Massachusetts Fruit IPM Report for 2018

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Weather

Low winter temperature recorded at the UMass Cold Spring Orchard was -10°F on January 7, 2018. There was some bud damage to sensitive peach varieties, but otherwise trees were nicely hardened off because of a late December 2017 to early January (very) cold stretch of weather. Apple green tip was about April 13, followed by a somewhat protracted full bloom period beginning before May 10 and continuing until at after May 15. Numerous new apple varieties make it increasingly difficult to pin down "full bloom" date. Otherwise, the growing season in Massachusetts and southern New England was more or less a tale of two seasons. The first part, from April through June, was nearly normal in terms of precipitation and temperature. In midsummer, temperatures increased, and rain fell, making a kind of southern summer from July on. This had an impact on diseases and physiological disorders.

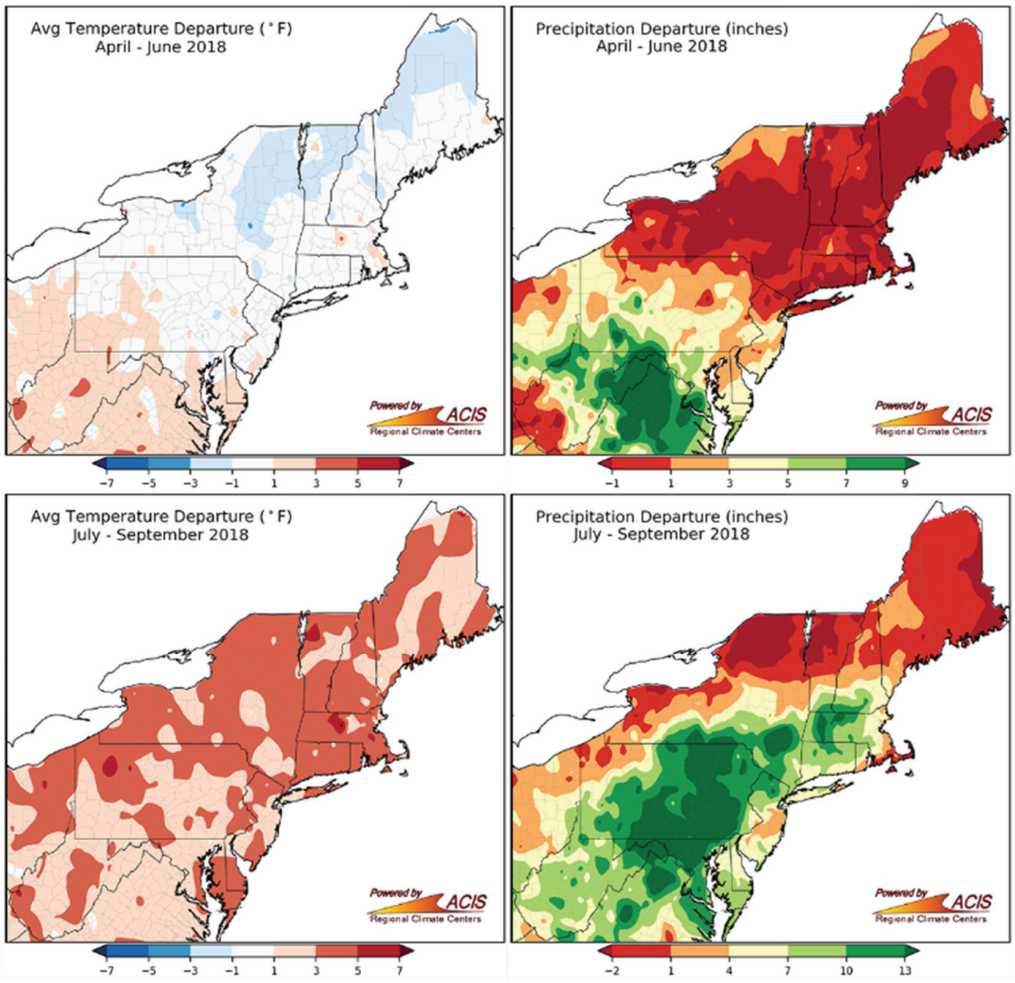

Figure 1. The 2018 growing season Northeast temperature and precipitation departure.

