

**State Reports Submitted to
NEERA1604**

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Virtual

Connecticut IPM Program Report, April 2021

Mary Concklin, IPM Program Coordinator

The Connecticut IPM Program 2020 Annual Report, IPM factsheets, and other information are available on the UConn IPM website (www.ipm.uconn.edu).

Funding

- The Connecticut IPM Program is funded in part by USDA (NIFA CPPM EIP, NIFA BFRDP, RMA, SCBG, SARE, FRTEP, AFRI ELI, APHIS), the Northeast IPM Center (NEIPMC), CT Department of Energy and Environmental Protection (CT DEEP), CT Department of Agriculture, and the University of Connecticut.

Team Members

- **University of Connecticut (UConn):** The IPM Program team includes Mary Concklin (IPM Program Coordinator), Abby Beissinger (resigned August 2020), Shuresh Ghimire, Miriah Kelly (resigned August 2020), Ana Legrand, Leanne Pundt and Victoria Wallace in the Department of Plant Science & Landscape Architecture, and the Department of Extension.
- **Partners/Collaborators:** State and Federal agricultural and environmental/non-governmental agencies and organizations; State, New England, and Northeastern fruit, greenhouse, grounds keepers, nursery, turf, landscape, and vegetable associations; industry suppliers/dealers; regional universities; educators; schools and municipalities; individual growers, farmers, and producers; Master Gardeners; and the general public.

Issue

- Integrated Pest Management applies multiple tactics in a variety of settings through the selection of appropriate tools and the education of agricultural industry members and Connecticut citizens to provide sustainable, science-based approaches for the management of plant pests (insects, mites, diseases, wildlife, and weeds, including invasive plants). The UConn IPM Program incorporates all possible pest management strategies through knowledgeable decision-making, utilizing the most efficient landscape and on-farm resources, and integrating cultural and biological controls. Program objectives include maintaining the economic viability of agricultural and green industry businesses, enhancing and conserving environmental quality and natural resources, educating participants on the effective use of biological control agents, and educating pesticide users about the safe use and handling of pesticide products.

Accomplishments

- COVID-19 impacted many outreach programs usually conducted face-to-face. However, our team members quickly adapted and offered many programs virtually, while others have been postponed until 2021 and 2022. IPM Program team members conducted fewer on-site educational trainings for fruit and vegetable producers, garden center owners, greenhouse growers, nursery producers and retailers, and turf and landscape professionals than in previous years. Virtual meetings became the norm. Growers and green industry professionals received information on the current status of and recommendations for important plant pests and training via pest messages, email alerts, webinars, newsletters, articles in national trade journals, management guides, websites, conferences, exhibits, and short courses.
- **Evaluations:** A formal IPM Collective Impact Assessment was conducted by IPM team member and evaluation specialist, Dr. M. Kelly. IPM programs were individually evaluated by the following methods: pre- and/or post program surveys and evaluations, testimonials, and unsolicited comments.

Connecticut IPM Program Outcomes

- There were 114,737 sessions created by 99,725 users of the IPM website (www.ipm.uconn.edu) during 2020, representing 145,137 page views.
- Vegetable integrated pest management education was delivered to over 600 vegetable growers and stakeholders every week from May to September 2020 through 19 weekly vegetable pest alerts focusing on pests, pest management and decision making, and safe pesticide use.
- In spring of 2020, our Vegetable Extension Program launched an online Vegetable Production Certificate course for the first time with an objective to effectively deliver information to beginner vegetable producers, especially when in-person interactions are limited. The course had seven online modules, each module with a self-paced video, supplemental materials, and a short quiz. In the post-course evaluation survey (total number of course participants = 23), respondents indicated on average 34% increase in their knowledge from the course.
- Over 400 invasive plant activities occurred in over 50 Connecticut towns, reaching over 8,700 Connecticut citizens in 2020, including agency and municipal staff. A minimum of 13,406 hours of intensive invasive plant training sessions and management activities was provided, as well as technical educational outreach.
- School and municipal grounds managers, nursery managers, and landscape professionals from 169 CT towns received 10 emails with information, educational materials, and best management practices, and a survey regarding the impact of COVID-19 on their management practices was completed.
- CT Invasive Plant Working Group biennial symposium, Realistic Solutions to Managing Invasive Plants, was delivered to 386 people, including grounds managers, landscape professionals, town conservation commission members, educators, master gardeners, arborists, and government officials.
- 482 fruit growers and industry members received 104 fruit messages covering pest information, management strategies, cultural practices, meetings and educational programming updates.
- UConn's 2020 Annual Cut Flower Growers Workshop was attended by 113 experienced & beginning growers, as well as those interested in pursuing this crop. 98% of attendees indicated this was an excellent workshop.
- UConn's 2020 Vegetable & Small Fruit Conference was attended by 264 growers and industry members, featured 9 topics and speakers. 90% indicated they learned something that would help their business.
- UConn's Bedding Plant Workshops were held just prior to the statewide shutdown at 2 locations in CT and attended by 61 growers. 100 % rated the conference as useful to very useful, 97 % were very or moderately likely to adopt a new practice as a result of attending these programs.
- 507 samples were processed in the Plant Diagnostic Lab in 2020.



Delaware – Integrated Pest Management Update
Regional IPM Meeting (NEERA 1604)
23 April 2021

IPM Team Members

Mark VanGessel – Extension Weed Science
Alyssa Koehler – Extension Plant Pathology
Brian Kunkel – Extension Entomology, Horticulture
Rose Ogutu – Horticulture Specialist, DSU
David Owens – Extension Entomology, Agriculture
Tracy Wootten – Horticulture Extension Agent
Carrie Murphy – Lawn and Garden Program Leader
Emmalea Ernest – Agriculture Program Leader

General Comments and Current State

Delaware integrated pest management activity is focused on agronomic crops (corn, soybean, sorghum, wheat, and barley), specialty crops (sweet corn, legumes, cucurbits) and community IPM (tree health and high tunnels). Funding is provided by the state, specialty crop block grants, commodity groups (Delaware and Maryland Soybean Board, Maryland Grain Producers Utilization Board, MarDel Watermelon Association, Pennsylvania Vegetable Marketing and Research Program), Northeast IPM Center, USDA NIFA, Sustainable Agricultural Systems, and USDA SARE.

The coronavirus pandemic markedly impacted IPM programming and there was a temporary hiring freeze for all workers.. Many of our long-standing programs made rapid adjustments to deliver content virtually. Virtual programming was met with mixed results. A virtual field day was attempted in August, but audience engagement was very limited. Virtual delivery of MidAtlantic Crop Management School in November was well attended and well received (as was the 2021 virtual Delaware AgWeek). The multi-state Herbicide-Resistant Workshop planned for spring 2020 was moved to a virtual format in the fall of 2020. Despite the challenges, setbacks, and restrictions, we were able to maintain field activity, consulting, and pest management surveys and pest management research was conducted. Timely, relevant information continued to be provided via newsletters in the Delaware Weekly Crop Update. We also successfully on boarded a new plant diagnostician (Jill Pollok) and an extension agent focusing on turf management (John Emerson).

2020 Activities

Outreach

- Weekly Crop Update – UD’s weekly pest and crop advisory continues to be successful and reaches over 700 unique email addresses. Issues run regularly from April to September; <https://sites.udel.edu/weeklycropupdate/>.
- Ornamentals Hotline – weekly newsletter reaching approximately 200 landscapers and other green industry professionals; <https://sites.udel.edu/ornamentals-hotline/archive/>.
- Delaware Horticulture Industry Expo January 2020
- Turf Expo November 2020
- Delaware AgWeek 2020
- MidAtlantic Crop Management School (virtual 2020)
- UD Weed Science program (along with other extension programs) continues to expand and refine website on integrated weed management (GROWIWM.org)
- Spotted Lanternfly trainings via zoom
- Emerald Ash Borer short course
- Increasing pollinator friendly plantings in developments
- Public engagement via Twitter and Instagram of multiple team members

Delaware EIP Extension Implementation Project

- Field Crops
 - Palmer amaranth management in soybean using narrow rows, harvest technology, cover cropping
 - Cover crop demonstration trials – 6 cooperator locations
 - Recorded weed emergence timing of over 12 common summer annual weed species, part of Hatch project coordinated by Cornell University)
- Forage – at least two alfalfa fields and one grass hay fields periodically scouted for insect and weed pests.
- Urban – tree planting demonstration was infested by Emerald Ash Borer.
- Specialty
 - Weed management and resistance – ‘overlapping residual herbicides’ – crop safety satisfactory when overlapping residuals. Continuing research before making recommendations
 - Insect trapping network and CEW resistance, Bt sentinels, – continuing to maintain insect trapping network, testing CEW resistance to pyrethroids and Bt traits in sweet corn in collaboration with UMD.
 - High tunnels, small fruit and vegetable pest management trials (DSU) – High tunnel pest management demonstrations with DSU.
 - 14 snap bean and 23 lima bean fields were surveyed close to harvest for weeds (part of a collaborative team coordinated by USDA-ARS Champaign-Urbana, IL)

Workshops

- 2020 Beginning Farmer Training (partially virtual)
- Master Gardener core and advanced training; Master gardener led trainings for general public

- Herbicide Resistance workshops – 5 half-day workshops with MD, VA, and DE (virtual)Expansion of undergraduate/graduate level IPM course for Plant and Soil Sciences Department

Other Current Projects

Cucurbit arthropod pest management research - seasonal pattern, resistance monitoring.
Nematode and Fungal disease survey of field crops across Maryland and Delaware
Disease yield loss estimates in corn, soybean, and wheat
Stevia disease demonstration plot
Small grains fungicide efficacy trials
Merging cereal rye and herbicide: how can we reduce herbicide inputs

Exploring the Benefits and Pitfalls of Planting Green
Slug and Natural Enemy phenology
Managing Ditches for Conservation Biological Control
Soybean Prophylactic Insecticide Costs and Benefits
2020 Insect Pest Management trial summaries are available at

<https://www.udel.edu/academics/colleges/canr/cooperative-extension/sustainable-production/pest-management/insect-management-reports/>

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Difficulties

Coronavirus restrictions at both the state and university level seriously impacted work efficiency, output, and outreach. For example, the A significant factor was the extreme limitation of seasonal workforce, which forced many programs to scale back plans or eliminate planned activities entirely.

Increasing pressure to implement some form of cost recovery for the plant diagnostic clinic. Other neighboring states that implemented cost recovery have observed a significant decrease in annual sample submission volume.

Maine IPM State Report

NEERA meeting 2021

James Dill / Glen Koehler / Griffin Dill

Professor of Entomology and IPM Coordinator / Associate Scientist IPM / IPM Professional

The UMaine Cooperative Extension IPM Program delivers pest management education, monitoring, forecasting, diagnostics, and individualized problem solving. In addition to commodity-specific outreach programs, the Pest Management Unit within the UMaine Cooperative Extension Diagnostic & Research Laboratory provides local, statewide, and regional support. The efforts of the lab and program staff help a variety of commercial and non-commercial stakeholders with effective, efficient, environmentally sensitive, and safe pest management. The Extension IPM Program collaborates with the Maine Department of Agriculture, Conservation, & Forestry (ME DACF), grower organizations, other university departments, and other New England universities in order to best serve the people of Maine and the region. The IPM programs have reached a number of underserved audiences, including Somali farmers in central Maine, Maine's Native American tribes, and Maine's Amish population.

TREE FRUIT

Apples are the dominant tree fruit in Maine. The main program components are the Maine Tree Fruit Newsletter (which covers horticulture, marketing, and other topics in addition to IPM), the Ag-Radar apple pest/horticultural tracking/forecast system, a pest scouting cooperative subsidized by the Maine State Pomological Society, webinars and in-person meetings, and individualized telephone and field visit support. Observations from the scouting coop are shared with over 500 commercial and hobbyist growers through the newsletter.

In the 2019 year-end program survey, 100% of the 27 apple growers who participated in the scouting co-op said that the visits were useful to their decision making. Ninety-six percent of surveyed growers said they had benefitted from an Apple IPM Program presentation or consultation, and 100% said that the newsletter had helped them with pest management decisions. Growers estimated that support from the Apple IPM Program helped them reduce pest damage losses by 32%, while also reducing production costs by an average of \$406 per acre, with an estimated \$6.3 million benefit to Maine's apple crop quantity and quality.

A new addition to the program in 2021 is site-specific weather forecast and observations at 1.5 mile spatial resolution and hourly temporal resolution for 79 Maine locations. Weather data service for another 79 sites beyond Maine is being provided to growers, consultants, and Extension programs, including the Purdue Extension Meloncast program. Data are delivered via twice daily email reports, real-time web charts and hourly CSV files. Data tables with additional elements not shown in the charts or email reports are in development. The weather data are also used as input for the AgRadar Tools decision support models for apple, with models for other commodities and IPM application sites in development.

SWEET CORN

Twenty farmers volunteered to have their cornfields used for pest monitoring and demonstrating IPM techniques for the major corn pests, including European corn borer, corn earworm, and fall armyworm. The number of farms included in the program was reduced from previous years in order to accommodate travel and safety regulations necessitated by the Covid-19 pandemic. Insect traps were set up and maintained by IPM field scouts trained to identify and monitor corn pest populations. Due to pandemic restrictions, all communication with farmers was carried out electronically, primarily through cell phone texts and email. Information gathered from volunteer farms was summarized and shared with sweet corn growers, agricultural consultants and Extension educators around the state. In 2020, 136 farmers received weekly pest updates through our e-mail newsletter. Our sweet corn IPM blog received over 100 views per week, peaking at the height of the corn season. We also shared our observations with researchers, extension staff and growers throughout the region. At present, we believe this program is reaching well over one half of the commercial sweet corn growers in the state, and at least two thirds of the acreage. We estimate that the program has saved, on average, more than three insecticide applications over more than 3000 acres of sweet corn in each season.

