

## Progress Report

<b>Title:</b>	<b>Supporting IPM on Diverse Massachusetts Farms through the Integration of Applied Res &amp; Ext Outreach</b>		
<b>Sponsoring Agency</b>	NIFA	<b>Project Status</b>	ACTIVE
<b>Funding Source</b>	Non Formula	<b>Reporting Frequency</b>	Annual
<b>Accession No.</b>	1013932	<b>Grants.gov No.</b>	
<b>Project No.</b>	MASN00105	<b>Award No.</b>	2017-70006-27137
<b>Project Start Date</b>	09/01/2017	<b>Proposal No.</b>	2017-04501
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<b>Submitted By</b>		<b>Reporting Period End Date</b>	08/31/2021
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**Program Code:** EIP**Program Name:** Extension Implementation Program**Project Director**

Hilary Sandler  
508-295-2212  
hsandler@umass.edu

**Recipient Organization**

UNIVERSITY OF MASSACHUSETTS  
COMMONWEALTH AVE  
AMHERST, MA 01003  
DUNS No. 153926712

**Performing Department**

Dept: Cranberry Stat Ext

**Co-Project Directors**

Clements, Jon

**Departments**

{NO DATA ENTERED}

**Non-Technical Summary**

Massachusetts is the 3rd most densely populated state; MA farm land is very valuable and often sought after for development. Despite this pressure, farmers steward over 523,500 acres, >10% of the MA land base. There are 7,755 farms (of which 2,651 are vegetable, berry, and fruit farms) in the state. The total number of farms has been steady since 2007, however the number of vegetable farms increased by more than 400 (28%) in the same time frame. Averaging 68 acres in size, 95% of MA farms easily fit the USDA definition of small farms, bringing in less than \$64,000 annually. Even with constant economic and biological pressures, MA farmers are committed to being efficient business owners and effective pest managers, optimizing the output of their small-scale specialty crop farms to meet consumer demands. MA farms generate over \$490 million in total sales per year with 47% from sales of specialty crops such as apples, strawberries, and cucurbits. MA has almost 300 farmers' markets and ranks 1st nationally by percentage of farms with Community Supported Agriculture (CSA).

Through increased adoption and implementation of effective IPM strategies, this EIP Project will support National Integrated Pest Management (IPM) Road Map goals of achieving increased profitability while reducing human health and environmental hazards. We will address stakeholder-identified priorities by integrating applied research and outreach activities for specialty crop growers in Massachusetts. Massachusetts produces more than 70 types of specialty crops and many of the farmers we work with grow more than 30 different crops on their farms. This project will focus on whole-farm IPM approaches tailored to fit diverse specialty crop growers. Specific commodity issues identified as high priorities by growers will be addressed through our applied research and demonstration trials and outreach programs.

We will promote IPM implementation by working closely with individual growers to adopt and apply IPM practices on their farms, conduct applied research trials to address grower-identified issues, host hands-on training and education, and collaborate with state agencies and Northeastern Extension personnel to develop and disseminate innovative educational and training resources. Evaluation and economic specialists on our team will provide expertise to increase our understanding of the influence of environmental and socioeconomic factors that affect farming decisions. We will use our current working relationships with individual stakeholders to engage Mentor, Partner, and Collaborator farmers, an outreach model we have successfully deployed over the past 6 years. Our leadership and partnership roles with Extension colleagues in New England and industry and regulatory organizations will continue to further IPM implementation for specialty crop farms in MA.

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Responding to stakeholder-identified needs, we will expand our skill capacity by participating in professional development programs to improve technical and educational support for MA specialty crop growers.

**Accomplishments****Major goals of the project**

Our Project has Three Overall Goals:

1. Improve IPM practices and strategies related to emerging, invasive, and established pests of specialty crops;
2. Increase IPM implementation and promote whole-farm sustainability through outreach and training activities and demonstrating effective technological strategies; and
3. Promote adoption of IPM by expanding and improving the skill capacity of Extension personnel, IPM practitioners, and growers.

Specific objectives for Goal 1 include establishing research and demonstration trials on Partner Farms, including University research stations, and obtaining monitoring data from Collaborator Farms that will direct management decisions and improve outcomes for the grower community at-large. Goal 2 objectives include training Mentor Farmers, providing timely diagnostics, bridging language barriers, and participating in regional digital reporting systems. Goal 3 objectives include acquiring skills in farm business management and information technology as well as obtaining and providing expanded capacity in weed research/outreach for vegetable and fruit farmers.

**What was accomplished under these goals?**

Goal 1: Improve IPM Practices and Strategies for Emerging and Established Pests  
Emerging Pests that Affect Multiple Specialty Crops (100% complete).