Diseases

Apple scab presented the normal management challenges this year. At the UMass Cold Spring Orchard (CSO), Ag-Radar recorded 13 infection periods, the first on April 25 and the last on June 4, with the most significant risk on May 6, May 12, May 15, and May 1. RIMpro patterns were

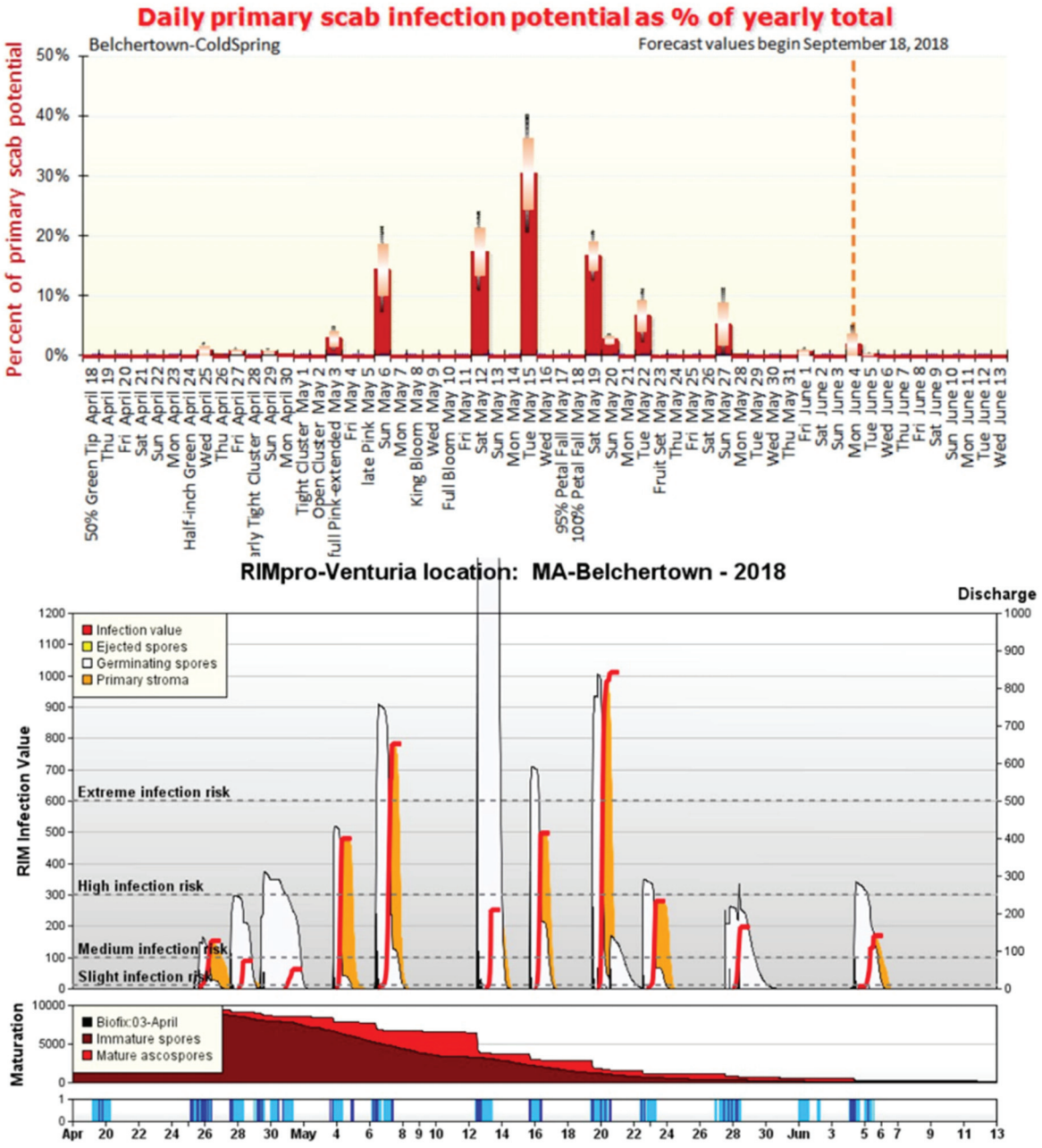

Figure 2. AgRadar (top) and RIMpro (bottom) primary apple scab infection periods, UMass Cold Spring Orchard, 2018.

very similar, with 11 infection periods, first on April 25 and the last on June 4, with the most significant risk on May 4, May 6, May 15, and May 19. Both systems recorded a slight chance of a primary infection on June 24. Early to mid-May was critical for scab fungicide sprays.