In 2020, our monitoring sites indicated that corn earworm numbers were somewhat higher than the previous season, but populations were quite variable from site to site. As a result, some fields required more insecticide sprays than the previous season, while others required fewer. Fall armyworm, was found in lower numbers in most locations, similar to last season, although it arrived fairly early and became more intense at the end of the season. This situation illustrated to farmers the importance of local monitoring for pests, and how pest pressure can vary greatly from site to site, even when they are geographically quite close. We also monitored most fields for western bean cutworm, which has become a significant corn pest in the Midwest and southeast regions in recent years. In 2019, numbers were much higher than observed in previous years of trapping this new pest, and 2020 continued this trend, strongly suggesting that this is becoming a new pest problem for corn in Maine.

POTATOES

The Potato IPM Program maintained 30 specialized insect traps, coordinated a statewide network of electronic weather stations, and surveyed 30 potato fields on a weekly basis during 2020. A series of five, sixteen foot high tower traps in Aroostook County was also operated from May through September 2020 to monitor the timing of aphid flights and the presence of certain aphid species. Through this trapping, approximately 6,000 individual aphids were examined and identified. During the 2020 growing season in Maine, potato colonizing aphid populations were at relatively low levels and although non-colonizing aphid populations were active, their activity was also relatively low. Outreach to potato growers was conducted through approximately 3,000 individual grower contacts and a weekly newsletter with current regional pest updates was emailed to over 460 industry staff in Maine, New Brunswick, and the eastern United States.

Through active field monitoring and outreach to growers, management strategies for multiple potato pests including Colorado potato beetle, European corn borer, and aphid species capable of

spreading potato virus Y (PVY) were implemented. These recommended management strategies helped reduce potential crop losses and reduced the unnecessary application of pesticides. The estimated economic impact of the Potato IPM Program's insect monitoring for Maine potato growers in 2020 was approximately \$10.6 million. The program distributes information through a potato pest hotline, weekly growing season newsletter, the annual Maine Potato Conference, and the annual Maine Potato Pest Management Conference,

SMALL FRUIT

Six volunteer farmers worked with Extension to provide monitoring sites and pest information for the major strawberry pests, including tarnished plant bug, strawberry bud weevil, two spotted spider mites, cyclamen mites and gray mold. The sites were scouted weekly by the Extension Specialist and/or a trained student scout. The number of farms included in the program was reduced from previous years in order to accommodate travel and safety regulations necessitated by the Covid-19 pandemic. The pest data collected at the sites were shared with growers via weekly electronic newsletters, our web site and a blog. Due to pandemic restrictions, all communication with farmers was carried out electronically, primarily through cell phone texts and email. In 2020, 161 people received the weekly Strawberry IPM Newsletter during the growing season.

Insect pest pressure in most strawberry fields was moderate in 2020, with two-spotted spider mites being the most common problem requiring action. Most growers were able to reduce insecticide sprays by one or two applications, due to very low pressure from strawberry bud weevil and tarnished plant bug. Although early spring conditions were quite wet, and threatened to increase incidence of fungal diseases, dry weather prevailed through bloom and harvest, reducing the need for fungicide applications for fruit rots.

Traps for the invasive small fruit pest Spotted Wing Drosophila were set out at nine volunteer farms in southern and central Maine. The number of farms included in the program was reduced from previous years in order to accommodate travel and safety regulations necessitated by the Covid-19 pandemic. The traps were monitored weekly for spotted wing drosophila by the Extension Specialist and/or a trained IPM scout. During the summer and fall, weekly updates of spotted wing drosophila populations were sent out to 1015 growers, consultants and Extension staff, with management recommendations. Our webpage and blog also supplied information on how to monitor spotted wing drosophila in fruit plantings and directed farmers to further resources for management strategies. Data and observations were shared with other state and regional programs. In 2020, spotted wing drosophila was observed early in the season (~7/20), and soon built to damaging levels, threatening all ripening fruit in most parts of the state. As a result, regular protective sprays were recommended through much of the season for raspberries, blueberries and fall strawberries. Growers who followed five to seven day spray intervals on ripening fruit were able to keep infestations from developing and maintained good quality for the season.

PUBLIC HEALTH

University of Maine Cooperative Extension conducts surveillance of ticks and tick-borne pathogens to track their distribution, detect trends or changes in tick activity, and to identify areas of risk for tick-borne disease in Maine. A total of 3,273 ticks were submitted to the UMaine Extension Tick Surveillance Program in 2020, with samples submitted from each of the state's 16 counties and from 354 towns. The majority of the ticks submitted were identified as blacklegged ticks (*Ixodes scapularis*), the primary vector of Lyme disease and other tick-borne pathogens, while American dog ticks (*Dermacentor variabilis*) also made up a significant portion of the submissions. In 2020, possibly as a result of increased outdoor human activity associated with COVID-19 combined with warm spring temperatures, adult deer ticks were encountered at exceptionally high rates during spring and early summer. Nymph numbers usually peak in June and early July. Nymphal deer tick activity was down in 2020, possibly due to the hot, dry weather during mid-summer.

Nearly 2,500 blacklegged ticks were tested for the causative agents of Lyme disease, anaplasmosis, and babesiosis with an infection prevalence of 37%, 7.5%, and 7.3% respectively. *Borrelia burgdorferi*, the causative agent of Lyme disease, was identified in ticks from each of the state's 16 counties, while the pathogens that cause anaplasmosis and babesiosis were more prevalent in southern and coastal counties.

In addition to tick surveillance, program staff also provided outreach to the general public on the management of tick populations and personal protection from tick bites. Approximately 750 clients contacted the lab directly for guidance on handling tick-related issues. Although travel and safety regulations necessitated by the Covid-19 pandemic decreased the number of public presentations on ticks, presentations were still conducted virtually for a variety of stakeholder groups including businesses, hospitals, gardening clubs, etc. Through these presentations, over 1,100 people were trained on the biology, ecology, and management of ticks and their associated pathogens.

2021 Maryland IPM State Report

Submitted by Kelly Hamby, MD IPM Coordinator

Situation: Maryland (MD) is a heavily urbanized, densely populated state bordering the Chesapeake Bay. Agriculture is the largest single land use in the state, with 32% of MD's total land area used for farming. The proximity between agriculture, environmentally sensitive areas, and human populations necessitates the implementation of sustainable IPM practices that reduce risks to human health and the environment. MD produces a broad diversity of agricultural commodities.

Green Industries. The green industries encompass production and management of nursery, greenhouse, cut flowers, landscape plants, and turfgrass. In MD the green industries are the 2nd largest commodity with an estimated value of over \$1.3 billion, nearly 30,000 acres in production including almost 500 acres of greenhouses, and over 300 plant production nurseries. Conventional green industry practices can have detrimental effects on the managed ecosystem resulting in increased pest outbreaks and costs to growers. Off-target impacts on the environment and human health may also result. Emerging invasive species continues to challenge plant production and maintenance, and the health of managed ecosystems. The University of Maryland Extension (UME) Master Gardener program plays a significant role in educating homeowners on issues related to the planning, design, installation, and maintenance of home gardens and landscapes. Master Gardeners need to be educated on research-based sustainable approaches to managing pests in home landscapes.

Pollinator Protection. A recent MD state initiative was developed to provide landowners cost-share to establish buffer habitats that are hospitable to pollinators. This new law and Conservation Reserve Program (CRP) initiative provides an opportunity to engage new clientele in pollinator conservation and habitat restoration. However, there is a clear need to first get communities fervent about pollinators partly by educating them on their important contributions.

Weed Management. Weeds are an important concern to MD vegetable farmers. Integrated weed management (IWM) programs are not well developed or widely practiced in MD vegetable production. As such, conventional and organic farmers in MD depend heavily on herbicides and tillage, respectively. Thus, it is vital that producers become more knowledgeable on IWM tools and the importance of adopting an IWM program. Herbicide resistant weeds also continue to be an issue in multiple production systems.

Agronomy. In 2020, roughly 19% of MD's total land area was planted in field crops (1,510,000 acres), which were valued at \$688,000,000 dollars in 2019. Climate change, emerging and invasive pests, pest resistance, and rapidly developing production technologies require timely responses for this important sector to maintain profitability. To improve water quality in the Chesapeake Bay watershed, MD growers abide by some of the most stringent regulations governing the timing, method, and amount of nutrients applied to agricultural land in the US [2]. IPM's science-based decision-making helps producers increase profitability while

protecting human health and the environment. Encouraging adoption of better management practices will help stakeholders face today's production challenges.

Response: University faculty, staff, and other IPM partners conduct applied research to evaluate the efficacy of pest management practices and to develop novel sustainable tactics. Our recent Extension Implementation Program submission included Agronomic Crops (30% of budget; 5 co-PDs), Communities (10% of budget; 2 co-PDs), Specialty Crops - Vegetables and Fruits (17% of budget; 2 co-PDs), Specialty Crops - Green Industry (12.3% of budget; 3 co-PDs), Pollinator Health (21.7% of budget; 2 co-PDs) and IPM Coordination (9% of budget; 2 co-PDs) priority areas. We support additional research and extension efforts with funding acquired from commodity boards, non-profits, and government sources at the local, state, regional, and national levels. Much of our work is performed in collaboration with stakeholders to develop practical solutions that will be adopted. We also perform demonstrations on stakeholders' properties as well as at University facilities to encourage adoption of best management practices. We educate face-to-face at extension meetings, field days, workshops, train-the-trainer events, in-service trainings, and through booths at events. Numerous print and web-based newsletters, publications, announcements, and updates are provided in addition to media broadcasts, social media presence, online videos, and other approaches to disseminate timely research-based information. University of Maryland Extension is currently assessing the needs of its staff and faculty to determine the infrastructure and knowledge needed to expand our ability to telecommute and deliver programming online.

Outputs and Impacts:

Green Industries

- Demonstration research on augmentative release of native parasitoids and assessing the impact on biological control of brown marmorated stink bug.
- Citizen Science project to identify alternate insect hosts of native parasitoids associated with brown marmorated stink bug; and the host plants that support a key native parasitoid to inform the development of successful biological control practices. Fifty Citizen Scientist have volunteered, been trained, and are collecting data for this project.
- Evaluating interactions between native and introduced natural enemies and their impact on invasive species.
- Results from these studies should lead to long-term sustainable management of BMSB.
- Results from these studies and on the management of BMSB have been presented at numerous local, regional, national and international stakeholder meetings.
- Conducted training for over 1,200 participants from the green industries and master gardeners (2020-present) through stakeholder and extension sponsored conferences.
- The Nursery and Landscape IPM Pest Report (web-based). The IPM Pest Report has been produced weekly since 2000 during the growing season (March – October). Since its initiation, the report has grown to over 4,000 weekly subscribers from 24 states. Surveys of the recipients show that the IPM Alerts help readers to better identify pests and beneficials, diagnose plant problems, select less toxic or alternative control measures, and reduce pest management costs.

- The Pest Predictive Calendar (web-based; 2016-present). In response to survey feedback from stakeholders, we developed a “Pest Prediction Calendar” that uses degree days and plant phenological indicators to predict when life stages of key pests are likely to be active and could be targeted for intervention. In the first year that the IPM Pest Predictive Calendar was available on-line (2016), 32% of those surveyed used the IPM Pest Predictive Calendar to predict and monitor pest activity and make timely pest management decisions. It has become one of the most viewed features of the Commercial Horticulture Web Site.
- Advanced Landscape IPM Short Course (taught annually). Dr. Raupp and Dr. Shrewsbury co-coordinate, and with other UME specialists (Dr. Rane, Dr. Clement, S. Gill) develop lectures and laboratory exercises for this multiday, 30 – 40-hour laboratory and lecture program that gives stakeholders the most up to date information on diagnostics and sustainable pest management tactics and strategies. Since 2005, this course has provided training for 694 attendees from more than 20 states and four countries.

Pollinator Protection

- Improving health of managed bees, increasing pollinator habitat, approaches to encouraging natural pollination services (Dr. vanEngelsdorp, Dr. Hooks, Dr. Espíndola)
- A seven-part series of extension publications were developed to help expand MD stakeholders’ knowledge of pollinators and enhance their interest in pollinator conservation (Dr. Hooks and Dr. Espíndola). The publication series discussed invertebrate and vertebrate pollinators ecology including their contribution to services in addition to pollination (e.g., biological control) and included information regarding how their populations can be protected and conserved. These articles were published in popular UMD extension newsletters and blogs. Vegetable and Fruit Headline and Agronomy News blog, to help promote pollinator knowledge, interest and conservation. These were read by ~2,500 and 3,000 stakeholders, respectively from each source.
- To reach the large urban and suburban populations of the state, Dr. Espíndola contributes to the Maryland Grows blog providing information about pollination and pollinators. Her blogs are extremely well-received, with each of her posts receiving hundreds (and often thousands) of visits, and based on the most recent analytics they have cumulatively received over 14,000 visitors. These blogs have received public comments asking more questions, thanking her for the useful information, and creating a place where people can connect, share and grow jointly their knowledge. As a result of her posts, she has received personal emails from Extension agents, members of the community, thanking her for the publications and asking her to continue contributing. Further, these posts have led to the publication of other articles in the public media, such as that recently published by the Sierra Club.

Weed Management

- Thus far seven extension publications covering IWM in vegetable crops have been developed and published in a MD stakeholder newsletter (Dr. Hooks). In addition to the newsletter, information regarding IWM in vegetable systems has been disseminated via field days, workshops, farm walking tours and commodity meetings held in person or via zoom to experienced and beginning farmers. These articles have helped expand

stakeholders' knowledge of IWM and demonstrated how various weed management options can be used as part of a synergistic weed suppression program. In FY 2020 supplemental monies were obtained from two USDA NIFA funding sources to conduct research aimed at enhancing IWM options in plasticulture vegetable production and another to create a novel cover cropping practice that can be used solo or synergistically with herbicides to effectively manage weeds and enhance natural enemy efficacy in sweet corn plantings. Since 2019 nearly 1000 stakeholders have become more knowledgeable on adopting IWM tools via presentations at conferences, field day, farm walking tour events and workshops.