- Downy mildew on winter greens: completed 1 variety trial leading to recommendations that are being implemented by growers.
- Presented 1 on-line workshop on pests of winter greens and their management.
- Visited 4 farms routinely to conduct enterprise budgets for winter spinach populations.
- Scouted for cranberry scale, 34 samples from 13 growers were assessed. Scouted and advised 13 sites for leafhopper and casebearer.

Advanced Apple IPM (100% complete).

- 20 on-farm research and demonstrations were conducted in MA, NH, and ME involving 1) Evaluation of entomopathogenic nematodes against plum curculio, 2) Evaluation of grower-friendly attract-and-kill strategy for apple maggot control, 3) Efficacy of multi-cultivar grafted apple trees as perennial trap crops for multiple pests, 4) evaluation of trap cropping in association with ghost traps for attract-and-kill of the brown marmorated stink bug (BMSB) and 5) statewide monitoring of BMSB using clear sticky cards.

Brassica IPM (90% complete).

- No Brassica research was conducted due to the pandemic. A webinar on brassica insect pest was held.

Efficacy of Organic Pesticides (95% complete).

- OMRI-listed fungicide, PerCarb (Biosafe, 85% a.i. sodium carbonate peroxyhydrate) was tested against haircap moss in cranberry. Although minor moss control was noted with single applications, high rates or multiple applications would likely be needed for significant control.
- Scouting visits and pesticide recommendations given for 2 organic cranberry farms.

Goal 2A: Increase IPM Implementation and Promote Whole-Farm Sustainability through Outreach and Training Activities  
Training scouts and IPM implementation on Mentor Farms (95% complete).

- We were unable to hire and train scouts during this period due to Covid, however 4 farms were scouted biweekly by team personnel.

- We were unable to routinely visit mentor farms during the pandemic.

Provide timely and accurate specialty crop disease diagnostics (90% complete).

- Pest diagnostics, pesticide efficacy, and forecasting are consistently the focus of our outreach programs, teleconferencing workshops, and field day events.

Conduct Workshops and Training (85% complete).

- Conducted webinar on BMSB (75 attendees)
- Held 12 on-line fruit grower meetings (1,640 attendees)
- Conducted 3 WPS trainings (51 attendees) and 2 respirator trainings (56 attendees).
- 13 vegetable workshops and trainings were held (1,304 attendees) targeting water quality, nutrition and horticulture, weed management, fertigation, and general vegetable IPM.
- Created 15 IPM Fruit Loop podcast episodes as companions to the Healthy Fruit newsletter (333 plays)

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- 17 YouTube videos were produced in lieu of the traditional summer orchard tour (258 views).  
Bridge Language Barriers (80% complete).
- 4 vegetable IPM articles were published.
- 1 presentation was made in Spanish on nutrient management for vegetables (6 Mentor Farmers).  
Promote Commonwealth Quality Program (CQP) (100% complete).
- Objective completed in Year 2.

#### Goal 2B: Increase IPM Implementation and Promote Whole-Farm Sustainability through Demonstrating Effective Technological Strategies

Digital Recordkeeping (90% complete).

- The nature of the reporting system has morphed into EDDmaps: <https://www.eddmaps.org/>. Our current efforts remain focused on BMSB.

Optimizing Technology Utilization on Specialty Crop Farms (85% complete).

- Licensed UMAS UAS pilots incorporated drone usage and precision ag techniques at UMass Cold Spring Orchard.
- UMass continued its participation in the maintenance and expansion of MyIPM app.
- Using Integrated Pest Information Platform for Extension and Education (iPiPE) (100 complete).
- Objective completed in Year 2. iPiPE went defunct in 2019.

Weather Stations and Sensors (100% complete).

- The Network for Environment and Weather Applications (NEWA) in MA provides useful weather tools and pest management models for fruit and vegetable growers. 4 new weather stations were added to NEWA in MA for a total of 52 active stations (most of them located on farms). In 2020, there were 1,181 Users (203 Returning Users) in MA using NEWA for a total of 256 contact hours. Apple Resources are the most used models for grower decision-making.

#### Goal 3: Promote IPM Adoption by Improving and Expanding Skill Capacity and Evaluating Progress

Business Management and IPM Decision Making (85% complete).

- Most efforts were curtailed due to Covid, especially performance of replicated trials for economics. As a stop gap, production data from 4 growers were analyzed.
- EIP Team Members worked with resource economists and growers to conduct 4 enterprise budgets for winter spinach production.

Weed Management (85% complete).

- Conducted 1 vegetable weed webinar (26 attendees) and 5 cranberry workshops with weed management presentations (407 attendees).

Information Technology (IT) Professional Development (90% complete).

- Created 1 video featuring a cranberry Mentor farmer.
- Created 8 video presentations posted to YouTube.
- EIP team started work with professional videographer to initiate production of 6 IPM videos.
- Created 15 Fruit Loop podcast episodess as an audio partner to Healthy Fruit.