Fire Blight pressure was moderate this year, though models differed. At the UMass CSO, the AgRadar Cougarblight model had one infection (High Risk) May 16, the Maryblyt/Eastern FB model one infection May 21, and while RIMpro indicated three infections, May 8, May 15-16, and May 18-19. Inoculation on May 15 developed severe symptoms in two trials at CSO. Fire blight outbreaks in commercial orchards were not

severe, as growers generally applied streptomycin at appropriate times, sometimes making more than one application, sometimes in combination with appropriately timed biological controls and/or prohexadione-calcium (Apogee, Kudos).

Summer rot diseases and related problems! The transition from normal precipitation through mid-June to very wet weather in July and August generated much more fruit rot than usual in MA. Honeycrisp was often infected, though other cultivars also had significant damage. The weather not only favored fungal infections but also made it difficult to keep fungicide protection on fruit. Relatively warm temperatures, particularly at night, exacerbated problems. Sunscald cracks on some cultivars increased damage. Spotted wing drosophila were found around damaged fruit, but were not associated with initiating infections.

We identified at least two fruit rots, black rot (*Bot-*

Figure 3. Typical fruit rot(s) on Honeycrisp and other apple varieties observed in 2018. Looks like bitter rot, but black rot also prevalent.

Figure 4. Marssonina leaf blotch on Morning Mist Fuji, September 26, 2018, UMass Cold Spring Orchard.

ryosphaeria obtusa) and bitter rot (*Colletotrichum sp*.). A third rot, white rot (*Botryosphaeria dothidea*) wasn't identified definitively, but may have also been present. To add to the confusion, early symptoms of these rots may be confused with the physiological diseases associated with calcium deficiency, bitter pit and cork spot, and with stink bug damage.

Marssonina leaf blotch (caused by *Marssonia coronaria*)showed up in late August and early September in MA, causing enough defoliation to raise some concern. Wet, warm summer weather appears to be increasing the severity of this new disease in MA. At the same time, other fungal diseases may be causing problems. Fungi in *Colletotrichum* sp. cause fruit rot, and some species can also cause leaf blotch. New *Colletotrichum* species may be moving into the region, as Glomerella leaf spot (yes, caused by *Colletotrichum*) has been found in eastern NY and is relatively common in NC. A physiological disease, necrotic leaf blotch is associated with Golden Delicious and related cultivars and causes

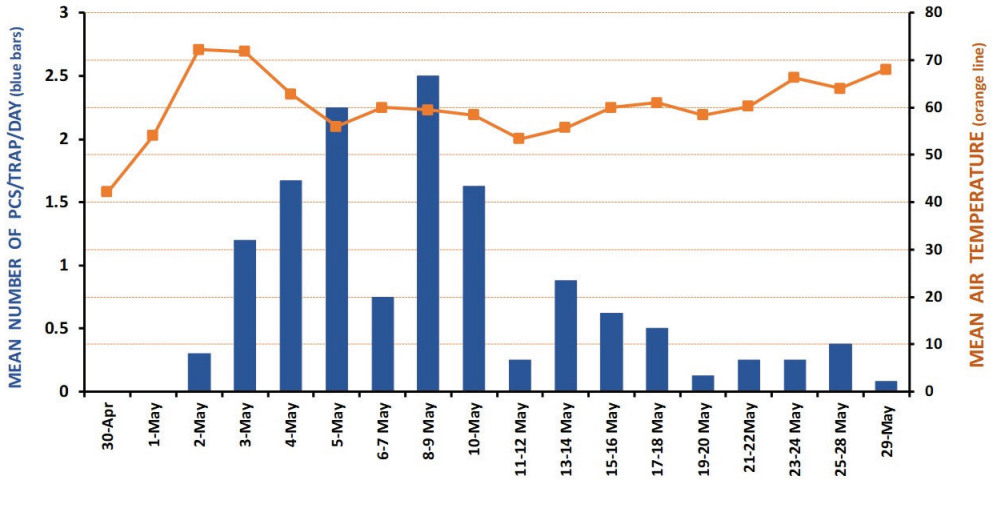

Figure 5. Temporal pattern of PC immigration into an unsprayed apple block, determined by odor-baited pyramid traps. The yellow rectangle shows the petal fall period for McIntosh trees at the UMass Cold Spring Orchard.

similar symptoms.