- Dr. Vollmer evaluated the effects of delaying cereal rye termination in combination with one-, two-, and three-pass herbicide programs in soybean. Delaying cereal rye termination to 2 weeks before planting or at-planting improved winter annual weed control and giant foxtail control, regardless of herbicides used or herbicide application timing. (Dr. Vollmer)
- An Integrated Weed Management Workshop was hosted in December by University of Maryland Extension, Delaware Cooperative Extension, and Virginia Cooperative Extension. This workshop addressed developing trends in herbicide resistance, how to develop an integrated weed management plan, and farmer adoption of IWM tactics. The workshop had over 155 participants from CT, DE, MD, NJ, PA, VA, and WV.

Agronomy

- Improved understanding and management of soils with high phosphorus concentrations, economic and environmental nitrogen fertilization decisions, and optimizing crop planting dates for a changing Maryland climate (Dr. Fiorellino). This includes evaluating industrial hemp to remediate soils with high phosphorus concentrations, understanding barriers to adoption of in-season nitrogen decision support tools by regional growers, and observing changes in pest populations when crops such as soybeans, wheat, and industrial hemp are planted outside their typical planting window.
- Dr. Fiorellino currently co-leads industrial hemp production research program at University of Maryland, providing current and potential hemp growers with resources to successfully produce industrial hemp.
- Determining biocontrol contributions of spiders in agricultural drainage ditches (Dr. Lamp)
- Improving variety selection using statewide grain variety trials (Dr. Fiorellino)
- Reducing insecticide use through better understanding of pest pressure and efficacy (Dr. Hamby)

Pest diagnostics

- Improving diagnostic capacity and training new agents using virtual plant clinics
- The UMD Plant Diagnostic Laboratory directed by Dr. Karen Rane receives 500-800 plant samples each year from commercial growers, landscapers, arborists, consultants and county extension field faculty, for diagnosis of arthropod pests, infectious diseases and abiotic disorders. Diagnostic tests used in the lab include microscopy, microbiological isolation, ELISA, and molecular assays. Clients receive electronic reports of diagnoses

and management recommendations. All diagnoses are uploaded to the National Data Repository of the National Plant Diagnostic Network (NPDN).

IPM in fruit and vegetable crops

- Identifying *Colletotrichum* spp. causing anthracnose in VA, MD, PA to detect potential spread of a more serious species and improve anthracnose management (Dr. Hu)
- Evaluating and improving the strawberry advisory system as a predictor of real-time disease incidence (Dr. Hu)
- Improving management of late season bunch rots (Dr. Hu)
- Developing a fungicide resistance testing service for MD small fruit (Dr. Hu)
- Improving spotted wing drosophila management in small fruit (Dr. Hamby)
- Impact of management approaches on fruit quality (Dr. Farcuh)

IPM in communities

- Increasing homeowner adoption of IPM through Master Gardener programming
- Establishment of a network of demonstration plots in suburban yards demonstrating effects of fall yard clean-up activities on overwintering predators and pollinators. (Dr. Burghardt)
- Working with 4H forestry team subject matter coach on forest insects and pests (Dr. Burghardt)
- Dr. Burghardt recently initiated a AFRI-NIFA project examining how the intraspecific genetic diversity and cultivar identity of street trees in Baltimore determines resistance to insect pests and abiotic stress. Results can be used by urban planners and nursery growers to enhance cultural control within IPM programs by choosing and propagating a selection of trees most likely to thrive in challenging urban environments.

Invasive species response

- Increasing citizen awareness of spotted lanternfly (Dr. Lamp) and boxwood blight (Dr. Rane) issues
- Providing a tick identification service to better understand Asian longhorned tick distribution (Dr. Fritz)

Climate Change

- In 2020, Dr. Via gave a series of six “Climate and Sustainability” webinars that started with 325 registrants and ended with 1028. The videos have been viewed >4500 times in less than 8 months. Dr. Via asked people to complete a survey after each webinar and received >350 comments and overall excellent reviews.

Pesticide Resistance

- Maryland (Dr. Dively lead, Dr. Hamby co-PD) leads a sweet corn sentinel monitoring network to conduct field evaluations of resistance to Bt proteins. In 2020, this network included 45 trials in 23 states (TX, AL, MS, FL, GA, SC, NC, VA, MD, DE, PA, NJ, NY, WV, OH, IN, IL, IA, NE, MN, WI, NH, and VT) and four Canadian provinces (ON, QB, PEI, and NS). Paired plots of Bt hybrids and non-Bt isolines established at each location effectively monitored field-evolved resistance in corn earworm (CEW) populations to Bt toxins, with particular focus on the Vip3A trait. The network provided evidence that Cry toxins are 80 to 90% less effective for control of CEW, compared to when first commercialized, and resistance continues to develop based on increases in kernel

damage and number of surviving larvae in Bt ears. The Vip3A toxin still provides near 100% control of CEW, even under very high population pressure at most trial locations. Altogether, ear sampling reported a total 95 live early instars in 114 damaged ears of 13,913 Vip3A ears sampled (0.82% damaged ears). Results published to the December issue of the Journal of Economic Entomology have influenced EPA to make proposed changes to the insect resistance monitoring protocol for Bt crops.

- Developing genomic monitoring approaches for diagnosing resistance (Dr. Fritz lead, Dr. Hamby co-PD)

EMERGING PESTS AND SCOUTING

Emerging Pests that Affect Multiple Specialty Crops

- 12 MA sites were checked weekly for **BMSB**. Data were shared with MDAR and UMass Extension. “Ghost” traps, the novel “attract-and-kill” strategy (BMSB pheromone and insecticide-treated netting), were deployed on 5 partner farms to determine fruit damage reduction viability at harvest.
- Implemented **SWD** monitoring system comparing diluted grape juice vs. 3 commercial lures. Findings were reported via *IPM Berry Blast*, *Healthy Fruit* newsletters and social media.
- Collaborated in augmented mapping information distribution network (*iPIPE*, now *AgPest/EddMaps*).
- Monitored **scale** populations on 28 cranberry farms, processed 218 vine samples and addressed emerging vegetable pests including **Allium leafminer fly** and **downy mildews (DM)** in lettuce and spinach. Provided management information via newsletters, workshops, fact sheets and IPM alerts.
- Conducted 1 replicated trial evaluating DM resistant varieties of spinach for NE winter production.

Advanced Apple IPM

- Achieved implementation of grower-sufficient fireblight (FB) risk management. Growers received timely alerts and consistent monitoring during the transition.
- Conducted apple scab (AS) spore observations at UMass Cold Spring Orchard to determine duration of primary spore availability. Compared observations to model estimates of ascospore maturity.
- Monitored and ID’d apple foliage for the emerging disease, Marssonina leaf blotch.
- Trained growers on AS and FB model output use; AS spore observations are on-going.
- Consistently demonstrated effectiveness of semiochemical based *attract-and-kill* strategies for plum curculio (PC) and other key pests of stone and pome fruit within and outside MA.
- Assessed pathogenic nematodes suppression for PC ground-dwelling stages in commercial farms.
- Held field workshops to demonstrate IPM tools, such as attracticidal spheres for apple maggot management, and control options for FB-sensitive crops.
- Results from applied research projects were presented to growers at state and regional meetings and through UMass Extension publications (e.g., *Healthy Fruit*, *Fruit Notes*).

Brassica IPM

- Our network of 5 researchers in 4 states worked with 15 growers to implement best

management practice in brassicas, and conducted 9 replicated trials on alternative pest management strategies.

- Wrote 10 newsletter articles, factsheets and reports; conducted 5 webinars with live attendance and video views totaling >1,047 growers and service providers; held 3 field days with 150 attendees.

Efficacy of Organic Pesticides

- Conducted replicated trials evaluating host-resistance to manage plant diseases without use of pesticides, a valuable strategy for organic growers whose choices of fungicides are very limited.
- We trained 10 undergraduate students on organic pest management, focusing on insect monitoring techniques, scouting, and organic management of key apple and vegetable pests.

OUTREACH AND TRAINING ACTIVITIES

Training scouts and IPM implementation on Mentor Farms

- We hosted our annual Advisory Group meeting for the EIP grant on March 9, 2020. We discussed priorities for the fourth year of the project (18 attendees).
- We regularly visited 14 Mentor Farms to scout, assess problems, and provide hands-on training for IPM techniques and pest identification. Growers were interviewed at the beginning and end of the season to determine implementation success and challenges. Intakes and scouting in 2020 are temporarily reduced due to State and University Covid-19 regulations.

Conduct Workshops and Training on Special Topics.

- Conducted one workshop on SWD identification and management (50 attendees).
- Published the 28th Annual March Message, providing information on cutting-edge research-based pest control, including recent research and potential future directions to MA and NE fruit tree growers. It discusses IPM issues within and outside the U.S.
- Developed a new IPM fact sheet series for various tree fruit and small fruit crops.
- Held 8 twilight meetings (300 attendees) and one field day (110 attendees).
- Conducted 4 WPS trainings (42 attendees) and worked with MDAR and UMass pesticide programs to host 1 WPS train-the-trainer session. We provided 9 Pesticide Certification consultations.
- We held a “how-to” diagnostics workshop for growers (35 attendees).
- We did one-on-one trainings and education on resistance management (53 attendees).
- 20 workshops and trainings were held (840 attendees) targeting organic growers, nutrient management, bee conservation, with other subjects addressed as dictated by grower needs.

Weed Management (65% complete).

- Secured registration of a new herbicide in cranberry, expanding mode of action options.
- Screened 5 novel herbicides (greenhouse) to identify products for priority IR-4 projects.
- Conducted 5 workshops to promote effective weed IPM on specialty crop farms (1287 attendees).
- Conducted 1 Partner Farm project (pronamide on new cranberry vines) and weed IPM support was provided to fruit and vegetable growers via field walks, newsletter articles, pest alerts, and workshops.

- Published 2 fact sheets: moss biology and dodder management.
- Developed and delivered a weed identification quiz at a regional meeting to determine growers' ability to accurately identify problem weeds on farm (80 respondents).

Bridge Language Barriers

- We evaluated survey responses and worked with collaborating institutions (CISA) and farmers to prioritize production of Spanish-language resources.
- Created a [general Spanish-resource page](#), with vegetable production resources, and a [Food Safety page](#), listing specifically food safety-related resources; all vetted by the UMass Translation Center.

Promote Commonwealth Quality Program (CQP).

- Our Vegetable and Fruit Teams partnered with MDAR in on-farm and classroom trainings, field walks and twilight meetings to prepare inspectors/auditors to use the IPM checklists.
- Work on the Cranberry CQP was completed and is posted on MDAR website.

TECHNOLOGY DEVELOPMENT

Digital Recordkeeping

- Team members continued to seek software/platforms to serve this need, investigating versatility of Farm Dog app and *AgPest/EddMaps* to determine feasibility of record keeping in those platforms.

Optimizing Technology Utilization on Specialty Crop Farms

- Conducted 1 educational workshop on the use of thermal cameras (125 attendees).
- Held 1 workshop on the use of unmanned aircraft systems (UAS) in cranberry (10 attendees).
- Published 1 fact sheet on agrivoltaic panels on cranberry farms and initiated a research project to collect preliminary environmental and plant data with a plywood prototype.
- Reviewed 16 proposals for dual-use of solar energy on specialty crop farms; 10 were approved.
- Three DTN© Smart Traps were used at UMass Cold Spring Orchard and 1 commercial orchard to remote monitor oriental fruit moth (OFM), codling moth (CM), and obliquebanded leafroller (OBLR).
- Utilized MyIPM workgroup session to leverage phones for creating phone-friendly apps.
- Installed 8 new weather stations with microclimate sensor potential.

Using Integrated Pest Information Platform for Extension and Education (iPIPE)

- We installed monitoring systems and gathered information on Collaborator farms. Information shared with our regional Extension colleagues to inform IPM decisions across state lines.
- 1 undergraduate scout was trained in scouting (Veg) and reported data to iPIPE weekly.

Weather Stations and Sensors

- Communications with growers about stations and data were accompanied with advice and questions about IPM and decision support systems (DSS) as supported by the NEWA platform.

- Approximately 50 tree fruit growers are steady users of models for apple scab disease, fire blight disease, and summer diseases as well as plum curculio, apple maggot, and other insects.
- Produced 1 video on using NEWA to determine apple scab infection risk and access weather forecast.
- Maintained 31 weather stations.

PROFESSIONAL DEVELOPMENT

Business Management and IPM Decision Making

- Extension Team Members worked with resource economists and growers to guide our examination of factors that influence whole-farm management decisions.
- We hosted a workshop on enterprise budget development (18 attendees).

Information Technology (IT) Professional Development

- Extension personnel held 10 virtual grower workshops (ca. 650 attendees).
- Veg and Fruit Teams use Instagram and Facebook, respectively, to promote grower connectivity.
- We were trained in MyIPM app development and disseminated information to stakeholders.
- Conducted 3 fruit-growing webinars (195 attendees). Video presentations posted to YouTube.
- Initiated Podcast component to Healthy Fruit.

Assessing Change in Behavior and Condition from IPM Extension Efforts (50% complete).

- Improved evaluation process to capture increasing knowledge and confidence in implementing IPM, as well as longer-term impacts.
- Highlighted costs of labor and different management strategies during Mentor Farmer evaluations.
- Two growers adopted the use of synthetic lures and perimeter-row applications of insecticide mixed with sugar as a phagostimulant for reduced-input management of apple maggot fly. Insecticide applications were reduced by at least 70%.