Assessing Change in Behavior and Condition from IPM Extension Efforts (90% complete).

- Used IPM toolkit to guide evaluation discussion and in evaluation plan for subsequent EIP proposal submission.
- We did not work on-farm with Mentor Farms in 2020 growing season due to COVID-19. Work was conducted virtually through webinars and other remote programming as well as through individual calls and emails.
- Evaluations of 7 online programs were conducted during the reporting period. A large majority of growers reported increased their knowledge of topics and that they intended to use what they learned in their work. One grower responded "Great job, very informative. Good review of basic principles (IPM pyramid) along with latest developments in control and resistance. Great pics of weeds, liked tips on how to ID." Online surveys also provided an opportunity to improve our collection of self-reported demographic data from program participants.
- A log of as-needed Extension assistance was kept, which included the farm/farmer, communication format (e.g., text, phone, email), the issue or question, and follow-up and/or resolution (over 150 interactions for this reporting period).
- Survey data from former Mentor Farmers was reviewed. Project personnel determined that follow-up surveys were unlikely to produce useful information about mid- and long-term impacts of Extension efforts. This review did generate substantive discussion about how to create evaluation tools for future projects that may be used to determine longer-term impacts of Extension interventions.
- Personnel met to discuss improvements to the project's evaluation process and evaluation plans for future EIP projects. The log formed the foundation for future evaluation planning. Because these recorded interactions were generally grower-initiated in response to a real-time issue, the log may include growers without sustained interactions with UMass Extension and reflect issues that are clearly of importance to these growers.

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Total number of peer-reviewed publications: 0

Total number of nonpeer-reviewed publications: 8 veg articles, 17 fruit pubs, 2 cranberry pubs plus 50 issues of our 3 newsletters

Total number of presentations: 94 presentations

Total number of people reached: >4,490 stakeholders

### What opportunities for training and professional development has the project provided?

Clements attended MyIPM Workshop, October 6-7, 2020; the 82nd Annual New England, New York & Canadian Fruit Pest Management Workshop, October 19, 2020; the 96th Cumberland - Shenandoah Fruit Workers Conference, December 2-4, 2020; Great Lakes Expo, December 8-10, 2020; NEWA 3.0 - Train the Trainer Webinar, March 19, 2021; and the New England Fruit Webinar Series, via Zoom.

Higgins attended and presented at the Long Island Agricultural Forum Jan 5-7, 2020 and VT Grower-to-Grower discussions on greenhouse management, Mar 24 and Mar 31, 2020.

Garafalo attended: Latinx Training Session I-Planting Seeds: Supporting Thriving Latinx Farmer and Farmworker Communities; Latinx Training Session II-Planting Seeds: Cultivating Connection: Culture and Communication; Latinx Training Session III-Planting Seeds: Harvesting Health: Provision of Services and Outreach; How to Build an Equity Agenda with Dr. Patricia Marshall. She also attended an Extension Climate Adaptation meeting sponsored by UMass Extension May 6, 2021, presented and attended CiderCon Feb 3-5 2021, and hosted, organized and attended 10 fruit meetings for New England growers 1/12/21-3/30/21.

Ghantous and Sandler attended a New Chemistry workshop offered by Syngenta on March 28, 2021.

Higgins and Scheufele hosted 4 talks by biopesticide company representative: AgBiome Oct 28, 2020, Summit Agro Nov 13, 2020, Marrone Bio Nov 12, 2020, and Certis Dec 7, 2020.

McKeag attended a workshop on Civil Rights Compliance Review, sponsored by USDA-NIFA, Aug 25, 2020, attended the Long Island Ag Forum sponsored by Cornell Cooperative Extension, January 5-7, 2021, participated in a workshop for Climate Adaptation Fellows (CAF), sponsored by UMaine, Jan 11-15, 2021, a Dry Farming Collaborative Winter Meeting sponsored by Oregon State U, Feb 25, 2021; and a soil moisture sensor session for CAF, sponsored by UMaine Mar 23, 2021.

McKeag and Higgins attended an Extension Climate Adaptation meeting sponsored by UMass Extension May 6, 2021.

Piñero, J.C. Wen, X.Y., and Godoy-Hernandez, H. 2020. Oral presentation at the 2020 Annual Meeting of the Entomological Society of America (November 11-25, 2020; ONLINE). Presentation title: "Optimizing the attractiveness of diluted Concord grape juice: an effective, low-cost attractant for *Drosophila suzukii* (Diptera: Drosophilidae)". Attendance: 109.

Sandler was Past-Chair of the NEERA 1604 group and organized a meeting of IPM coordinators by zoom (due to covid 19). The virtual meeting was held April 23, 2021 and attended by 18 people including 5 members of the NEIPM Center. Sandler also represented Northeast IPM Coordinators at the virtual National IPM Coordinators meeting on October 21, 2020.

