County Winter Commercial Tree Fruit School, St. Thomas, PA.
- Peter, K. A.** (2020i, February 25). *Understanding different pathogens in the orchard: Bacteria, fungi, and viruses – Oh my!* Appalachian Fruit Region Winter Commercial Tree Fruit School, Osterburg, PA.
- Peter, K. A.** (2020j, February 26). *Understanding different pathogens in the orchard: Bacteria, fungi, and viruses – Oh my!* Erie County Winter Commercial Tree Fruit School, North East, PA.
- Peter, K. A.** (2020k, February 27). *Understanding different pathogens in the orchard: Bacteria, fungi, and viruses – Oh my!* Western Region Winter Commercial Tree Fruit School, Wexford, PA.
- Peter, K. A.** (2020l, July 22). *Managing nematodes in fruit orchards* [Webinar]. Wisconsin Apple Grower Association. <https://vimeo.com/440766002/06ad896e64>
- Peter, K. A.** (2020m, July 28). *Fire blight control options: How to not repeat the 2020 season* [Webinar]. University of New Hampshire Cooperative Extension. [https://media.unh.edu/media/Fire+Blight+Control+Options/1\\_om8zj2u0](https://media.unh.edu/media/Fire+Blight+Control+Options/1_om8zj2u0)
- Pierce, K., Thomas, C., Martin, P., & **Peter, K. A.** (2019, December 6). *Sensitivity distribution to 11 fungicides in a population of Colletotrichum isolates from apple*. Cumberland-Shenandoah Fruit Workers Conference, Winchester, VA. <http://csfwc.grapepathology.org/2019-95th-meeting>
- Quesada, C., **Seifrit, D.**, **Peter, K. A.**, & **López-Uribe, M. M.** (2020, January 29). *Clase práctica sobre plagas, enfermedades y insectos beneficiosos de las frutas*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Sastre, B., **Gorgo, M.**, **Seifrit, D.**, & Chawner, M. (2020, January 29). *Práctica de laboratorio sobre la evaluación de la salud de suelos*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Schupp, J. R.** (2020a, January 23). *Research on fruit thinning*. Ohio Produce Network, Columbus, OH.
- Schupp, J. R.** (2020b, January 23). *Research on orchard systems / pruning*. Ohio Produce Network, Columbus, OH.
- Schupp, J. R.** (2020c, January 28). *Blossom thinning Golden Delicious using lime sulfur and the pollen tube growth model*. Mid-Atlantic Fruit and Vegetable Convention, Hershey, PA.
- Schupp, J. R.** (2020d, January 30). *Peach rootstocks – What’s on the horizon?* Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Schupp, J. R.** (2020e, February 17). *PGRs for apple fruit finish problems*. Adams County Winter Commercial Tree Fruit School, Biglerville, PA.
- Schupp, J. R.** (2020f, February 19). *PGRs for apple fruit finish problems*. Franklin County Winter Commercial Tree Fruit School, St. Thomas, PA.
- Schupp, J. R.** (2020g, March 3). *Experience with new peach rootstocks*. 2020 Michigan Spring Peach Meeting, Benton Harbor, MI.
- Schupp, J. R.** (2020h, March 10). *Post-bloom thinner combinations including Accede™ on fruit set, yield and fruit size of ‘Buckeye Gala.’* Northeast Plant Growth Regulator Working Group, Wilkes-Barre, PA.

- Schupp, J. R.** (2020i, March 11). *Russet and cracking of Regal 10-45 and 'GoldRush' apples: Effects of canopy position and GA<sub>4+7</sub>sprays*. Northeast Plant Growth Regulator Working Group, Wilkes-Barre, PA.
- Schupp, J. R.** (2020j, July 8). *Regional on-farm trials with Controller and Krymsk 86 rootstocks*. Pennsylvania Peach and Nectarine Program Virtual Meeting.
- Schupp, J. R., & Crassweller, R. M.** (2020, February 19). *Identifying and avoiding herbicide injury and the uses of burndown herbicides*. Franklin County Winter Commercial Tree Fruit School, St. Thomas, PA.
- Seifrit, D.** (2020a, March 7). *Grafted aftercare*. 2020 Master Gardener Grafting Workshop, Biglerville, PA.
- Seifrit, D.** (2020b, March 7). *Types of grafting*. 2020 Master Gardener Grafting Workshop, Biglerville, PA.
- Vaudo, A., **Biddinger, D. J.**, Sickel, W., Keller, A., & **López-Uribe, M. M.** (2019, November 17). *Hornfaced mason bee (Osmia cornifrons) larval pollen provisions indicate foraging preference for Rosaceae host-plant species and suggest efficient orchard-crop pollination*. 2019 Entomological Society of America Annual Meeting, St. Louis, MO.
- Weber, D. E.** (2020a, January 30). *High tunnel cherry production: Pros and cons*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.
- Weber, D. E.** (2020b, March 7). *Grafting tools*. 2020 Master Gardener Grafting Workshop, Biglerville, PA.
- Weber, D. E.** (2020c, March 7). *Principles of grafting: A brief introduction*. 2020 Master Gardener Grafting Workshop, Biglerville, PA.
- Weber, D. E.** (2020d, March 7). *Selecting scion and rootstock*. 2020 Master Gardener Grafting Workshop, Biglerville, PA.
- Weber, D. E.** (2020e, March 7). *Topworking a tree*. 2020 Master Gardener Grafting Workshop, Biglerville, PA.
- Weber, D. E., He, L., & Huang, M. J.** (2020, January 29). *An update on the Automated Ag / DBR Bandit Cyclone: A preliminary evaluation of a harvest-assist platform*. Mid-Atlantic Fruit & Vegetable Convention, Hershey, PA.