UNH Cooperative Extension's IPM program has historically focused on educational efforts in Specialty Crops IPM, IPM in the Community, and Public Health IPM. This year is a time of great transition in our organization as we see the retirements of critical members of our team, hire new members, and focus our attention on training the next generation of IPM practitioners. We are also taking stock of lessons learned during a dramatic shift to distance education in response to the COVID-19 pandemic.

Retirements ☹️

- George Hamilton, Hillsboro County, Fruit & Vegetable Crop Production, Crop Protection, Pesticide Application Technology, Sprayer Calibration
- Cheryl Smith, Plant Diagnostic Clinic Director, Specialty Crops Protection Specialist

Plant Diagnostic Lab

- Experimented with video chat diagnostics in lieu of physical sample submissions
- Hiring a new plant pathologist to head UNH-PDL

Training the Next Generation of IPM Practitioners

- Training field scouts (college, high school); attempting to recruit from collaborating farms
- Incorporating Extension objectives into UNH graduate student projects
- "Support networks" for inexperienced specialists and high level growers
 - Northeast Tree Fruit IPM YouTube channel
<https://www.youtube.com/channel/UCHllsldMjM9rL49i4ZzDYdA>
 - SWD Monitoring Support Group Facebook page
<https://www.facebook.com/groups/522970225768806>

Distance Education

- Webinars! So many webinars! Live and available online
<https://www.youtube.com/channel/UCP15ui7R8clKcMIP1E0W1pw>
- Over-Informed on IPM podcast <https://extension.unh.edu/over-informed>
- Anecdotally, we felt that we lost contact with many of our regular clients during our shift from in-person meetings to webinars. However, we connected with many new clients using this format and many of those new clients were in what we would consider underserved audiences. This includes women, parents of young children, geographically isolated farmers, farmers with limited transportation, and farmers with day jobs.
- Worked with NH Division of Pesticides to deliver web-based continuing education credits for pesticide applicators

Tree Fruit IPM

- Prepare NH orchardists for potential BMSB Outbreak
 - DIY Trapping networks identified only small regions of concern
- Encourage the use of alternatives for Lorsban for trunk borers



- Provide education on delivering entomopathogenic nematodes through irrigation
- Encourage the use of NEWA weather modeling for managing tree fruit pests
 - Establishing new stations, maintaining existing stations
 - One-on-one training and web-based tutorial on how to use weather data/models for IPM decision making
- Collaboration with NRCS & Xerces Society to encourage the adoption of Integrated Pest & Pollinator Management plans
 - On-site pollinator assessments to improve wild bee identification, identify pollinator habitat in and around orchards, inform decisions on hive rental/purchase or establishment of new pollinator habitat
 - Building a working relationship between Extension and NRCS to inform 595 programs

Vegetables

- Encourage adoption of monitoring key pests of sweet corn
 - Continue monitoring networks
 - Provide education on pesticide resistance, principles of resistance management
- Encourage adoption of monitoring and behavioral controls for key pests of cucurbit crops
 - Continue monitoring networks
 - Provide education on behavioral controls, like border row only sprays, trap cropping, attract & kill, mass trapping
- Identify pests of extended season vegetable production. After two years of scouting tunnels and surveying growers in order to determine key pest of early season vegetable production (February – May), we have yet to find any patterns in typical pest problems other than overwintered aphids and abiotic stress caused by high humidity and extreme temperature fluctuations. There is a need for more research in this area before we can advance with our educational objectives.

Greenhouse, Nursery & Landscape

- Conduct a needs assessment for NH's ornamental crop IPM
 - Neonicotinoid alternative pest management strategies for several scenarios
 - Thrips resistance management a top priority

Community IPM

- Respond to high demand for information about growing and preserving food
 - Facebook live events: <https://www.facebook.com/AskUNHExtension/>
 - Granite State Gardening Podcast & Newsletter <https://extension.unh.edu/blog-category/granite-state-gardening-podcast>

Public Health

- Work with State & Non-Profit Organizations to provide education on ticks & tick-borne disease



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New York State IPM Report, NEERA 1604 Meeting, April 23, 2021

Prepared by Alejandro A. Calixto, NYS IPM Program

SITUATION

New Yorkers are exposed to risks from pests and the methods used to control them.

RESPONSE

The NYS IPM Program is reducing environmental, health and economic risk by teaching, demonstrating and researching IPM practices. We conduct programs in agricultural crops—fruits, vegetables, ornamentals, field crops and livestock; and community settings—schools, homes, municipalities, parks, and golf courses.

RESULTS/IMPACT

Funding: In 2020 we received these core funds:

- NYS via NYS Dept of Ag and Markets: Agricultural IPM, \$1,000,000
- NYS via NYS Dept of Environmental Conservation: Community IPM, \$550,000
- Federal USDA-NIFA, CPPM-EIP, \$275,000

In addition, our staff directly leveraged nearly a half million dollars in outside grants that came to our program, Cornell faculty and staff, and other partners. We were also critical collaborators on additional grants totaling \$246,000 coming into Cornell and Cornell Cooperative Extension.

2019-2020 Annual Report, Our NYSIPM Annual Reports are excellent tools for communicating NYSIPM to stakeholders. In our most recent report, we featured biopesticide efforts, on farm demonstration in peppers, pesticide alternatives to control Douglas-fir needlecast, intensive apple IPM workshop, surveys of soybean cyst nematode, tick and tick-borne diseases surveillance, cover crops to prevent weeds and farewell to Director Jennifer Grant and Extension Educator Lynn Braband. This report shows NYSIPM's positive impact on New Yorkers and their environment and are excellent outreach tools for our program. The latest report is available [here](#).

2020 Virtual NYSIPM Conference: *School IPM: Where We've Been and What's next.* August 2020. This conference focused on bringing together a wide range of speakers to address and discuss the status of School IPM adoption and where we need to go in the future. Attended by approximately 70 school staff, educators, scientists, regulators and policy makers.

NEWA – Network for Environment and Weather Applications: The Network for Environment and Weather Applications ([NEWA](#)) delivered over 40 insect, plant disease, crop management, degree day, and weather summary models to locations across 28 US states. 2,741 total online contact hours were achieved in 2020, a result of both new and ongoing outreach efforts across the network.. Total weather stations increased to 717, up 6% from 2018 (676). Major components of a new website platform are complete. Ten insect models have been recoded, tested and finalized. Migration of remaining disease and apple management models is ongoing with targeted completion of Spring 2021.

Resources produced

- [The NYS IPM Image Gallery](#) provides visual identification information and links to IPM



- educational materials with over 4,583 images and videos (up 7% from 2019).
- 8 podcasts on Weed IPM (“Into the Weeds”) available in [Spotify](#) and [Google Podcasts](#)
- [Spotted lanternfly expansion map](#)
- [Spotted wing drosophila distribution map](#)
- Blogs
 - [ABCs of School and Child Care Pest Management](#)
 - [Weekly Field Crop Pest Report](#)
 - [Spotted Wing Drosophila](#)
 - [Biocontrol Bytes](#)
 - [Sweet Corn Pheromone Trap Network](#)
 - [Ornamental Crops IPM](#)
 - [ThinkIPM](#)
 - [Your NEWA](#)
- Twitter feeds
 - @NYSIPM
 - @NYSFieldCropsIPM
 - @OrnamentalIPM
 - @Iknwplnts
 - @IPM_School&Childcare
 - @AmaraDunn
 - @LynnBraband
 - @Tinigua

Highlights by Commodity

Community (Schools, homes, parks, golf courses, municipalities, etc.)

- Before COVID-19, the Community IPM Team provided 1,482 contact hours of in-person presentations and workshops. From mid-March on, the team provided over 1,600 contact hours of live, virtual workshops and webinars. Many of these presentations were recorded, captioned, and made available through the NYSIPM YouTube channel.
- Surveillance and outreach on tick and tick borne diseases in NY.
- Long Island Pesticide Pollution Prevention Project (LIPPP) – A title for the campaign was created “Our Land, Our Water” and set the foundation of the outreach campaign.
- 2020 Virtual NYS IPM Conference – “*School IPM: Where We’ve Been and What’s next*”
- NYS Community IPM is a partner in the Northeast Regional Center of Excellence in Vector Borne Disease, funded by CDC and housed at Cornell University.
- Continued long-term partnership with NYS Park Golf Courses on reduced chemical golf course management.

Vegetables

- Surveys of potential insect and disease pests of hemp were conducted in several farms.
- Coordinate statewide efforts for the NY Sweet Corn Pheromone Trap Network (SCPTN).
- Tested and demonstrated cultivation for weed management in sweet corn, snap beans, and beets; and are testing a weed zapper.
- Coordinate statewide efforts for surveillance of Soybean Cyst Nematode in dry beans.

Fruits

- Coordinate the Apple IPM Intensive Workshop during the Empire Producer’s Expo.
- Coordinate surveys for virus complex in apple orchards.
- Conduct NY grape commodity survey for insect pests and pathogens.

- Revision of the NEWA website apple IPM tools.
- Coordinate a survey for five exotic pests and virus complex in apples in 18 apple orchards in 11 counties. Pest surveyed were the Summer fruit tortrix moth,
- Participated in NYS's Incident Command Structure for spotted lanternfly; created ID and awareness resources; surveyed the preferred host, *Ailanthus altissima*, tree of heaven; developed webinars and distance courses; created insecticide guides; and held a regional SLF conference.
- Organized statewide trapping network for spotted wing drosophila.
- Tested hummingbirds as biocontrols in raspberries.
- Worked with NYSDAM and USDA to stop spread and help management of European Cherry Fruit Fly
- Evaluation of methods for management of bindweed in New York vineyards.

Ornamentals

- Evaluation of deer repellents for reducing deer damage to Christmas trees.
- Continue research on beneficial arthropods and pollinator habitat plots adjacent to Christmas trees at Cornell AgriTech.
- Researched reduced-fungicide usage for Christmas tree production to reduce risk to pollinators
- Continue working with growers to evaluate use of GDD based insect models for conifer pests

Livestock and Field Crops






- Documenting and expanding biological control of the cereal leaf beetle in small grains with a parasitic wasp.
- In Season weekly calls to improving Field Crop Extension connectivity and outreach.
- Evaluations of seed treatments alternatives for managing early season pests of corn.
- Training and education for advanced and beginner Certified Crop Advisors in the Northeast
- Coordinate statewide efforts for surveillance of Soybean Cyst Nematode in soybeans.
- Western bean cutworm and true armyworm Pheromone trapping network
- Tested and demonstrated various traps for fly management on dairy farms.
- Field crops weekly pest report and evaluation.
- Preliminary surveys of dung beetles associated with pastures and their potential role as competitors of face and hon flies impacting livestock.
- Effective waterhemp control programs and compatibility with interseeding in corn.
- Controlling herbicide resistant waterhemp in soybeans.

Web and Social Media Presence

Social media and other internet-based outreach were expanded throughout 2020, including starting the updates of the website "[Biological Control: A guide to Natural Enemies in North America](#)"

To reach diverse audiences in New York State, including those in various age groups, program staff continued to promote the IPM Image Gallery on Flickr, Facebook, YouTube and Twitter, as well as adding an Instagram account. This table presents the data on the number of visitors, subscribers and followers in our different sites and media channels.

Visitors, Subscribers and Followers

	2020	2019	% Increase
nysipm.cornell.edu	329,316	318,845	+3.1
eCommons downloads	697,966	516,969	+25.9
ThinkIPM Blog	140	128	+8.6
 YouTube	978	687	+29.8
 Flickr	55	52	+5.4
 Twitter	1556	1433	+7.9
 Facebook	1254	1024	+18.3
 Instagram	158	0	-

Pennsylvania Integrated Pest Management (PAIPM) Program Report to NEERA 2021

Ed Rajotte, IPM Coordinator and Professor of Entomology
uvu@psu.edu

PAIPM is a diverse program that spans agricultural and urban systems. Listed below are some of the programs supported by EIPM in Pennsylvania. All programs also leverage other outside funding from federal, state and non-governmental organization sources. Project leaders are listed.

In addition, there are IPM programs in all Pennsylvania agricultural commodities including horticultural crops, animal production and the green industry.

Integrated Pest & Pollinator Management for Eastern Apple Orchards-David Biddinger, Research Professor of Entomology

Field evaluation of registered and experimental insecticides/acaricides are evaluated at the Penn State Fruit Research & Extension Center in Biglerville for pest control and non-target effects on biological control and pollinators. This applied research is then translated into grower recommendations for the mid-Atlantic region through the Penn State Tree Fruit Production Guide which was chosen as the national award winner by the American Society for Horticultural Science (446 p. <https://extension.psu.edu/tree-fruit-production-guide>). Grower extension presentations are made several times a year to update growers on the best pest management practices that will conserve biological control of secondary pests such as mites, aphids, and scale insects and to conserve the 50+ species of wild bees that have replaced honey bees as the main pollinators of apple. Yearly workshops are given often in conjunction with the Xerces Society to educate growers and the general public about bee diversity, conservation through additional floral resource plantings or through pesticide selection and timing in IPPM programs. Additionally, an 85 page extension publication was developed for growers and the public: Managing Northeast Apple Orchards for Pollinators and Other Beneficial Insects: Integrated Pest Management, Habitat Enhancement and Managed Bees. Penn State University and Xerces Society for Invertebrate Conservation Joint Publication, 85 p. <https://extension.psu.edu/shopby/guides-and-publications?keyword=biddinger>

Spotted Lanternfly Control and Insecticide Impacts on Non-target Arthropods, Including Bees.