Sandler participates regularly in Regional IPM "call-ins", which help to strengthen our Extension network and re-focus our educational efforts as needed. Occasionally experts join the call to share on a pest of interest (e.g., spotted lantern fly, SWD). We held sessions on Zoom, allowing us to share photos and slide presentations. She also attended a workshop on Japanese Knotweed on July 16, 2020, offered by UMass Extension.

Sandler, Sylvia and Ghantous were invited speakers at various cranberry workshops across the United States.

Sandler attended a Work-Life Balance training, June 16, 2020, a Resiliency Workshop on June 23, 2020, and a Racism Workshop July 24, 2020 offered by UMass. She participated in a workshop on UAVs on November 3, 2020 sponsored by the American Phytopathological Society. She also attended on-line seminars offered by Fraunhofer Institute on Solar Energy Systems on agri-voltaic research.

Scheufele and Higgins attended the Great Lakes Expo, Dec 8-10, 2020 and High Tunnels after Dark, sponsored by UNH, Dec 1 and Dec 8, 2020.

Scheufele hosted a weekly Vegetable Pest Alerts call using Zoom including 30 Extension Educators from all New England States and New York to share timely IPM issues occurring on farms through the season, and to share expertise.

### How have the results been disseminated to communities of interest?

We have positive and consistent contact with our stakeholders throughout the year. We delivered an extensive array of workshops, presentations, and training sessions throughout the reporting period. We published 3 newsletters (50 issues total) that reached more than 3,200 speciality crop growers. We participated in Regional IPM "call ins" and working groups, which help to strengthen our Extension network and re-focus our educational efforts as needed. We bring unknown crop damage issues to the meetings and the knowledge we gain is transferred directly to our growers. Almost all EIP team members are part of the organizing committee for the New England Vegetable and Fruit Conference, a bi-yearly event that attracts more than 1,500 growers from across New England. We are invited speakers to other states' Extension events where we present and train speciality crop growers. We are well networked with our colleagues and this facilitates exchange of information that helps the New England grower community.

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**What do you plan to do during the next reporting period to accomplish the goals?**

Goal 1: Improve IPM Practices and Strategies for Emerging and Established Pests

Emerging Pests that Affect Multiple Specialty Crops.

- Objective complete; No work planned.

Advanced Apple IPM.

- Objective complete; No work planned.

Advanced Vegetable/Brassica IPM.

- Presentations of relevant IPM strategies will be made to growers at state and regional meetings and through UMass

Extension publications.

- Tasks related to completing field work from 2021 will be completed.

Efficacy of Organic Pesticides.

- Presentations will be made to growers at state and regional meetings and through UMass Extension publications.

- Tasks related to completing field work from 2021 will be completed including use of copper for moss control in cranberry.

Goal 2A: Increase IPM Implementation and Promote Whole-Farm Sustainability through Outreach and Training Activities

Training scouts and IPM implementation on Mentor Farms.

- We will perform concluding tasks for Mentor Farm projects.

Provide timely and accurate specialty crop disease diagnostics.

- We will produce a narrated powerpoint on sampling (upright dieback, scale, Phytophthora root rot, and weeds).

- Diagnostic information will be collated and shared at winter meetings.

Conduct Workshops and Training.

- Workshops and trainings relevant to this proposal will be presented during winter 2021-22, including increasing awareness about green spanworm, scale, and invasive species.

- We will complete 6 training videos in partnership with eTown Video and post on-line. Topics are: attract-and-kill strategies, downy mildew in grape, drone in agriculture, tensiometers, cover crops and roller-crimper, and onion thrips.

- We will do 1 in-person and 1 on-line demonstration on integrating UAS technologies on-farm.

Bridge Language Barriers.

- Work will continue with Spanish-speaking and other non-English speaking mentor farmers. This work continues to lead to the production of printed resources, workshops with live interpretation, and translation of extant IPM factsheets to other languages.

Promote Commonwealth Quality Program (CQP).

- Objective complete; No work planned.

Goal 2B: Increase IPM Implementation and Promote Whole-Farm Sustainability through Demonstrating Effective Technological Strategies

Digital Recordkeeping.

- Team members will use EDDMaps and collect mapping data on BMSB.

Optimizing Technology Utilization on Specialty Crop Farms.

- We will configure 2 Matrice 100 aircraft and conduct demonstrations for growers.

- We will work with American Robotics to explore data collection and use information to attend to goals in new EIP grant.

- We will conduct research and outreach regarding dual-use of solar energy on working specialty crop farms (blueberry and cranberry) and evaluate projects fostering dual-use on specialty crop farms and connect this work to our new EIP21 project.