In general, climate change appears to be bringing diseases common in places like NC to MA. This will require significant rethinking of summer disease management practices.

Insects

Gypsy moth continued to give us trouble here and there in orchards. Some level of larval feeding damage was observed on apple. Females were observed laying eggs in forested orchard borders. On the up side, we were also able to ID (with the help of the Elkinton lab) an old natural enemy of gypsy moth eggs, the parasitic wasp *Ooencyrtus kuvanae.* More information on the gypsy moth situation can be found in the small fruit section that follows.

Plum curculio. In 2018, in one unsprayed apple block at the UMass CSO the first PC showed up at 220 DD (base 43°F), closely matching the 5-year (2000-2004) average DD accumulation of 228 DD. The immigration period was considered to be over soon after petal fall, when PC captures in odor-baited traps were quite low in despite of relatively warm air temperatures. About 88% of the total number of PCs were captured by the last day of petal fall.

Tarnished plant bug. Most fruit damage seen during pre-harvest surveys seemed to be the result of TPB feeding (unless you count rots, which are addressed in the disease section, oh man!). Early season damage was seen in flower buds too.

Brown Marmorated Stink Bug. The UMass Extension Fruit Program has been tracking the invasive Brown Marmorated Stink Bug (BMSB), *Halyomorpha halys*, since 2012. For the past six years, the number of BMSB captured in pheromone-baited traps had remained relatively low, until now. Trap-capture data for 2018 showed that this year BMSB populations were greater than any of the six previous years. Suspected feeding injury by stink bugs (allegedly BMSB) has been reported in a couple of orchards, however, the actual levels of damage have not been quantified yet. In late September, one grower deemed necessary the application of a perimeter row spray targeting BMSB as a result of trap captures exceeding threshold for the first time in MA. In an attempt to kill as many BMSB as possible, on 5-September one ghost trap was deployed at each of 5 orchard blocks. As of 12-October, the 5 ghost traps have killed 245 BMSB adults and nymphs.

Codling moth. Just a quick note that codling moth (CM) pheromone trap catches were very high in some orchards. Some orchards reported significant CM damage to apples in despite of control efforts. We don't know yet if we are experiencing a double flight peak for each generation, with the second peak being more OP-resistant.

Horticulture

Despite what appeared to be non-copious bloom in some cases, apple fruit set was quite copious. Ditto for peaches, however, it was quite variety-dependent in both tree fruits. Apple (and peach!) crop load management remains one of our most significant horticultural challenges.

Figure 6. Brown marmorated stink bug adults attracted and killed under 'ghost trap' in a commercial orchard (September 6, 2018).

Weed control! (Isn't that a pest management thing?). Copious precipitation resulted in rampant weed growth, both annual grasses and broadleaf weeds, and perennial weeds. Weed control often falls to the wayside, however, an integrated approach including timely application of both pre-emergent and contact herbicides to reduce the seed bank is required where an herbicide strip is desired. Especially important in new plantings on dwarf rootstocks! But be sure to follow herbicide label advisories on minimum tree age and avoid contact with bark when using contact herbicides.

The peach crop and harvest was pretty much as usual, however, wet weather set in and brown rot was its usual difficult stuff under wet conditions. Apple harvest was a bit of a slog, unseasonably warm late August into early September temperatures delayed red color development, and apples were very large. Quality was not the best, but everyone got through it and sales have been brisk. Buy Local! As already mentioned, some orchards had severe rot problems, most likely on account of slacking off on fungicide applications late in the summer, but also fostered by the high heat and humidity.

Small Fruit

Winter moth egg hatch occurred during the third week of April in 2018 at approximately 20–50 GDD Base 50˚F (177-243 GDD Base 40°F); approximately 1 week later than in 2017. Winter Moth flight in November 2017 was light suggesting lower WM populations. Blueberry growers reported very low levels of winter moth damage in 2018 marking 2 consecutive years of reduced pressure from this invasive pest. The accepted explanation is that the biological control agent, *Cyzenis albicans*, a tachinid fly, released by Dr. Joe Elkinton in 41 sites across Massachusetts, has become widely established and is having a measurable impact. We published 3 (of 13 total) Massachusetts IPM Berry Blasts (often in collaboration with Heather Faubert in RI) with information about winter moth to 456 recipients.