Approximately 80 different insecticides have been evaluated for efficacy and residual activity of this invasive pest at the Penn State Berks Campus in Reading. From this applied research has come control recommendations (<https://extension.psu.edu/spotted-lanternfly-management-resources>) for the grape, tree fruit, Christmas trees, ornamentals, and homeowners at: <https://extension.psu.edu/spotted-lanternfly-management-in-vineyards> , <https://extension.psu.edu/spotted-lanternfly-management-for-residents> , <https://extension.psu.edu/treating-black-walnuts-with-insecticides-for-spotted-lanternfly-control>. These trials have also been the basis for over a dozen 2(e) label amendments by companies to include spotted lanternfly control on various insecticide labels, and the bases for several 24C Special Local Need label changes for forestry and ornamental control. A large-scale evaluation of the organic bio-insecticide *Beauveria bassiana* and the neonicotinoid insecticide, dinotefuron,

was conducted with ground and helicopter applications at the Blue Marsh federal park. Both efficacy and residual activity on SLF in the field and impacts on non-target ground and aerial arthropods (i.e. bees, ground beetles, parasitic wasps etc.) were evaluated to inform both the Pennsylvania Department of Agriculture and the USDA-APHIS for future large-scale gypsy moth type control programs being contemplated, and for hard targets such as ports, airports and rail junctions where there is not tolerance because of export issues or high risk areas of spread exist. Evaluations of SLF eggs using a digital microscope to detect native parasitoids adapting to a new host as they have done in the past with other invasive pests such as the Brown Marmorated Stink Bug, show no such host shift in the case of SLF. In the course of collecting tens of thousand of SLF nymphs and adults, none have been found to have been parasitized by native parasitoids, although some generalist predators are utilizing them as food.

Serving the Hispanic Community in Agriculture– Maria Gorgo-Gouravitch, Food Safety, IPM and Water Quality Extension Educator

Advancing Penn State Extension’s Latinx Outreach Efforts using Innovative Educational Formats

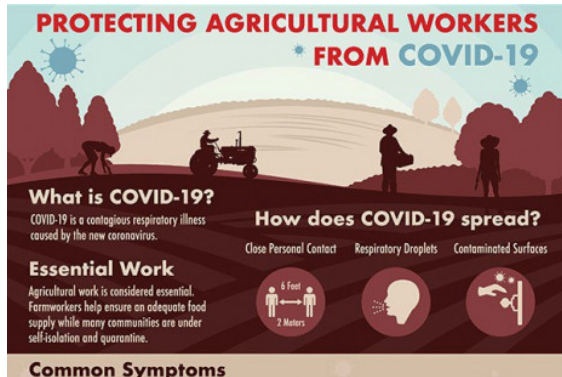
The Penn State Extension [Latinx Agricultural Network](#) continues to develop innovative educational formats in Spanish for providing timely resources to life sustaining ag businesses. Team members coordinate a [new Penn State Extension Agricultura en Español facebook page](#) with the mission of providing 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, April through August, 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.



**Penn State Extension
Agricultura en Español**

Protecting Agricultural Employee Health during COVID-19

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. Secretary Russell Redding led the final forum on July 30th, and recorded webinars and handouts are [on-line](#).



Our team has 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

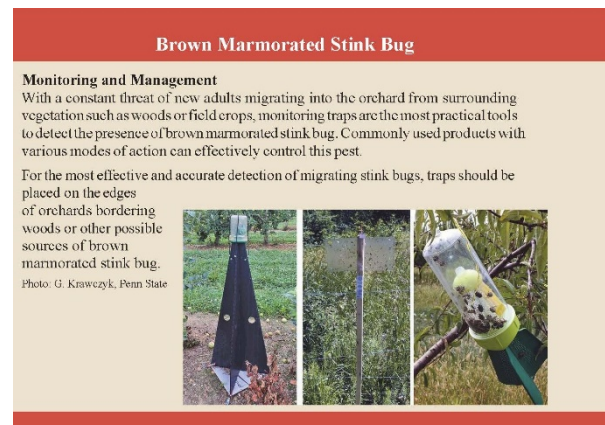
are being distributed by agricultural employee health providers, produce auctions, and extension educators.

Pennsylvania Farm Employer’s Listserv

One of the outgrowths of the Protecting Agricultural Employee Health webinar series is a new discussion group for human resources personnel called the Pennsylvania Farm Employer’s Listserv (PFEL). Proposed by Penn State Center for Agricultural and Shale Law Staff Attorney Brook Duer and organized in collaboration with the tree fruit team, this email-based networking and resource-sharing group is specifically tailored to agricultural labor issues for those with human resources responsibility at agricultural operations. In this forum, farm employers can 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 is open to the public but requires registration. To request to join the list, send an email to pfel-subscribe-request@lists.psu.edu. Please put the word “subscribe” in the Subject: header and in the message body. Contact daniel.weber@psu.edu for additional information.

Support for Plain Sect Grower Crop Diversification Transitions

During the PDP process, educators identified a need for a tree fruit IPM field guide for plain sect growers who are diversifying their operations by planting tree fruit. In cooperation with the pesticide education program, the team produced a full-color field guide on identification and sustainable management of tree fruit diseases, pests, and physiological disorders. Extension educators are distributing the guide to produce auctions and during site visits.



IPM in Pennsylvania Schools and Childcares and IPM in human communities - Michelle Niedermeier and Dion Lerman – PA IPM Staff

Schools and Childcares

1. The 3rd edition of our *IPM for Pennsylvania Schools and Childcares: A How-to Manual* was released in February 2020, after more than a year under revision. It is available as a [hardcopy](#) and a [free PDF](#) download. This edition was updated to include current laws and regulations, new chapters (e.g., the role of pests as asthma triggers, bed bugs, and beneficial insects and pollinators) and color photographs throughout. Updates were made possible with additional funding from the Centers for Disease Control and Prevention (CDC), The Pennsylvania Department of Public Health, the American Lung Association, and the Pennsylvania Asthma Partnership.

2. PA IPM has long partnered with Head Start and Early Head Start programs and sits on several health service advisory councils (HSAC) for programs in southeast Pennsylvania. We attend quarterly meetings and serve as area experts on indoor environmental health and pest and pesticide issues, and provide training for their staff and resources for the families in their programs. Additionally, we are active members of the Philadelphia Department of Public Health's (PDPH) Interagency Childcare Consortium (IC3). Meetings are held quarterly (although paused because PDPH staff have been temporarily reassigned to COVID detail) and are designed to pool and disseminate knowledge and resources for home- and center-based childcare facilities directors and staff.

3. Pennsylvania's K-12 Academic Standards are unique in that we have separate Environment & Ecology (E&E) standards as part of the general academic state standards for public schools. The [E&E academic standards](#) were first approved in 2002. There have been several reviews/revisions over the years, but none of the revised standards were approved, thus the 2002 standards are the current standards. Beginning in early 2020 we learned that there was a coalition forming to eliminate these separate standards, in favor of national STEM standards that are far more basic and general in approach, and thus effectively removing IPM and Agriculture from the Pennsylvania academic K-12 standards.

Current proposed draft standards:

- [Pennsylvania Integrated Standards for Science, Environment, Ecology, Technology and Engineering \(Grades K-5\)](#) (PDF);
- [Pennsylvania Integrated Standards for Science, Environment and Ecology \(Grades 6-12\)](#) (PDF); and
- [Pennsylvania Technology and Engineering Standards \(Grades 6-12\)](#) (PDF)

PA IPM has participated in numerous meetings and conference calls, and contributed via focus groups and other events to advocate for the E&E standards. The process continues to move forward but is currently stalled in the State Attorney General's office.

Somewhat related, PA IPM is among the founding members of the Pennsylvania Green & Healthy Schools Partnership (PAGHSP), which works closely with the National Wildlife Foundation to advance the Eco-Schools USA program in Pennsylvania. Monthly executive board meetings look to reduce the barriers of implementing environmental education and to increase environmentally literacy rates amongst the Pennsylvania student population to be equipped with

critical thinking, problem solving, as well as social and basic life skills to meet present and future environmental issues.

4. School Reopening/COVID mitigation

COVID = Pest

+ Disinfectants = Pesticides

IPM for Schools

I am on a PA Healthy Environment and Reopening Schools Workgroup, pulled together by PDE (Tamara Peffer - content advisor for the K-12 State Academic Standards for Environment & Ecology.) We have been meeting weekly, since the beginning of May 2020 to work specifically on school health and reopening guidance, synthesis, and outreach.

It is a diverse, but small (less than 20) group of people representing state agencies and environmental/public health groups. The nature of the discussions lend themselves toward the importance of the state school IPM mandate and how as it relates to school reopening issues (pests, applications of pesticides including disinfectants, etc.). There is not a representative from PDA attending, so I represent them as well.

There have been many twists and turns in how and on what we've been working, and the various projects and outreach to schools, but currently the Pennsylvania Department of Health epidemiologists, in partnership with the Drexel School of Public Health, are putting together a PPT presentation that will be available as a live session and recorded for future viewing (hopefully with the ability to edit as the base of knowledge continues to grow and guidance will need to be changed accordingly. Here is the only draft of the PPT that I saw:

https://drive.google.com/file/d/1_4uZ6Bj4TEOP43UE1T_XMJ2jtIGxIBbd/view?usp=sharing

I submitted several pages of edits to this draft, with specific changes to the 1 slide about IPM. I also provided verbal feedback on a work group call relating to the state school IPM mandate and specifically about disinfectants being pesticides that are regulated by the US EPA under FIFRA (new news for far too many state agency people, and others!)

There is so much to consider with school reopenings. As usual, the knee jerk reaction is that school facilities folks are listening to their vendors and buying all sorts of equipment and products and gadgets and then coating everything with a disinfectant ... the importance of having/using an IPM plan are glaringly obvious! As such, we have also started a NE School reopening work group with experts and practitioners from Maine to Pennsylvania. We meet weekly to share ideas and help guide each other as schools continue to reopen.

Shortlist of Schools and Childcares Partners: Head Start/Early Head Start, Philadelphia Higher Education Network for Neighborhood Development - K-16 Work Group, School District of Philadelphia, Pennsylvania Department of Education, Pennsylvania Department of Health, Pennsylvania Department of Environmental Protection, Pennsylvania Department of Conservation and Natural Resources, NE IPM Center - School IPM Working Group, National School IPM Network, Women for a Healthy Environment, Pennsylvania Green & Health

Schools Partnership, National Wildlife Federation, Philadelphia Department of Public Health, Health Federation of Philadelphia, Children's Hospital of Philadelphia

Community

1. Until COVID closures, PA IPM was an active member of the Philadelphia Department of Public Health (PDPH), Office of Preparedness Climate Change & Health Advisory Group, and the asthma subcommittee. This group met bi-monthly for several years, but meetings have been paused since February 2020 as PDPH staff were temporarily reassigned to COVID detail.

2. PA IPM is also an active member of the Delaware Valley Regional Planning Commission's (DVRPC) Healthy Communities and Public Participation Task Forces. We regularly attend meetings and provide input related to the built environment and planning's impact on pest populations. Meetings have continued virtually throughout COVID shutdowns.

3. PA IPM is the de facto Penn State Extension pest management education provider for Philadelphia and surrounding southeast counties, especially for urban pests such as bed bugs, rats, mice, mosquitoes, cockroaches, etc. We provide custom-tailored outreach, education, and training on Integrated Pest Management and Healthy Homes to Pennsylvania residents, and to the staff of the agencies that serve them. We regularly respond to resident ID requests, questions, and concerns around pests and provide evidence based IPM solutions via email and phone calls (and in person, pre-COVID).

We are active members of the bi-monthly PSU Vector-borne disease team and the bi-weekly Spotted Lanternfly research update calls. Additionally, we regularly attend the Department of Entomology's Friday seminar (now that it is on Zoom), and regional and national entomology, IPM, and other related research updates and training programs to stay current with best management practices.

Additionally, PA IPM works to connect University researchers with partners. Over this last year we have found SLF collection sites and urban farms for PSU grad students and post docs to do field work.

4. One of our longest community partnerships in Philadelphia is with the Children's Hospital of Philadelphia - Community Asthma Prevention Program (CHOP-CAPP). We have partnered with [Dr. Tyra Bryant-Stephens](#) for almost two decades in programs, projects, and trainings for her community health outreach workers, the families they serve, and the greater Philadelphia asthma community around IPM and related environmental health issues in the built environment. We meet bi-monthly and on a need-to basis with her and her team to address environmental triggers of asthma.

Shortlist of Community Partners: Philadelphia City Council, Philadelphia Department of Licenses & Inspections, Philadelphia Department of Public Health - Vector Control and Office of Preparedness for Climate Change, Community Legal Services, Liberty Resources, Liberty Community Connections, Children's Hospital of Philadelphia – Community Asthma Prevention Program (CHOP-CAPP), Public Health Management Corporation, Delaware Valley Regional Planning Commission, Philadelphia Higher Education Network for Neighborhood Development - Sustainability Work Group,

5. We responded to a change on state Medicare/Medicaid benefits that included reimbursement for “pest eradication” services for disabled adults. While groundbreaking in providing, for the first time, essential pest control for an underserved and vulnerable population, there was concern about how the benefit would be delivered and administered since there was no precedent or in-house expertise on pest control in the Pennsylvania Department of Health and Human Services. Beginning in January 2019, meetings were held with the three managed care organizations (MCO’s) administering the benefit in southeast Pennsylvania. They recognized their lack of expertise, and the institutional barriers to effective administration. To be reimbursable, services must be provided by a certified Medicare/Medicaid provider; no pest control companies were certified. Working with Liberty Resources, the Philadelphia area Federally certified Center for Independent Living, who provide comprehensive services for the regions 45,000 disabled adults, a solution emerged. Liberty created an entity, housed in their home modification program, to act as a pest control company that would subcontract with local integrated pest management (IPM) providers and interface with the MCO’s and state agencies. This process went through several design iterations, but was finally operational in February 2020, with the PA IPM Program consulting as the Technical Director. Only two homes had been serviced before the COVID-19 shutdown forced the program to pause, before gradually resuming over the summer. As of 3/21/2021, the program has treated 108 homes, with virtually all reporting successful elimination of the pest in a single visit, and complete customer satisfaction. Bed bugs were the most common pest treated, accounting for over 38% (n=42) of treatments; only about 5 homes required retreatments. Cockroaches (n=24, or 23%) were the next most common pest treated, with rodents (n=21; 19%) rounding out the top complaints. Only 9% (n=10) of treatments involved more than one pest, and squirrels and fleas also required treatment.