- Team will continue to use multi-media resources (podcasts, websites, virtual conferences, social media platforms, etc.) to effectively communicate and prioritize measures in a highly adaptive fashion

Using Integrated Pest Information Platform for Extension and Education (iPiPE).

- Objective complete; No work planned.

Weather Stations and Sensors.

- Our work with NEWA is on-going and will be reported on in our EIP21 progress report for Y1. NEWA and RIMPro are used to disseminate disease alerts in Healthy Fruit newsletter.

Goal 3: Promote IPM Adoption by Improving and Expanding Skill Capacity and Evaluating Progress

Business Management and IPM Decision Making.

- We will train students to record information for grower enterprise budgets. Physical recordings are the basis for computing revenues and costs. We will make revenue and cost comparisons between IPM and non-IPM strategies to determine the best economic outcome.

Weed Management.

- We will collect, process and analyze data from 2021 field and greenhouse studies.

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- We will interview growers to assess specific needs of vegetable farms to determine the frequency and intensity of problematic annual and perennial weeds.
- Information Technology (IT) Professional Development.
- We will expand our knowledge, use and development of web-based applications for remote teaching through the use of podcasts and programs like Zoom, GoToWebinar, Facebook Live, Instagram, and more.
  - We will gain education and experience on the use of UAS and dual-use solar.
- Assessing Change in Behavior and Condition from IPM Extension Efforts.
- The project team will continue to work on a process to standardize the collection of interactions across different Extension commodity groups in a readily accessible way (e.g., using a standardized data collection form and shared response database) as well the addition of a rating scale or other mechanism to measure growers' satisfaction with the support they received and allow opportunity for future feedback and follow-up. This tool, as envisioned, would be applicable for both remote and in-person farm visits and would allow us to generate a robust pool of data from affected farmers by which to assess and improve our outreach.

**Participants****Actual FTE's for this Reporting Period**

Role	Non-Students or faculty	Students with Staffing Roles			Computed Total by Role
		Undergraduate	Graduate	Post-Doctorate	
Scientist	1.2	0	0	0	1.2
Professional	6	0	0	0	6
Technical	0.5	0	0	0	0.5
Administrative	0.8	0	0	0	0.8
Other	0	0	0	0	0
Computed Total	8.5	0	0	0	8.5

**Student Count by Classification of Instructional Programs (CIP) Code**

{NO DATA ENTERED}

**Target Audience**

Specialty crop growers, conventional and organic growers, Spanish and English-speaking farm workers, beginning and women farmers, UMass Extension staff, Regional Extension IPM specialists, IPM consultants and scouts, agricultural service providers, farm managers and decision makers, newsletter subscribers, workshop and meeting attendees, industry representatives, UAS pilots and trainees.

**Products**

{Nothing to report}

**Other Products****Product Type**

Audio or Video

**Description**

Clements, J. 2020. Blending technology and IPM: the 2020 story of a Berkshire's Massachusetts apple orchard. YouTube video: [https://youtu.be/fMW0\\_8WURgM](https://youtu.be/fMW0_8WURgM)

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**Product Type**

Audio or Video

**Description**

Clements, J. 2020. Weather data in, DSS out for apple scab infection period model -- does it make a difference? YouTube video: <https://youtu.be/2tnmt5kD4Uo>

**Product Type**

Audio or Video

**Description**

Clements, J. 2020. Apple harvest open office, weekly (Tuesdays at noon) from August 18 through October 6. Via Zoom. All videos also posted on YouTube.

**Product Type**

Other

**Description**

Healthy Fruit, Vol. 28 (2020), Nos. 11-22; Vol. 29 (2021), Nos. 1-8. (App. 190 subscribers.)

Healthy Fruit is a timely newsletter that includes information on tree-fruit horticulture, pest management, and related topics.

**Product Type**

Other

**Description**

Veg Notes, Vol 32(11-28), Vol 33(1-6). Timely newsletter that delivers information on vegetable IPM (2880 subscribers).

**Product Type**

Other

**Description**

Cranberry Station newsletter. Vol 21(4-7), 22(1-4). Periodic newsletter with IPM and horticultural news for the cranberry industry (230 subscribers).

**Product Type**

Other

**Description**

Clements, J. 2020. A comparison of using the 'Ferri' version of the fruitlet growth rate model and the Malusim app to predict fruit set in 2020 of Gala, Honeycrisp, Empire and Pazazz apples at the UMass Cold Spring Orchard in Belchertown, MA. 96th Cumberland – Shenandoah Fruit Workers Conference, December 2-4, 2020. 45 attendees.

**Product Type**

Other

**Description**

Clements, J., and D. Cooley. 2020. A Comparison of Four On-Site Weather Stations and One Virtual Weather Service as Data Sources in 2020 for the Apple Scab Infection Period Model at the UMass Cold Spring Orchard in Belchertown, MA. 82nd Annual New England, New York & Canadian Fruit Pest Management Workshop, October 19, 2020. 25 attendees.