### Representation in Popular Media

Penn State Extension frequently appears in the popular media, either by providing press releases which are picked up by news outlets, by producing content directly for television, radio, or print, or by being interviewed a member of the professional news media. The following is a sampling of some of those contacts.

- Crowley, J. (2020, September 10). The stink bug invasion is coming and here's what you need to know. *Newsweek*. <https://www.newsweek.com/stink-bug-invasion-fall-2020-how-treat-prevent-1531023>
- Duke, A. (2019, October 9). Latinx Agricultural Network formed at Penn State to address community's needs. *Penn State News*. <https://news.psu.edu/story/592288/2019/10/09/academics/latinx-agricultural-network-formed-penn-state-address-community>

- Duke, A. (2020a, May 15). Three honored for commitment to diversity in College of Agricultural Sciences. *Penn State News*. <https://news.psu.edu/story/620315/2020/05/15/academics/three-honored-commitment-diversity-college-agricultural-sciences>
- Duke, A. (2020b, August 13). Research helps explain source of pathogen that causes bitter rot disease. *Penn State News*. <https://news.psu.edu/story/628288/2020/08/13/research/research-helps-explain-source-pathogen-causes-bitter-rot-disease>
- Duke, A. (2020c, August 14). Research helps explain source of pathogen that causes bitter rot disease. *ENN: Environmental News Network*. <https://www.enn.com/articles/64891-research-helps-explain-source-of-pathogen-that-causes-bitter-rot-disease>
- Duke, A. (2020d, August 14). Source of pathogen that causes bitter rot disease. *Science News*. <https://www.sciencedaily.com/releases/2020/08/200814131008.htm>
- Duke, A. (2020e, August 17). Research helps explain source of pathogen that causes bitter rot disease. *Morning Ag Clips*. <https://www.morningagclips.com/research-helps-explain-source-of-pathogen-that-causes-bitter-rot-disease/>
- Duke, A. (2020f, August 17). Source of bitter rot disease pathogen revealed. *Technology Networks*. <https://www.technologynetworks.com/tn/news/source-of-bitter-rot-disease-pathogen-revealed-338633>
- Gill, C. (2020, June 29). Checklist of Pa. Bees documents 49 new species and some that may be endangered. *Penn State News*. <https://news.psu.edu/story/624343/2020/06/29/research/checklist-pa-bees-documents-49-new-species-and-some-may-be>
- Gohil, H., Muehlbauer, M., Polanin, N., & **Crassweller, R. M.** (2020). *Active frost protection methods for your orchard* (Cooperative Extension Bulletin No. E363; Rutgers Cooperative Extension Bulletin). Rutgers University. <https://njaes.rutgers.edu/e363/>
- Gorgo, M.**, & Sanchez, E. (2020, February 20). Latinos and agriculture: A Changing demographic. *Penn State College of Agricultural Sciences*. <https://agsci.psu.edu/diversity/files/latinos-agriculture-changing-demographic.pdf>
- Growing Produce Staff. (2020, July 7). Surprise! Researchers find new pathogen in apples. *Growing Produce*. <https://www.growingproduce.com/fruits/surprise-researchers-find-new-pathogen-in-apples/>
- Gruber, P. (2020, July 23). High season for orchard insect pests. *Lancaster Farmer*. [https://www.lancasterfarming.com/news/main\\_edition/high-season-for-orchard-insect-pests/article\\_2bf6efa6-cd1f-11ea-9096-c70c373896cb.html](https://www.lancasterfarming.com/news/main_edition/high-season-for-orchard-insect-pests/article_2bf6efa6-cd1f-11ea-9096-c70c373896cb.html)
- Krawczyk, G.** (2020, July 8). Mid-summer management of insect pests in fruit orchards outlined by PSU. *Fruit Growers News*. <https://fruitgrowersnews.com/news/mid-summer-management-of-insect-pests-in-fruit-orchards-outlined-by-psu/>
- LaJeunesse, S. (2020, August 14). Research helps explain source of pathogen that causes bitter rot disease. *Scienmag Science Magazine*. <https://scienmag.com/research-helps-explain-source-of-pathogen-that-causes-bitter-rot-disease/>