Another major project that is moving forward after pandemic-induced delays, is the establishment of an Urban IPM Technician Training program that will train underserved Philadelphia residents to become licensed pesticide applicators and apply IPM techniques to residences and local businesses. This job development project is being created in partnership with ECA, a primary provider of weatherization and home renovation services under city contracts; they already conduct building trades training. The first cohort is scheduled to launch in the fall of 2021.

Other public-facing activities of the Philadelphia PA IPM office were largely curtailed by the pandemic, although video-based training did continue, including two 2-day Essentials of Healthy Homes for Practitioners were held for the Philadelphia and Bethlehem Health Departments. Ongoing partnerships and task force work continued remotely, including with the West Philadelphia Promise Zone Housing Committee and the Philadelphia Hoarding Task Force.

IPM in Agronomic Crops – John Tooker, Professor of Entomology

We continued our efforts to promote IPM in field crop production. Over the past year, we communicated with the agricultural community of Pennsylvania the value and limitations of insecticidal seed treatments, insect-resistant crop varieties, details of pest biology, and alternative means of controlling insect pests, including farming to increase diversity and improve biological control. We have also started promoting IPM in the context of broad interest in soil health. Farmers seem to recognize that there is value in farming for healthier soil, so restrained use of insecticides aligns well with farming for soil life and diversity. One of our key efforts focused

on soybean production, and we continued an ongoing effort of running a sentinel plot program in Pennsylvania soybean fields. Working with county-based extension educators, the main goal of the project was to encourage growers to adopt Integrated Pest Management by providing growers with a statewide assessment of insects and diseases active in soybean fields. This effort benefited farmers by exposing them weekly to realistic, unbiased assessments of populations of insects and diseases in soybean fields. Ample research has shown that soybean farmers over rely on insecticides and fungicides because they do not have a firm understanding of the threats that insects and fungal pathogens pose to their fields. Our scouting efforts of “typical” soybean fields, usually grown without insecticides and fungicides, by extension educators provided qualified assessments of pest populations that colonized fields around the state. After seeing our reports, we expected that growers would seek to learn what is active in their fields. If they experienced mild pest populations, then they would see first-hand that that insecticides and fungicides are not needed in most soybean fields. This first-hand experience can lead them to embrace scouting, which is the key to implementing Integrated Pest Management and lowering production costs by allowing farmers to avoid using necessary inputs.

Beekeeping and Pollinator Protection – Margarita Lopez-Urbe, Assistant Professor of Entomology

1. Working toward best management practices for organic beekeeping: a side-by-side comparison of management systems (USDA-NIFA-OREI)

We are finishing the third year of this project that focuses on a side-by-side comparison of honey bees under three different management systems: conventional, organic and chemical-free. One of the great achievements of this project has been the ability to create bridges of communication between beekeepers who manage honey bees using conventional practices and beekeepers who choose to manage bees without the use of chemicals. The latter group has historically been marginalized from mainstream beekeeping meetings because of their ideology for bee management. We have successfully brought together these groups of beekeepers to have open discussions about beekeeping practices. Our research has revealed that the organic management system is the most profitable and sustainable for beekeepers in Pennsylvania with economic gains that are twice as high than the gains of beekeepers who manage bees using a conventional system.

2. Strengthening honey bee health through genome-assisted breeding (USDA Animal Health)

We are working with beekeepers from Pennsylvania to develop 10 areas across the state where we will genotype and phenotype genetic lines to identify those that perform well in Pennsylvania and are disease tolerant/resistant. The long term of this project is to help initiate a beekeeper-led regional breeding programs of more resilient honey bee with reduced overwintering losses.

3. Which bees are best: Testing the performance of commonly available honey bee stocks for Midwestern and Northeastern beekeepers (USDA-NIFA-CARE)

In collaboration with Purdue University, we generating field relevant data on the performance and profitability of multiple commercially available honey bee stocks in the Midwest and Northeast. We currently have 10 apiaries across Pennsylvania where we are running a side-by-side comparison of five genetic stocks community used among our beekeepers. Our long-term

goal is to generate evidence-based data that will help beekeepers choose the best stocks that will increase sustainability and profitability of their beekeeping operations.

4. Maximizing pollination services for blueberry production in Pennsylvania (Northeast SARE)

While managed honey bees are regularly rented to achieve optimal pollination in commercial blueberry farms, there are two disadvantages with this approach to guarantee pollination: (1) honey bee rentals are costly, and (2) honey bees are less efficient pollinators of blueberries than wild bee species. In a survey we conducted to blueberry growers in 2018, 50% of the participants reported that they use honey bees for pollination services. Still 53% of growers reports concerns about pollination limitation in their farms. We are partnering with blueberry growers in Pennsylvania to generate information that will improve their production practices by maximizing pollination services. Specifically, we plan to (1) identify what bees are providing the greatest pollination, and (2) quantifying pollination limitation. Results from this study will provide critical information to increase blueberry yields in our partner's farms and help them define which bee species should be emphasized for conservation efforts.

Extension Publications:

López-Urbe MM, Underwood RM. (2020). How to Keep Bees During COVID-19. *Pennsylvania State Extension* (Newsletter Article) <https://extension.psu.edu/orchard-pollination-strategies-for-maintaining-pollination-services-in-tree-fruit>. Also available in [Spanish](#).

López-Urbe MM, Biddinger D (2020). Orchard Pollination: Strategies for Maintaining Pollination Services in Tree Fruit. *Pennsylvania State Extension* (Newsletter Article) <https://extension.psu.edu/orchard-pollination-strategies-for-maintaining-pollination-services-in-tree-fruit>

Grozinger C., López-Urbe MM, Underwood RM. (2020). Viruses in Honey Bees. Penn State Extension. (Fact sheet). <https://extension.psu.edu/viruses-in-honey-bees>

IPM for vegetable crops – Beth Gugino, Professor of Plant Pathology and Environmental Microbiology

Over this past year, the 1-800-PENN-IPM hotline was expanded to provide more offerings on timely topics related to vegetable, small fruit and tree fruit production as well as greenhouse IPM. Special-purpose lines addressing COVID-19 and PDA pesticide applicator license program were also added in addition, to a series of Spanish-language messages, translated for members of the Latinx community. The menu of vegetable options was expanded to include a general update as well as updates on onion/Allium, tomatoes/potatoes, sweet corn and vine crops. In 2020, the vegetable and small fruit messages were accessed over 1700 times throughout the season.

Although COVID-19 limited expansion of Penn State Extension informational kiosks and lending libraries in 2020, a series of eight evergreen posters were on topics such as Preventing the spread of coronavirus, Dealing with high soluble salts levels in high tunnels to Sanitation practices for packing lines and Blueberry cane diseases were developed and disseminated. In addition, timely information generated from sweet corn pest, cucurbit downy mildew and late blight monitoring programs was posted weekly enabling growers to make timely pest

management decisions. Efforts are underway to evaluate the impact of this program over the past several years.

Rhode Island IPM Report 2021

Lisa Tewksbury (IPM Coordinator) and Heather Faubert (co-IPM Coordinator)

Situation: Invasive insects - Brown marmorated stink bug (BMSB) and Spotted lanternfly (SLF)

BMSB is now impacting southern New England including Rhode Island as it is being found in peach orchards in RI. While not found in RI yet, SLF has been found in CT and is an important new pest. We have been monitoring for this in grapes and stone fruits.

Response: Each year we have set traps in stone fruits to detect BMSB and provide information to growers at twilight meetings. Lisa Tewksbury is a participant in the SLF Working group and Stakeholder partnership group, both groups organized by Penn State. Members of the SLF working group collaborate in a specialty crops grant (SCRI) to conduct research to develop management tactics for SLF. URI is contributing to SLF biocontrol research. Alana Russell received additional funding from a USDA PPA7721 outreach grant to develop educational displays and outreach presentations for grower groups and URI Master Gardeners in Rhode Island. The URI biocontrol website is a source of regular SLF updates.

Results: Rhode Islanders are educated about BMSB and SLF. As BMSB populations increase in RI and if SLF is introduced, growers and gardeners in RI will be aware of these invasive species and informed about management techniques. We will collect records of individual growers' pest management efforts to determine outcomes of our programming.

Situation: Beech leaf disease (BLD) found in forests in RI in 2020

Response: Heather Faubert diagnosed a sample at the URI Plant Protection Clinic, surveyed RI for BLD with RI DEM, and continues to educate RINLA members and the general public about beech leaf disease. Heather has joined the beech leaf disease working group organized at the Ohio State University.

Results: Beech leaf disease is currently confined to one town in RI at this time. URI and RI DEM will be setting up long-term monitoring plots in beech forests in collaboration with the beech leaf disease working group.

Situation: Invasive insect - Emerald ash borer (EAB)

Emerald ash borer was found in RI for the first time in 2018 and is beginning to cause mortality to ash trees in the northern part of the state.

Response: Since 2019 the URI biocontrol lab has been setting up Lindgren funnel traps throughout RI, in collaboration with RI DEM to identify appropriate sites in RI with EAB for release of EAB biocontrol agents. The USDA has deregulated EAB and the primary focus of management for this pest is biological control.

Results: Rhode Island has received 3 species of EAB parasitoids in one site in Washington county and two species in six sites in Providence counties. The three parasitoids are: *Oobius agrili*, *Spathius galinae*, and *Tetrastichus planipennis*. Monitoring for recovery and establishment will begin in 2021 and the establishment of the three parasitoids will protect continued development of regenerating ash in RI forests.

Situation: Vegetable growers with production issues

Response: Andy Radin, agricultural extension agent, specializes in vegetable crops production, including soil fertility management, irrigation, cultural practices, and insect pest and plant disease management.

Results: Andy produces a newsletter for the grower community, twice per month during the growing season months, and once per month in the winter. Every issue features pest alerts, and often at least one article focuses on specific pests, diseases, or the ailments of a particular crop. This newsletter is emailed to 500 subscribers. Andy also participates in a weekly tele-conference with vegetable crops extension professionals throughout New England and NY State. IPM plant protection is the dominant topic of discussion across all crops.

Situation: Fruit growers with production issues

Response: Heather conducts farm visits, newsletters, and grower meetings.

Results: In collaboration with UMass, Heather Faubert participated in two virtual fruit grower twilight meetings in 2020. These meetings provide growers with appropriate IPM techniques on managing current insect and disease problems and potential future problems.

Situation: Invasive plant - Swallow-worts

Response: Since 2017 the URI biocontrol lab has released *Hypena opulenta*, a biological control agent of swallow-worts in a total of 11 sites in RI, CT, and MA.

Results: Successful overwintering has been documented in one site in RI, but establishment has not yet been confirmed.

Situation: Invasive insect - Lily leaf beetle (LLB)

Response: URI continues to monitor lily leaf beetle larvae for LLB parasitoids as part of a citizen science project. We have received larvae from New England and New York.

Results: LLB parasitoids are established in RI, MA, CT, NH, and Maine, NY and parts of Canada, and are managing LLB on cultivated lilies.

Situation: invasive insect - winter moth

Response: Heather monitors winter moth populations in RI and advises fruit growers, landscapers, and plant owners about winter moth management via email newsletters and grower meetings. Biocontrol agent, *Cyzenis albicans*, was released throughout Rhode Island from 2011-2017 and their establishment continues to be monitored.

Results: Winter moth population monitoring results in fewer pesticide applications to fruit farms and landscapes than in recent years. *Cyzenis albicans* has been recovered at most release sites.

Situation: invasive plant - Japanese knotweed

The URI biocontrol lab is collaborating with Fritzi Grevstad from Oregon State University to release and evaluate a new biocontrol agent of Japanese knotweed.

Response: *Aphalara itadori* was released in 3 locations near the University of Rhode Island. We will evaluate overwintering, establishment and impact of *A. itadori* in the release sites in 2021.

Results: TBD

**Vermont IPM Extension Implementation Program
2020-2021 Annual NEERA Report
Ann Hazelrigg, IPM Coordinator**

IPM Implementation in Agronomic Crops - Heather Darby

Field Days & Winter Conferences

- 11th Annual Hops Conference, Burlington VT 2/28/20 (66 attendees + 10 via live broadcast)
IMPACTS:
 - 35% selecting lowest impact pesticides.
 - 95% allowed to better scout/identify/manage pests with IPM system
- 16th Annual Grain Growers Conference, Essex VT 3/24/20
 - Cancelled due to COVID-19
- Agendas/presentations: <http://go.uvm.edu/cqu7e>
- Virtual Field Day Fridays, Jul 24, Aug 7, 21, Sep 4, 18, 2020, 5 webinar series, virtual event, 127 attendees, https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/Virtual%20Field%20Day%20Fridays/opening_slide_-_welcome_FDF.pdf
- Virtual Grain Conference – 3 part Series, 3/23 – 4/9/2021 (87 attendees).
- Virtual Hop Conference – 6 part Series, 3/30 – 4/15/2021 (50 attendees).

Dry Bean Disease Survey

- 5 farms (75 acres total) surveyed twice during the season in 2018 and 2019 for diseases and insect pests (Alburgh, Cambridge, Danby, and Glover, VT and Northfield, MA)
- Farmers invited to participate and assisted with scouting 75% of the time
IMPACTS:
 - 95% indicated learning how to better identify disease and pests.
 - 100% helped to develop IPM strategies
 - 60% helped to test seed quality

Seed Quality Testing

- 179 samples in 2018; 143 samples in 2019; analyzed for disease, mycotoxins, germination (small grains, dry beans)
IMPACTS:
 - As a result of outreach and farmer education, seed quality submissions to the lab has increased by 30% since 2014.
 - 3 farmers have reported less issues with bean diseases as a result of testing seed for seedborne diseases prior to planting.
- 179 samples in 2018; 143 samples in 2019; 212 samples in 2020 analyzed for disease, mycotoxins, germination (small grains, dry beans)
IMPACTS:
 - As a result of outreach and farmer education, seed quality submissions to the lab has increased by 30% since 2014.
 - 3 farmers have reported less issues with bean diseases as a result of testing seed for seedborne diseases prior to planting.
 - 2 farmers have reported increased access to markets by providing quality information.