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**Product Type**

Other

**Description**

Clements, J., and D. Cooley. 2020. A Comparison of Four On-Site Weather Stations and One Virtual Weather Service as Data Sources in 2020 for the Apple Scab Infection Period Model at the UMass Cold Spring Orchard in Belchertown, MA. 96th Cumberland – Shenandoah Fruit Workers Conference, December 2-4, 2020. 65 attendees.

**Product Type**

Other

**Description**

Garofalo, E. 2021. Online presentation 'Orchard Pest Chat'. CiderCon 2021, American Cider Association 2.3.2021 (attendees: 75).

**Product Type**

Other

**Description**

Piñero, J.C. 2021. Presentation 'Deciphering the chemical ecology of an invasive pest, *Drosophila suzukii* (Diptera: Drosophilidae)'. Stockbridge School of Agriculture Seminar series (2.1.2021) (40 attendees).

**Product Type**

Other

**Description**

Piñero, J.C. 2021. Online presentation 'Advances in the control of fruit flies'. Annual meeting of the Entomological Society of America - Eastern branch meeting, 3.24.21 (Attendees: 42).

**Product Type**

Other

**Description**

Piñero, J.C. 2021. Online presentation 'An overview of semiochemicals used for invasive fruit fly (Tephritidae and Drosophilidae) management'. Turkish Ministry of Agriculture and Forestry - Online International Workshop on Biotechnical Methods, 3.25.2021 (attendees: 125).

**Product Type**

Other

**Description**

Piñero, J.C. 2021. Online presentation 'How research on insect sensory ecology has led to improved attract-and-kill systems for tephritid fruit flies'. Macquarie University Australia, 5.10.21 (attendees: 75).

**Product Type**

Other

**Description**

Piñero, J.C. 2021. Online presentation 'Deciphering the chemical ecology of an invasive pest, *Drosophila suzukii* (Diptera: Drosophilidae)'. Institute of Biotechnology, University of Veracruz (Xalapa, Mexico), 5.21.2021 (attendees: 105).

**Product Type**

Other

**Description**

Clements, J. 2021. Pre-season apple thinning briefing for growers: Using PGR's to optimize crop load for a



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profitable 2021. March 18, 2021. <https://ag.umass.edu/fruit/news/2021-pre-season-pgr-apple-thinning-briefing>. On-line grower meeting.

**Product Type**

Other

**Description**

Piñero, J.C. 2020. The Invasive Pest Brown Marmorated Stink Bug in Massachusetts: Biology, Monitoring, and Management. Invasive Species Webinar Series. UMass Extension Landscape, Nursery and Urban Forestry Program, and UMass Extension Fruit program. June 16, 2020. 75 attendees. On-line grower meeting.

**Product Type**

Other

**Description**

Piñero, J.C. 2020. Online presentation 'Managing early-season apple insect pests'. New England Winter Fruit Seminar Series, 3/10/2021 (attendance: 20). On-line grower meeting.

**Product Type**

Other

**Description**

New England Winter Meeting Series 2021 (8 meetings; 1/12/21, 1/19/21, 1/26/21, 2/16/21, 3/3/21, 3/10/21, 3/23/21, 3/30/21). New England Extension Fruit Educators Consortium. Online. (attendance: 1,365 total). On-line grower meeting.

**Product Type**

Other

**Description**

Piñero, J.C. 2021. Online presentation 'Insect pest management at bloom'. Cornell / NYS state-wide IPM program, 4.13.2021 (Attendees: 45). On-line grower meeting.

**Product Type**

Other

**Description**

Clements, J., and D. Olmstead. 2020. 2020 NEWA Agricultural Outreach Report for Massachusetts. On-line publication. [https://ag.umass.edu/sites/ag.umass.edu/files/pdf-doc-ppt/2020-newa-ag-outreach-report-ma\\_1.pdf](https://ag.umass.edu/sites/ag.umass.edu/files/pdf-doc-ppt/2020-newa-ag-outreach-report-ma_1.pdf).

**Product Type**

Audio or Video

**Description**

Garofalo, E. and Ware, L. 2020. UMass IPM Fruit Loop co-production of Healthy Fruit, Vol. 28 (2020), Nos. 11-22; Vol. 29 (2021), Nos. 1-8. (App. 190 subscribers.). UMass IPM Fruit Loop is a podcast accompanying the newsletter that provides an alternative way for growers to get up to date weather, horticulture, pest & disease information.

**Product Type**

Audio or Video

**Description**

Ware, L., Garofalo, E., Clements, J., Pinero, J., Petit, E. 2020. Seventeen educational you-tube videos were produced in lieu of the usual summer orchard tour. Research subjects included Grape Canopy Management, SWD in multiple fruit crops, beneficial nematodes, cover-crops, cider apple trees, crop trapping, and other IPM strategies underway.