- Mehar, P. (2020, July 7). New fungal pathogen found in NY apples orchard. *Tech Explorist*. <https://www.techexplorist.com/fungal-pathogen-found-ny-apples-orchard/33547/>
- Muhollem, J. (2020a, April 16). Learn what Extension's Latinx Ag Network offers on new Facebook page. *Morning Ag Clips*. <https://www.morningagclips.com/learn-what-extensions-latinx-ag-network-offers-on-new-facebook-page/>
- Muhollem, J. (2020b, September 3). Learn what Penn State Extension's Latinx Ag Network offers on new Facebook page. *Penn State News*. <https://news.psu.edu/story/614335/2020/04/06/impact/learn-what-penn-state-extension%E2%80%99s-latinx-ag-network-offers-new>
- Mulhollem, J. (2020, April 22). Learn what Penn State Extension's Latinx Ag Network offers on Facebook page. *Fruit Growers News*. <https://fruitgrowersnews.com/news/learn-what-penn-state-extensions-latinx-ag-network-offers-on-facebook-page/>
- NH Agricultural Experiment Station. (2020, August 11). Researchers manage apple scab using seafood byproduct. *Morning Ag Clips*. <https://www.morningagclips.com/researchers-manage-apple-scab-using-seafood-byproduct/>
- Penn State Extension. (2019a, October 29). Latinx Agricultural Network formed at Penn State to address community's needs. *Morning Ag Clips*. <https://www.morningagclips.com/latinx-agricultural-network-formed-at-penn-state-to-address-communitys-needs/>
- Penn State Extension. (2019b, October 30). Latinx Agricultural Network formed at Penn State to address community's needs. *Bctv.Org*. [Latinx Agricultural Network formed at Penn State to address community's needs](https://www.bctv.org/news/latinx-agricultural-network-formed-at-penn-state-to-address-communitys-needs)
- Penn State Extension. (2019c, October 30). *Se crea la Red Agrícola Latinx en Penn State para atender las necesidades de la comunidad latinx en Pensilvania*. <https://latinonewspa.com/nacionales/regionales/se-crea-la-red-agricola-latinx-en-penn-state-para-atender-las-necesidades-de-la-comunidad-latinx-en-pensilvania/>
- Penn State Extension. (2020, April 7). La red de trabajo Penn State Extension Agricultura Latinx invita a personas de habla Hispana relacionados con agricultura a conectarse en Facebook. *Latino News*. <https://latinonewspa.com/nacionales/pennsylvania/la-red-de-trabajo-penn-state-extension-agricultura-latinx-invita-a-personas-de-habla-hispana-relacionados-con-agricultura-a-conectarse-en-facebook/>
- Peter, K. A.** (2020, July 9). Improving late season fire blight and brown rot management. *Fruit Growers News*. <https://fruitgrowersnews.com/news/improving-late-season-fire-blight-and-brown-rot-management/>
- Ramanujan, K. (2020, July 6). Scientists identify new pathogen in NY apples. *Cornell Chronicle*. <https://news.cornell.edu/stories/2020/07/scientists-identify-new-pathogen-ny-apples>
- Schneck, M. (2020, September 10). Big stink bug home invasion season is coming. *Penn Live Patriot News*. <https://www.pennlive.com/life/2020/09/big-stink-bug-home-invasion-season-is-coming.html>
- Skernivitz, T. (2020, August 11). Shrimp shells loom large in fight against apple scab. *Growing Produce*. <https://www.growingproduce.com/fruits/shrimp-shells-loom-large-in-fight-against-apple-scab/>

## **Innovations to Better Serve Our Stakeholders**

### **Increased Interdisciplinary Work**

Extension horticulture educators worked with the food safety team, the web team, and the Associate Director of Extension to design a landing page for Extension resources and programming relate to COVID-19. Resources in Spanish have a separate landing page.

### **Latinx Agricultural Network**

The Penn State Extension Latinx Agricultural Network (with leadership from horticulture educators) developed innovative educational formats in Spanish for providing timely resources to life sustaining ag businesses. Team members coordinated a new Penn State Extension Agricultura en Español Facebook page with the mission of providing science-based information on agricultural production, food safety, and workplace safety. This page currently has 7,356 followers, many from Latin American countries. Bilingual educators and program assistants translated 11 COVID-19 related articles and 9 Commercial Horticulture Production articles and are completing translations of 10 Victory Gardens Reinvented! Webinars, 9 Master Gardeners' container gardening factsheets, and 7 Living on A Few Acres Webinars.

### **Increased Emphasis on Electronic Means of Communications**

Educators encouraged growers to use Educators' personal cell phones as the primary contact point for fruit production information since most Extension offices were closed to the public or irregularly staffed due to COVID-19. Similarly, both researchers and Educators encouraged the use of text messages and photos from tree fruit growers across the state to facilitate a more rapid flow of questions and information between the grower to the educator. Many Educators also scheduled "office hours" using the video conferencing app Zoom. The use of Facebook posts on fruit related topics increased significantly, making the information equally accessible to both hobbyists and commercial growers.