Extension Outreach Education

- Virtual Reality Scouting Tool for Hop Growers (VRScout Hops) completed 2019
<http://go.uvm.edu/3myft>
- eXtension Campus online course of 2020 Hops Conference
<https://campus.extension.org/enrol/index.php?id=1784>
- 4 Hop Blog Posts <http://go.uvm.edu/5svb7>
- 6 Hop Power Hour webinars (Mastering spring activities, Powdery mildew, Decade: a farmer shares experiences, Irrigation systems, Harvest timing/effect on quality, Hop viruses/viroids) (110 new views) <http://go.uvm.edu/9nezy>
- Hop goScout surveys (completed April-August 2018)
- Darby, H. 2020. Seed Disease and Organic Management – For Cereals Grown in the Northeast. St. Albans, VT. https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/Articles_and_Factsheets/Seedborne_diseases_pamphlet_final.pdf
- Darby, H. 2020. Northeast Dry Bean Pest Guide. University of Vermont Extension Northwest Crops and Soils Program. St. Albans, VT. https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/Articles_and_Factsheets/NEDryBeanPestGuideApril2020.pdf (accessed 15 Dec. 2020)
- Darby, H. 2020. Cereal Rye Production Guide. University of Vermont Extension Northwest Crops and Soils Program. St. Albans, VT. https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/Articles_and_Factsheets/Rye_Production_Guide.pdf (accessed 30 Dec 2020)
- Outcroppings Blog posts (4) -195 subscribers
 - Potato Leaf Hoppers Have Arrived! (Jun 2020)
<https://blog.uvm.edu/outcroppn/2020/06/24/potato-leafhoppers-have-arrived/>
 - Watch Out for Slugs! (Jun 2020) <https://blog.uvm.edu/outcroppn/2020/06/25/watch-out-for-slugs/>
 - The European Corn Borer in Hops and Hemp (Jul 2020)
<https://blog.uvm.edu/outcroppn/2020/07/02/the-european-corn-borer-in-hops-and-hemp/>
 - Be on the Look Out! (Aug 2020) <https://blog.uvm.edu/outcroppn/2020/08/27/be-on-the-look-out/>
- What's Hoppening-Musings from the Hop Yard! Blog posts (3) -155 subscribers
 - Early Season Management (Apr 2020)
<https://blog.uvm.edu/hoppenin/2020/04/20/early-season-management/>
 - Potato Leaf Hoppers Have Arrived! (Jun 2020)
<https://blog.uvm.edu/hoppenin/2020/06/24/potato-leafhoppers-have-arrived-3/>
 - Japanese Beetles in Hops in the Northeast (Jul 2020)
<https://blog.uvm.edu/hoppenin/2020/07/02/japanese-beetles-in-hops-in-the-northeast/>

IPM Implementation in Specialty Crops: Apples and Grapes - Terry Bradshaw

Extension Outreach Education

- Commercial Horticulture website created
<https://www.uvm.edu/extension/horticulture/commercial>

- 154 subscribed to vtapplegrower@list.uvm.edu listserv; 289 subscribed to vermontgrape@list.uvm.edu listserv
- 101 UVM Fruit blog posts promoting IPM tools, Network for Environmental & Weather Applications (NEWA), advertising IPM meetings <http://go.uvm.edu/ogreu>
- 130 grower consultations
- New England Tree Fruit Management Guide updates, January 2021 <https://netreefruit.org/>
- Session planning/presentations
 - 2021 Vermont Tree Fruit Growers Assoc. Annual Meeting, online (Vermont Pesticide Program, Invasive Insects) 2/18/21 (49 attendees)
 - IMPACTS:**
 - 91% have moderate/considerable knowledge on Vermont Pesticide Program, Invasive Insects (up to 107% increase)
 - 59% moderately/very likely to adopt at least one new IPM practice
 - 69% moderately/very likely to apply and use pesticides more safely
 - New England Winter Fruit Seminar Series. Jan-Mar, 2021.
 - Series of ten webinars co-presented by New England Extension Fruit professionals.
 - Primary organizer, coordinator of pesticide applicator's license credits.
 - 1993 total live attendees; all webinars recorded and posted for later viewing at: <https://www.youtube.com/playlist?list=PLUL3FZJYGp3n04GfGTIQgoXoKbK7R2Xx7>
- Presentations (attendees)
 - Tree Row Volume: What it is, why it matters, and how to use it. New England Winter Fruit Seminar Series. 3/23/2021. (98)
 - Apples. Vermont Agriculture and Food System Strategic Plan presentation to the House & Senate Agriculture Committee. 2/11/2021 (26)
 - Cider apples in 2021: Where do we Stand? New England Winter Fruit Seminar Series. 2/09/2021 (147)
 - Adding Tree Fruit to a Diversified Farm. Vermont Vegetable and Berry Grower Webinar Series. 12/9/2020
- Media
 - Redesigned UVM Fruit YouTube.
 - Now 56 total videos collected from previous sited (Organic Apple, Grape, and UVM Orchard).
 - Eight new videos produced during reporting period.
 - The 2020 Vermont Apple Season. Across the Fence Television Segment, WCAX TV, Burlington, VT. 9/21/20.
 - COVID Farm Market Safety. Across the Fence Television Segment, WCAX TV, Burlington, VT. 9/09/20.
 - Seeds to Society segment. Dave Gram Show, WDEV Radio. 9/8/20. <https://wdevradio.com/congressman-peter-welch-2020-apple-crop-and-edward-snowden/>
 - As apple harvest begins in Vermont, farmers say COVID is not the problem. VT Digger. 8/30/2020

IPM Implementation in Specialty Crops: Ornamentals/vegetables in greenhouses/high tunnels and nursery settings - Margaret Skinner

Tri-State IPM Workshop

- The 24th annual Tri-State IPM Workshop was held virtually due to the pandemic as a couple, 2.5 hour Zoom sessions focused on effective use of biocontrols and using natural enemies and pesticides compatibly and common root disease issues and how to prevent them.) Two invited speakers, Suzanne Wainwright-Evans (Buglady Consulting) and Margery Daughtrey (Cornell Univ.) Jan 14 and 21, 2021 (>120 attendees)

IMPACTS:

- 71% of attendees attended a Tri-State IPM workshop in the past; 21% 62% of the attendees were new to our workshop series. Of those that attended in the past, 61% attended 1-5 workshops, 15% attended 6-9 and 24% attended greater than 10.
- 83% of attendees found disease session useful – very useful and 85% for the insect management session.
- 77% learned new techniques they intend to use this year (compatibility of natural enemies with pesticides, importance of record keeping when scouting, inexpensive microscopes to assist with pest id, cultural methods for prevention of insects and diseases and sanitation strategies).
- The workshop topics that resulted in the greatest increase in knowledge about how to implement IPM was the identification of foliar diseases (86%), root diseases (83%), insects (82%), biological control use (80%) , chemical pesticide use/integration (61%) and disease monitoring (61%).
- 35% of attendees indicated on-site/in-person was the best structure for this workshop, 29% thought online was best and 35% were unsure. Many indicated they missed the hands-on and networking opportunities in-person offers while others liked the convenience of not having to travel.
- The most common strategies adopted for insect pest management were use of predators (17%), organic methods (16%), parasites (15%), nematodes (15%) and conventional pesticides (15%).

IPM First

- 3rd biennial high tunnel production conference “High Tunnels After Dark” was organized and held via Zoom. This is a collaboration between UNH, UVM and UMaine. The event was multifaceted with three sessions that focused on production technologies, disease and insect pests and soil and crop management. Growers from 17 different states and Canada joined in (>150 attendees).
- Provided ongoing support for network of over 40 growers through on site or virtual meetings or email.
- 6 new operations requested site visits.
- 40+ site visits were made in 2020

IMPACTS: (carry-over from 2019-2020)

- 100% use IPM strategies (i.e., biopesticides, natural enemies, scouting, trap or habitat plant use, etc.) to manage pests
- 100% regularly scout for pest problems
- 67% used plant mediated IPM systems
- 76% use sticky cards for monitoring
- 100% rely on the use of biocontrols as chemical pesticide alternatives
- 69% indicated it was a high priority to protect pollinators and other beneficial insects in greenhouse, nursery and landscape settings.

- 88% intend to provide habitat plantings to help attract and sustain pollinators

Extension Outreach Education

- Presentations
 - Smith, C., A. Wallingford, C.F. Sullivan. Diseases & Insects in High Tunnels: Common and Not-so-common
 - Problems and How to Manage Them. High Tunnels After Dark. Virtual High Tunnel Production Conference. December 1, 8 & 15, 2020.
<https://extension.unh.edu/blog/high-tunnels-after-dark-2020-high-tunnel-production-conference>
 - Skinner, M. & C.F. Sullivan. 2021. UVM Virtual Grower-to-Grower Session, Beneficial Insects. 31 Mar. 2021. Burlington, VT. 38 participants.
 - Skinner, M., C.E. Frank Sullivan, S. Wainwright-Evans, M. Daughtry, C. Smith, G. Fish, K. Murray. IPM Virtual Reality. 25th Annual Tri-State Greenhouse IPM Program Workshop, Online, January 7 (Bugging Out) & 21 Disease Disasters), 2021.
 - Sullivan, C.F., M. Skinner & A. Hazelrigg. Vermont Vegetable & Berry Growers Association (VVBGA) Webinar Series: Aphids on Winter Crops. September 15, 2020.
 - Sullivan, C.F., M. Skinner & R. Maden. Vermont Vegetable & Berry Growers Association (VVBGA) Webinar Series: Tomato Pests. August 12, 2020.
- Factsheets & Articles
 - Parker, B.L., A. Davari & M. Skinner. 2020. Can Western Flower Thrips be managed without insecticides? American Floral Endowment Thrips & Botrytis Newsletter, Fall 2020, Issue 3.
 - Skinner, M., C.F. Sullivan & B.L. Parker. 2021. Want to save money on pesticides? Scout for Thrips! American Floral Endowment, Thrips & Botrytis Newsletter, February 2021, Issue 1.
 - Skinner, M., B.L. Parker & C.F. Sullivan. 2019. Chapter 15. Integrated Pest Management in Greenhouse and Other Protected Cultivation Systems. In: Current and Future Developments in IPM; Eds: M. Kogan & L. Higley, Burleigh Dodds Sci. Publ. Cambridge, UK. www.taylorfrancis.com/books/9780429275395
- Websites
 - Overall: 1,950; Ent Lab: 954; Landscape IPM: 291; Greenhouse IPM: 472

IPM Implementation in Communities - Ann Hazelrigg and Beret Halverson

Master Gardener Course

- Delivered through Extension Foundation Moodle course platform. Plant Diagnostic Clinic Program Support Team lectures: entomology, plant pathology, turf care. Jan 17-May 22, 2020 (105 students)
- 66 active volunteers put in over 6,157 volunteer hours, 99 projects/events, 34,136 contacts with the public about pesticide reduction, pest identification, IPM strategies (2020).
- 2020 Master Gardener Course
 - IMPACTS**
 - 89% moderate/considerable knowledge about use of Integrated Pest Management (IPM) practices when gardening (790% increase)
 - 85-95% moderately/very likely to adopt IPM gardening practices (Select disease-resistant plants, Identify pests before management, Improve timing of pest

management, Use cultural practices as first management choice, Use pesticides as a last resort, Choose least toxic pesticides, Reduce use of pesticides)

- “The EMG’s Course has brought about awareness’s of Sustainable Gardening & Integrated Pest Management that are now a part of living in my world of gardening.”
- “I thought the course was a great introduction to the science behind gardening.”
- “I learned far more than I expected and look forward to sharing the information with others.”

Master Gardener Helpline

- 795 questions answered by phone/email
- 0 specimens submitted for pest identification

Master Gardener Advanced Training

- 2020 Summer Pest & Disease Updates (147 participants). Provided by Ann Hazelrigg.

IPM for Pollinator Health

Orchard Pollinator Survey

- 2 orchards surveyed monthly, 2020 season; abundance, diversity catalogued

Greenhouse/High Tunnel/Nursery Pollinator Habitat Program

- 9 sites established pollinator habitat plantings, 1 new site trained.

IMPACTS

- 75% of growers indicated the plantings attracted public attention
- 100% provided education to customers about their importance
- 88% did not provide habitat plantings prior to taking part in this program.
- 100% will continue to establish these plantings after the end of the project.
- 63% gained considerable knowledge of beneficial insect id
- 88% gained moderate to considerable knowledge of beneficial life cycles
- 88% gained considerable knowledge of the types of plants used to attract beneficials
- 250 updated habitat-planting brochures distributed to retail customers (Bringing In Un-Bee-lievable Beneficials)
- Two webinar presentations included in a “Creating Pollinator Friendly Landscapes” course for Master Gardeners
- Factsheets & Articles
 - Sullivan, C.F. & M. Skinner. 2020. The Sedulous Syrphid Fly, Our Un-Bee-lievable Beneficials (Part 1). The Dirt, Green Works Newsletter, Spring issue, VT Association of Professional Horticulturists. Ferrisburgh, VT. <https://vnlavt.org/2020/03/01/2020-spring-issue/>
 - Sullivan, C.F. & M. Skinner. 2020. Persistent Pest Parasites, Our Un-Bee-lievable Beneficials (Part 2). The Dirt, Green Works Newsletter, Summer issue, VT Association of Professional Horticulturists. Ferrisburgh, VT. https://www.scribd.com/document/468604200/VNLA-Summer-Issue-2020-The-Dirt#from_embed
 - Sullivan, C.F. & M. Skinner. 2020. The Insidious Flower Bug, Our Un-Bee-lievable Beneficials (Part 3). The Dirt, Green Works Newsletter, Fall issue, VT Association of Professional Horticulturists. Ferrisburgh, VT. https://www.scribd.com/document/483881573/Fall-Issue-of-the-Dirt-2020-Web#from_embed

- Sullivan, C.F. & M. Skinner. 2021. Lively Lady Beetles, Our Un-Bee-lievable Beneficials (Part 4). Green Works Newsletter, Winter issue, VT Association of Professional Horticulturists. Ferrisburgh, VT. https://www.scribd.com/document/498995527/VNLA-Winter-Issue-of-The-Dirt-2020-21#from_embed

Master Gardener Pollinator Short Course

- 2020 Creating Pollinator Friendly Landscape Course (38 participants). This is a self-paced, online course for small landowners and home gardeners in Vermont focused on Integrated Pest Management strategies to attract pollinators and reduce pesticide use in your garden.