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Other

**Description**

Garofalo, E., Piñero, J.C., Schloemann, S. 2020. Apple IPM: Anatomy of a Decision Support System. IPM Fact Sheet Series, University of Massachusetts Extension, Fact Sheet AD-007.

**Product Type**

Other

**Description**

Garofalo, E., Sandler, H. 2020. Apple IPM: Mile-a-Minute. IPM Fact Sheet Series, University of Massachusetts Extension, Fact Sheet AW-001.

**Product Type**

Other

**Description**

Garofalo, E., Piñero, J.C. 2021. Pear IPM: Pear Psylla Scouting. IPM Fact Sheet Series, University of Massachusetts Extension, Fact Sheet PI-001.

**Product Type**

Other

**Description**

Clements, J. 2021. HRT-RECIPE - Predicting fruit set using the fruitlet growth rate model. <https://ag.umass.edu/fruit/fact-sheets/hrt-recipe-predicting-fruit-set-using-fruitlet-growth-rate-model>.

**Product Type**

Other

**Description**

Clements, J., and W. Cowgill. 2021. HRT-Precision crop load management of Honeycrisp: flower bud identification and precision pruning. <https://ag.umass.edu/fruit/fact-sheets/hrt-precision-crop-load-management-of-honeycrisp-flower-bud-identification>.

**Product Type**

Other

**Description**

Ware, L., Pinero, J. 2021. Three fact sheets were translated into Spanish: Apple Scab, Plum Curculio, and Spotted Wing Drosophila.

**Product Type**

Other

**Description**

Garofalo, E., Piñero, J.C. 2021. Pear IPM: Pear Psylla Scouting. IPM Fact Sheet Series, University of Massachusetts Extension, Fact Sheet PI-001.

**Product Type**

Other

**Description**

Clements, J. and D. Cooley. 2020. A comparison of four on-site weather stations and one virtual weather service as data sources in 2020 for the apple scab infection period model at the UMass Cold Spring Orchard in Belchertown, MA. 2020 Great Lakes Expo. POSTER

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**Product Type**

Other

**Description**

Clements, J. 2020. A comparison of using the 'Ferri' version of the fruitlet growth rate model and the Malusim app to predict fruit set in 2020 of Gala, Honeycrisp, Empire and Pazazz apples at the UMass Cold Spring Orchard in Belchertown, MA. 2020 Great Lakes Expo. POSTER

**Product Type**

Other

**Description**

Clements, J., D. Cooley, P. O'Connor, and J. Krupa. OrchardWatch: remote sensing of weather conditions across multiple locations in a single orchard, does it make a difference? 2020 Great Lakes Expo. POSTER

**Product Type**

Other

**Description**

Clements, J., and J. Piñero. 2020. Blending technology and IPM: Onset Hobo RX300 weather station and NEWA, DTN Smart Traps, and "attract and kill" trap of brown marmorated stink bugs. A case study in a Berkshire's Massachusetts apple orchard. 2020 Great Lakes Expo. POSTER

**Product Type**

Other

**Description**

Webinar. UMass Mini-Twilight Series: Greenhouse Fertigation with Judson Reid of Cornell Cooperative Extension, 21 attendees.

**Product Type**

Other

**Description**

Webinar. UMass Mini-Twilight Series Vegetable Weed Management Using IPM, with Bryan Brown, NY State IPM Program, 26 attendees.

**Product Type**

Other

**Description**

Webinar. Ag Water Series Pt 1: Water Use Regulations, Water Monitoring Tools, and Efficient Irrigation, 39 attendees.

**Product Type**

Other

**Description**

Webinar. Ag Water Series Pt 2: Water System Mapping & Water Testing for FSMA, 45 attendees.

**Product Type**

Other

**Description**

Webinar. Ag Water Series Pt 3: Post-Harvest Water Quality & Sanitizer Use, 43 attendees.

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**Product Type**

Other

**Description**

Webinar. Getting the Most Out of Beneficial Nematodes, 111 attendees.

**Product Type**

Other

**Description**

Webinar. Southern New England Twilight Meeting Series: Pests of the Year, 290 attendees

**Product Type**

Other

**Description**

Webinar. Sue Scheufele, Diseases of Bean and Spinach Seed, NOFA-NY Winter Conference/Northeast Organic Seed Conference. 65 attendees.

**Product Type**

Other

**Description**

Webinar. Genevieve Higgins and Sue Scheufele with Jim Correll, Southern New England Twilight Meeting Series: Spinach Field Day. 179 attendees.

**Product Type**

Other

**Description**

Webinar. Southern New England Twilight Meeting Series: Greenhouse Seedling Production, 248 attendees.