Gypsy moth populations were extremely high in several regions of Massachusetts in 2017 following the drought conditions in 2016 whereby the natural control agent *Entomophaga maimaiga* was suppressed by the dry conditions. Rain later in the summer of 2017 reactivated the *E. maimaiga* fungus and increased gypsy moth mortality later in the season thereby reducing egg laying and overwinter populations for 2018 (see images below). In 2018 GM populations were lower with only a few localized areas of outbreak. Timely insecticide applications (e.g., B.t.) to control this pest were only needed in some locations.

Spotted Wing Drosophila (SWD) – UMass Extension maintained a 10-trap network for monitoring the

onset of SWD activity for 2018. Scentry traps and lures were used in most cases and traps were monitored on a weekly basis starting in mid-June. First capture coincided with sustained capture dates beginning at approximately June 25, 2018. This was similar to the timing in 2017 and again put some crops at risk that had not been considered vulnerable to SWD in the past; late ripening varieties of June bearing strawberries and sweet cherries. Grape growers again reported significantly high populations in vineyards during harvest indicating that late season sprays may be needed in this crop. Four issues of Massachusetts IPM Berry Blast (456 recipients) contained information on SWD pest status and management recommendations. Trap capture results from the 10-site network were reported on iPiPE.

A demonstration project showing how to build and manage an affordable, small scale exclusion netting system for protecting late ripening floricane raspberries from SWD was installed at the UMass Cold Spring Orchard at a cost of approximately $500. The system used PVC pipe as structural support, a combination of standard and pressure treated lumber, 80-gram exclusion netting. The tunnel was 100 ft in length with fifteen 3rd year black raspberry crowns of 3 varieties ('Niwot', 'Bristol' and 'Mac Black'. From this 75' row of plants we harvested 125 lbs. ($600-$650+ retail value) of fruit with no insecticide (or fungicide) sprays needed. This showed that the investment in exclusion netting can pay for itself in a short period of time. The only problem encountered was after harvest was complete there was an outbreak of aphids which dissipated after the exclusion netting was removed.

Special Projects/Research Publications

The UMass RIMpro Advisory Service was continued in 2018 with twelve orchards paying $250 each to join the Service. Members had access to a website with RIMpro model outputs including scab, fire blight, codling moth, and -- new this year -- a fruit thinning model. Most likely these growers will be on their own sign-up for RIMpro in 2019.

For a second and final year, a UMass team including Extension Educators, a graduate student, and two undergraduate students ran a pheromone trap network across Massachusetts orchards as part of the eIP and iPiPE Northeast Apple Crop Pest Program. Traps were checked weekly and pest incidence/counts were entered into the iPiPE portal. iPiPE is a collaborative effort between researchers, Extension specialists, and growers that utilizes near real-time data to provide pest status, education, and outreach on a national scale.

Figure 7. Exclusion netting being installed over black raspberries at UMass Cold Spring Orchard.

Led again and hosted by UMass, the New England Tree Fruit specialists team contributed to the online edition of the New England Tree Fruit Management Guide. Being 100% online at netreefruit.org, the Guide is continually updated and is the centerpiece of New England specialists' collaboration on tree fruit recommendations. The Guide was built with responsive web design, so it is very mobile friendly.

The Eco Apple App was updated; however, it was turned over to the IPM Institute for further updates. The App target audience is Eco Apple growers, the objective to make Eco Apple approved spray chemical information available by bud stage and pest. The app is free (thanks to some leftover Northeast SARE money) and can be used by any apple grower wishing to restrict their spray chemical use to Eco Apple approved chemicals. The app is available on both the Google Play and Apple App Stores.

MyIPM (another app!) was updated in cooperation with Clemson University and others. In particular, pear insects was added, and pear and apple diseases were updated. MyIPM is a helpful diagnostic app that provides both chemical and non-chemical management recommendations for insect and disease problems in multiple crops. (Apple, pear, peach, strawberry, blueberry, etc.) But the main goal is to provide chemical resistance management help, including fungicide and insecticide modes of action, with chemical spray rotation help. MyIPM is available on both the Google Play and Apple App Stores.

In collaboration with researchers at Cornell's Hudson Valley Lab (Acimovic), an Asian pear variety block at the UMass Orchard in Belchertown was dissected over time of fire blight cankers which were a result of purposeful inoculation in 2017. Canker samples were taken back to the Hudson Valley Lab and deep-frozen for later analysis, the objective being to look at overwinter ability of the bacteria. These trees were all cut down and removed by bloom in 2018.