IMPACTS:

- 90-100% moderate/considerable knowledge of pollinator friendly practices (How Neonicotinoid pesticides behave in the environment, Where to find pollinator information on pesticide labels, Pesticide formulations that affect pollinators, Timing pesticide applications to protect pollinators, Bee Biology, Species, and Identification, Pollinator Habitat Design, Pollinator Plant Selection)
- 100% of those who use pesticides will reduce use of pesticides
- 100% learned something that will improve use of IPM practices when trying to protect pollinators in the landscape
- “It covered all aspects of the topic and motivated me to do all I can on my own land to protect these important species.”
- “Learned more about IPM techniques and identifying pests vs beneficial pollinators”
- “Now know the proper formulations, timing, and techniques for pesticide application to reduce harm to pollinators”

IPM Implementation in Pest Diagnostic Facilities – Ann Hazelrigg

Plant Diagnostic Clinic Disease/Insect/Weed Diagnostics

- Many fewer samples due to COVID 19.
- No home garden samples accepted in 2020 growing season.
- ~100 samples diagnosed, IPM information provided.
- ~100+ email pictures diagnosed, IPM information provided

IMPACTS:

- 100% commercial clients said diagnostic ID helped to manage their pest problem with IPM
- 50% commercial clients were able to reduce pesticides as a result of the IPM information
- “Maybe we didn't reduce (pesticides) but we at least knew what to spray, when (as a result of the IPM recommendation)”
- “Yes, with positive ID of certain plant diseases, I have switched to cultivars with bred resistance, avoiding sprays and crop loss.

Extension Outreach Education

- Presentations
 - UNH Pesticide Supervisory workshop. Tree Diseases. Online. 1.14.21 (30)
 - Southern New England Extension Vegetable Growers' webinar. Diseases of High Tunnel Tomatoes. Online. 1.14.21 (300) <https://youtu.be/mfRo9P4F0YM> (Evaluated)
 - VT Vegetable and Berry Annual Conference. Pests and Diseases of 2020. Online. 1.24.21 (201) https://www.uvm.edu/sites/default/files/UVM-Extension-Cultivating-Healthy-Communities/horticulture/VVBGA/2021_VVBGA_Annual_Meeting.pdf (Evaluated)

- Commercial Pesticide Applicators meeting for Field and Forages. Diagnosing diseases in the field. 3.25.21 (51) (Evaluated)
- NH Arborist Association. Plant Diseases. Online. 3.16.21 (77 attended: 4 MA, 1 ME, 72 NH. 41 for pesticide credits, 47 for ISA credits)
- MG Helpline Advanced Training 3.17.21 (20)
- Ft Ticonderoga Garden Series. Garden and Tree Pest and Disease Updates. Online. 4.10.21 (44) and 4.17.21.
- VT Vegetable and Berry Annual Conference Fairlee, VT. 1.28.20 (200)
<http://www.uvm.edu/vtvegandberry/VVBGAMeeting2020Presentations.html>
- NH Certified Crop Advisor Conference. Portsmouth NH. How to diagnose diseases in the field. (60) 1.30.20 (35)
- UVM PSS 127 Greenhouse Management. Plant Disease lecture. 2.14.20 (20)
- NOFA-VT Commercial Grower Roundtable. Burlington, VT. 2.15.20 (30)
- NOFA-VT Garden Disease and Insect Issues. Burlington, VT. 2.15.20 (50)
- UVM PSS 021 Intro to Agroecology. Plant Disease lecture 3.19.20 (60) narrated video.
- NE Plant Diagnostic Network. Highlights of Vermont disease and pest issues. Northampton, MA. 3.9.20 (20)
- NE American Phytopathological Society Meeting. Northampton, MA. 3.10-3.12.20 (60)
- MG Helpline Advanced Training 3.17.21 (20)
- Ft. Ticonderoga Gardening Conference. Ft. Ticonderoga, NY. 4.4.20-cancelled due to COVID
- UVM Master Gardener Plant Pathology Lecture webinar/interactive Q and A. 4.9.20 (125)
- UVM PBIO 117 Plant Pathology. Plant Disease lecture. 4.19.20 narrated video due to COVID
- Hemp Disease Basics Webinar. Online. 8.10.20 (20)
<https://www.youtube.com/watch?v=wouZy-3loxk&feature=youtu.be>
- VT Vegetable and Berry Pest and Disease Webinar. Online. 8.28.20
- UVM Lunchtime MG webinars. Pests and Diseases. Online 6.30.20, 7.31.20, 8.28.20 (30/each)
- UNH Pesticide Supervisory Workshop. Tree Diseases. Online. 9.17.20 (30)
- National IPM Coordinating Committee Annual Meeting. Recap and Results of the 2019 Meeting. Online. 10.21.20 (50)
- Burlington Garden Club. Pests and Diseases. Online. 10.22.20 (30)
- UVM Master Gardener Helpline Wrap up. Diseases and Pests of 2020. Online. 11.17.20 (20)
- Northeast Plant Diagnostic Meeting. Onboarding Committee Update and VT Pests and Diseases of 2020. Online. 12.9.20 (30)
- Articles/Factsheets/Newsletters/Listserve/Guides
 - VT nursery and Landscape Association magazine, The Dirt:
 - Hazelrigg, A. Winter/Spring Vol 46 Issue 4. <https://vnlavt.org/2021/03/07/2020-21-winter-newsletter/>
 - Hazelrigg, A. Fall Vol 46 Issue 3. <https://vnlavt.org/2020/11/11/2020-fall-newsletter/>
 - Hazelrigg, A. Summer Vol 46 Issue 2. <https://greenworksvermont.org/2020/07/09/2020-summer-issue/>
 - Hazelrigg, A. Spring 2020, Vol 46 Issue 1. <https://vnlavt.org/2020/03/01/2020-spring-issue/>

- New England Vegetable Management Guide annual updates <https://nevegetable.org/>
- New England Small Fruit Management Guide annual updates <https://ag.umass.edu/fruit/publications/new-england-small-fruit-management-guide>
- Television
 - No programs in 2020-2021 due to COVID-19.

IPM Education for Pesticide Applicators - Ann Hazelrigg and Sarah Kingsley Richards

Pesticide Applicator Education

- On-demand online training (participants)
 - Vermont Pesticide Education: Managing Pests While Protecting Pollinators (1 credit) (1)
- Factsheets
 - Pest Management Principles
 - Neonicotinoid Pesticides
 - Managing Pests While Protecting Pollinators (homeowner)
 - Managing Pests While Protecting Pollinators (commercial crops)
 - Managing Pests While Protecting Pollinators: Apple Orchards
 - Managing Pests While Protecting Pollinators: Greenhouse & High Tunnel Production
 - Managing Pests While Protecting Pollinators: Blueberry Crops
 - Managing Pests While Protecting Pollinators: Pollination & Pollinators References

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IPM State Report (2020-'21) - West Virginia

The IPM team members in West Virginia have been carrying out Extension IPM programs in primarily in the areas of Specialty Crops (Tree Fruit, Vegetables, and Urban Horticulture (Master Gardeners)).

Staff changes. Dr. Carlos Quesada was appointed as the Extension Entomologist during summer of 2020. Dr. Adeola Ogunade was appointed as the Evaluation Specialist in 2020. Both Carlos and Adeola are Co-PI's on the EIP grant submitted. Dr. Jorge Atilas was appointed as the Dean of WVU Extension Service in 2020.

Significant outputs of past 12 months:

1. Termination of EQIP cost-share program for one commercial orchard in the Potomac Valley Conservation District, and continuation of two additional orchards in the Eastern Panhandle District.
2. Continued publication of quarterly IPM Chronicle newsletter.
3. Ongoing statewide experiments to correlate growing degree-day and soil temperature on the germination of two invasive annual grasses, Japanese stiltgrass (*Microstegium vimineum*), and joint-head arthraxon (*Arthraxon hispidus*).
4. Continued programming in Greenhouse and High Tunnel IPM.
5. Display materials (Poster, yard-signs, brochures) developed for participants of Tree Fruit IPM Plan (to be displayed in the Farm Markets).
6. Three IPM Mini-grants funded to evaluate the use of cover crops in orchards, physical methods to manage cucurbit pests, and validation of prediction models to control fire-blight.

Success Stories

Approximately 300 acres of apple is currently carrying out the Tree Fruit IPM plan. IPM practices implemented by the growers included application of pesticides based on threshold levels, use of semio-chemicals and reduced-risk pesticides, partial application in orchards, along with application under proper environmental conditions. Results of a 3-yr replicated demonstration of mating disruption to control peach-tree borers in peach orchards generated grower interest and was published in '*Insects*' (Frank et al. 2020).

High tunnel and greenhouse growers participating in utilization of beneficial insects found as a high as a 100% increase in control of pest populations. In addition, at least two growers work with insectaries to supply beneficials as part of their IPM program. IPM specialists have been routinely engaged in carrying out Extension programs in specialty crops and Urban Horticulture. Integrated Disease Management program in tree fruit provided recommendations to manage scab, fire-blight, and sooty mold diseases, based on forecast models, to growers to spray only when needed. This also helped reduce the risk of resistance buildup in the respective fungal and bacterial causal organisms. Customized weather stations with built-in disease prediction models were installed at additional locations in the state by collaborating with NEWA and are now fully

operational at the tree fruit-growing region of the state. We were able to document self-reported increases in knowledge and skills learned, and an increase in the number of growers that use monitoring tools. Growers followed weather events and disease predictions received from us to protect fruits from diseases.

For vegetable disease management we released two varieties of tomato (Mountaineer Pride and Mountaineer Delight) with increased resistance capability towards Septoria Leaf Spot as well as Late Blight and Wilt diseases (Verticillium and Fusarium wilt). We distributed 2,500 seed packets during the current cycle to encourage growers to implement these host-resistance traits thereby reducing the use of fungicides. Spread of vegetable diseases, specifically cucurbit downy mildew (CDM) and late blight of tomato and potato was also tracked through CDM-IPMPIPE and USAblight.org, respectively. AgAlerts were provided to growers to take preventative measures when it was necessary.

In weed management, through statewide field research, we are now able to predict the germination period of two invasive grasses in West Virginia, jointhead Arthraxon (*Arthraxon hispidus*) and Japanese stiltgrass (*Microstegium vimineum*) using a growing degree day (GDD) model. A pilot cost-share program to employ an integrated approach to manage weeds in pastures was launched in the state as a result of working closely with WVCA by generating an implementation. A live weed-collection was displayed at the West Virginia State Fair, Marshall County Fair, and the State Small Farm Conference.

One of the goals has been to popularize and introduce the concepts of IPM not only to the farming community but also to the public in general i.e., the consumers. For the period 2017-2020, 783 people had gone through the Extension Master Gardener Program, 635 people have participated in IPM-related programming at the Extension Master Gardener Annual Conferences. Specialists are also co-authors on regional Pest Management Guides for Tree Fruits, Vegetables, and Agronomic Crops during the past three years. Quarterly issues of 'The IPM Chronicle' were published during the past cycle. This newsletter continues to receive wide readership both within and outside the state. Factsheets, pamphlets, IPM bulletins, pest ID information (Weed of the Week, emergent pests etc.), were also published. A section of WVU Extension Service website is dedicated to articles generated by the IPM Team which witnessed about 25,000 page-views during 2020 with over 11,000 unique views.

We created an IPM trifold brochure containing graphics and condensed information that could be passed on to the end-user during Extension events and a mobile IPM Booth that could be set up during such events. During the past three years, the IPM Team participated the Small Farm Conference and State Fair (except in 2020 when it was cancelled). IPM booths with brochures were set up at these events. We compiled electronic mailing lists for greenhouse and high tunnel producers, tree fruit growers, vegetable producers, small farm producers, and Master Gardeners to provide timely information related to IPM. Evaluations of various programming efforts indicated that the ability/understanding of participants improved in all areas including: IPM practices, identification of pests, scouting/monitoring, non-chemical pest management measures, selection of chemical sprays, pollinator safety, understanding of pesticide labels,

matching signal-words with toxicity ratings, safe pesticide storage, handling and disposal of pesticide spills, balancing plant nutrition, and identifying mineral deficiencies.

Weed ID Fact-Sheets. Apart from routine weed identification and management assistance in 2020, six fact-sheets related to identification and management of problem weeds as web-based publications were generated. They were disseminated through social media to WVU Extension clientele during the growing season (May-October).

Respectfully submitted by:

Rakesh Chandran, IPM Coordinator, Extension Weed Specialist

Team Members:

Carlos Quesada	Former Extension Entomologist
Mahfuz Rahman	Extension Plant Pathologist
Mirjana Danilovich	Extension Consumer Horticulture Specialist
Adeola Ogunade	Evaluation Specialist
Barbara Liedl	Associate Professor (WVSU Collaborator, Controlled Environment IPM)
Whitney Dudding	IPM/Plant Diagnostics Associate