**Product Type**

Other

**Description**

Webinar. Southern New England Twilight Meeting Series: High Tunnel Fertility, 150 attendees.

**Product Type**

Other

**Description**

Webinar. Genevieve Higgins, Intro to Nutrient Management in Spanish, 6 mentor farm attendees.

**Product Type**

Other

**Description**

Webinar. Sue Scheufele and Becky Sideman, Faruque Zaman, Dan Gilrein. Practical Recommendations for Managing Insect Pests of Brassicas, 81 attendees

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**Product Type**

Other

**Description**

Higgins. The Cultural Significance of Vegetables and Herbs, and Tomatoes/Nota Sobre la Importancia Cultural de las Hortalizas y Hierbas Aromaticas, y Tomates. Food Gardening in Massachusetts 2020 Vol 1:5 and 1:6.

**Product Type**

Other

**Description**

Higgins. Vegetable/Herb of the Week: Peppers/Hortaliza/Hierba Aromatica de la Semana son las Pimientos. Food Gardening in Massachusetts 2020 Vol 1:7 and 1:8.

**Product Type**

Other

**Description**

Higgins. Vegetable/Herb of the Week: Brassica Family/Hortaliza/Hierba Aromatica de la Semana: Familia de las Brasicas. Food Gardening in Massachusetts 2020 Vol 1:11 and 1:12.

**Product Type**

Other

**Description**

Higgins and Scheufele. Introduction to Managing Pests/Introduccion al Manjeo de Plagas. Food Gardening in Massachusetts 2020 Vol 1:13 and 1:14.

**Product Type**

Other

**Description**

Higgins and Scheufele. Managing Insects in Your Garden. Food Gardening in Massachusetts 2020 Vol 1:15.

**Product Type**

Other

**Description**

Higgins and Scheufele. Managing Diseases in Your Garden. Food Gardening in Massachusetts 2020 Vol 1:17.

**Product Type**

Other

**Description**

Higgins and Scheufele. Managing Weeds in Your Garden. Food Gardening in Massachusetts 2020 Vol 1:19.

**Product Type**

Other

**Description**

McKeag. Farm Pick-Your-Own/Agricultural Tourism Activities. MDAR Guidance Bulletin.

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**Product Type**

Other

**Description**

Sandler, Ghantous, and Sylvia. Cranberry Bogsides on zoom. June 8, 2020 (24 attendees); May 12, 2021 (15 attendees), and May 20, 2020. On-line grower meeting.

**Product Type**

Other

**Description**

Sandler, Ghantous, and Sylvia. Cranberry Research and Extension Update meeting. Jan 26-27, 2021 (180 attendees). On-line grower meeting.

**Product Type**

Other

**Description**

Sandler, Ghantous, and Sylvia. 2020 Pesticide Safety Meeting. Aug 18 and Aug 20. (40 attendees each day). On-line grower meeting.

**Product Type**

Other

**Description**

Sandler, Ghantous, and Sylvia. 2021 Pesticide Safety Meeting. April 27 (50 growers) and April 28 (54 growers). On-line grower meeting.

**Product Type**

Other

**Description**

Sylvia. Respirator training. March 15 (41 attendees) and March 22, 2021 (15 attendees). On-line grower meeting.

**Product Type**

Other

**Description**

Sylvia. 2021 WPS trainings. March 22 (14 attendees), Mar 29 (20 attendees) and June 2 (8 attendees). On-line grower meeting.

**Product Type**

Other

**Description**

Sylvia. Pesticide exam preparations. March 24 (8 attendees) and April 30, 2021 (6 attendees). On-line grower meeting.

**Product Type**

Other

**Description**

Sylvia. Pesticide License Recertification Assistance for Growers, 1-on-1 (23 growers).

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**Product Type**

Other

**Description**

Sylvia and Averill. Casebearer Pest Alert. Special insert for Cranberry newsletter, July 2020.

**Product Type**

Other

**Description**

Sandler, Ghantous, and Sylvia. Cranberry Chart Book 2021-2023 update and revision.  
<https://ag.umass.edu/cranberry/publications-resources/cranberry-chart-book>.

**Product Type**

Other

**Description**

Wick, Sandler, and Ghantous. Aquatic weeds: Biology, diversity and grower assessment of presence on cranberry farms.  
Fact Sheet.

**Changes/Problems**

Restrictions resulting from the Covid 19 pandemic adversely impacted our ability to travel (e.g., Mentor Farmer visits) and to host in-person gatherings and to conduct field research. We increased our output of on-line educational products to "fill the gap". Many of our stakeholders actually preferred the on-line meetings occasionally (not totally in lieu of in-person meetings, but in addition to). We plan to continue to incorporate on-line offerings into our typical outreach products.