Another collaboration with Cornell University was beta testing the Malusim app. Malusim is a web and mobile (iOS and Android) app that interfaces with the apple fruitlet growth rate model to help with precision thinning and similarly with the apple irrigation model to provide irrigation guidance (preventing both over- and under-watering). Malusim is linked to NEWA for real time weather information that are used in both the apple thinning and irrigation models. We expect Malusim to be released to all interested apple growers for the 2019 growing season. Get a sneak peek at malusim.org.

Funded by Northeast SARE in cooperation with Quan Zeng at the Connecticut Agricultural Experiment Station, a block of Jonagold apples at the UMass Orchard in Belchertown was treated with several alternatives to antibiotics, including Bloomtime Biological, Blossom Protect, Double Nickel, Cueva and Oxidate, as well as a streptomycin control. Trees were inoculated with *Erwinia amylovora* at 70% bloom. Resulting infection incidence in blossom clusters was very high, 97% for untreated controls. Streptomycin incidence was 39%, while incidence in treatments using the antibiotic alternatives ranged from 69% to 97%.

In another test, McIntosh on M.7 were treated with different rates and timings of copper-phosphite (BluLogic, 1% metallic copper, NutriAg Ltd.). Trees were inoculated with *Erwinia amylovora* at 70% bloom. Disease incidence in clusters on untreated control was 88%, compared with a streptomycin control at 68%. BluLogic incidence ran from 79% to 83%. Shoot blight incidence in the untreated trees was 48%, and 15% in the streptomycin treatment. BluLogic shoot blight incidence ranged from 21% to 38%. BluLogic moderately reduced scab incidence relative to untreated controls, and did not russet fruit. For more information, see www.getblulogic.com.

We participated in the weekly Northeast Regional Berry Call-in organized by Cornell University that brought together Extension and Industry and Growers from the Northeast (PA to Ontario) to discuss current observations and timely topics together. These calls are extremely useful for problem solving and general awareness of growing conditions and challenges. Calls started in mid-April and ran through July.

For a second year in a row, a UMass team composed of research and Extension faculties and staff, with student support, conducted research in an one acre block of 'Polana' raspberries to test efficacy and best placement of attracticidal spheres for management of spotted wing Drosophila. This was the last year of a multi-state SARE grant project directed by Tracy Leskey (Appalachian Fruit Research Station, USDA).

On-farm demonstrations of the effectiveness of odor-baited trap trees as an attract-and-kill strategy for PC adults, and entomopathogenic nematodes (EPN) as biological control agents against PC larvae in the soil were conducted in six commercial orchards (five in MA, one in NH) from May to August 2018. Data are being processed.

Figure 8. Emergence cages deployed underneath an odor-baited trap tree to monitor emergence of adult plum curculios as part of demonstrations of biological control using EPNs applied to the soil.

Research/Extension Grants Received

Clements, J. iPiPE Northeast Apple Crop Pest Program. iPiPE: Integrated Crop Pest Information Platform for Extension and Education. Pennsylvania State University/North Carolina State University/USDA AFRI Cooperative Agricultural Project.

Piñero, J.C., Leskey, T.C., Shapiro,-Ilan, D., Faubert, H., Concklin, M, and Hamilton, G. Project title: "Developing a multi life-stage management strategy for apple maggot, a persistent tree fruit pest in the Northeast, through the integration of attract-and-kill and biological control". Funding agency: NIFA Crop Protection and Pest Management program. The main goal of this 3-year project is to develop an integrated multi-stage management program for AMF involving attract-and-kill (against AMF adults) and use of entomopathogenic nematodes (against AMF larvae in the soil) that minimizes use of insecticides. Participant states: CT, MA, NH, RI.

Piñero, J.C., Schloemann, S., Simisky, T., Garofalo, E., and Clements, J. Project title: "Invasive Insect Pests Threatening Specialty Crops in Massachusetts: Research, Monitoring, Stakeholder Engagement and Education". Funding agency: MA Department of Agricultural Resources. Project objectives: (1) To develop and evaluate a grower-friendly mass trapping system to reduce populations of spotted wing drosophila, *Drosophila suzukii*, (2) to support existing monitoring systems for BMSB and SWD, and to initiate monitoring of spotted lanternfly, and (3) To engage and educate stakeholders through a multi-dimensional stakeholder engagement and education program involving a conference, workshops, field days, and dissemination of relevant information among stakeholders.