Cornell Cooperative Extension
Eastern NY Commercial Horticulture Program

VOLUME 6, ISSUE 7 - OCTOBER 2018

Tree Fruit News

Marssonina Leaf Blotch of Apple -
A Growing Problem in South-Eastern New York

Dr. Srdjan Acimovic & Dan Donahue

Excessive rain in New York and the rest of the Eastern US experienced in the second half of both the 2017 and 2018 growing seasons favored the development of Marssonina Leaf Blotch (MLB), a disease caused by *Marssonina coronaria* (sexual stage *Diplocarpon mali*). In early September 2017, in the lower-Hudson Valley and south NY we found MLB late in the summer in more than several apple orchards on Mutsu, Honeycrisp, NY-1 (SnapDragon), NY-2 (RubyFrost), Gala, Red Delicious, Golden Delicious, Pristine, Grimes Golden, Northern Spy, Stayman Winesap, Tompkins King, and others. The alarming outcome was defoliation of lower part of the tree crowns, especially where moisture due to heavy *continued on next page*

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SAVE THE DATE:

Eastern NY Fruit and Vegetable Conference

February 19th-21st, 2019

Desmond Conference Center
660 Albany Shaker Rd
Albany, NY 12211

Sessions will include:

Tree Fruit
Vegetables
Berries
Grapes
Business Management
Industry Trade Show
General Session: Pollination ***new***
FSMA Grower Training Course ***new***
Irrigation ***new***
Vegetable Fertigation ***new***
CSA Farming ***new***

Join us for the 2nd Annual Eastern NY Fruit and Vegetable Conference! This year we will be expanding our conference to include a third day and many exciting new sessions. Speakers, topic details, and registration information will be available soon.
Mark your calendars, and don't miss this great line-up!

dew or sprinkler irrigation was present up until midday. When we examined the structures from round, brown to grey leaf spots of this disease (Fig. 1A, C), we found typical *Marssonina* sp. fungal spores originating from spore groups called acervuli (Fig. 1**B**). In 2017, leaves of Mutsu, Honeycrisp, Winesap, NY-1, NY-2 were microscopically examined. Defoliation of the lower part of the crown in 2017 was associated with orchards where fungicide cover sprays were not applied as frequently as the weather patterns required. In 2018, from mid-September up until Mid-October, new reports of apple tree defoliation started coming in. The most affected cultivars were Rome, Mutsu, Goldrush, Honeycrisp, Ginger Golds, Williams' Pride and others. Again, we detected the two-celled fungal spores typical for *Marssonina* sp. in leaf spots (Fig. 1B).

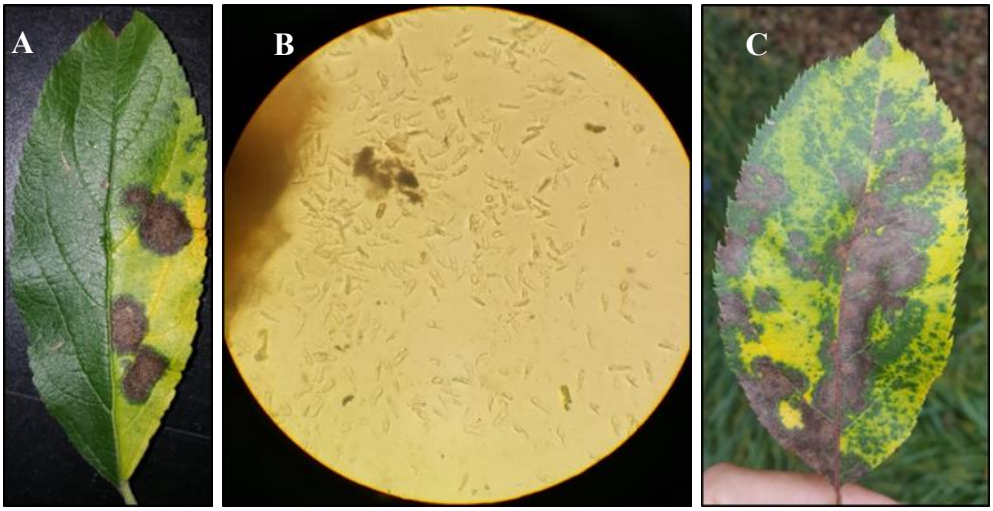

Figure 1. (A) Marssonina Leaf Blotch symptoms on leaf of NY-2 (RubyFrost) apple leaf. (B) Spores visible under the microscope typical for Marssonina sp. obtaind from acervuli collected from leaf spots in figure A. (C) Marssonina leaf blotch on Mutsu leaf (Photos by Acimovic S. G., 2017, 2018).

In 2017, we focused our efforts on pathogen isolation from the infected leaf samples and performed a dozen of isolation attempts and different methods. After preliminary molecular analyses of isolated fungi and two-gene sequencing that was done for recovered fungal isolates, the results came negative, indicating that we were not successful in isolating M. coronaria. However, when we tried the last test option, i.e. when we extracted total DNA from leaves showing MLB (containing mix of both fungal and plant DNA) and conducted a molecular method called PCR with previously published primers (Oberhänsli et al. 2014), we got positive identification of M. coronaria. However, this was not a good result as plant pathologist always aims to isolate the fungus i.e. causal organism of a disease in a pure culture and replicate pathogenicity test by inoculating healthy leaves of apple to prove 100% the result obtained by PCR detection. It is known in literature that M. coronaria is difficult to isolate (Lee et al. 2011), especially from samples collected at the end of the growing season when many saprophytic fungi live on the leaf surface and inhabit dead blotches caused initially by M. coronaria. This makes it very challenging to isolate this pathogen and for identification efforts to be completed. We are continuing our efforts in 2018 to confirm this species in NY by isolation and reliable diagnostic methods.

In recent years and in the past, MLB outbreaks in USA were reported in New York, Pennsylvania, Wisconsin. Disease is also known in Canada, Brazil, Panama, India, China, Taiwan, Korea, Japan, and several European countries (Romania, Italy, Germany, Austria, Switzerland). In Europe the most susceptible cultivars are Topaz, Jonagold, Gala, Golden Delicious and Luna. In Asia, the most affected is Fuji. Usually, the cultivars that are resistant to apple scab are more susceptible to MLB (Lebleu, 2015). MLB is a problem in both conventional and organic apple orchards, especially when reduced spray programs are attempted in a year very frequent rains during summer. MLB leaf symptoms express as grey to brown large round spots (blotches) that can coalesce in time, or are sometimes in a form of more dispersed smaller spots on more resistant cultivars (Fig. 1C). First symptoms are usually visible at the end of August and beginning of September. When leaf infections become severe due to lack of fungicide cover sprays, they lead to leaf yellowing and lower crown defoliation (Fig. 2A). Apple leaf symptoms are more prevalent then symptoms on fruit, which we haven't found in NY (Fig. 2B and C). MLB leads to defoliation of apple trees during late summer if cover sprays with fungicides are not applied at shorter spray intervals, in alignment with frequent rains events. During 2018, the disease started expressing in NY around 5-15 September. Most affected were the blocks where summer cover sprays with fungicides were not tightened, i.e. applied at shorter intervals than in a normal year, to re-cover after frequent rains we got in July, August and

This paper was supported by the Cornell Cooperative Extension ENYCHP Challenge Fund Grant Proposal titled "Confirm the Presence and Distribution of a New Apple Disease in Eastern New York".

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September.

Even though, the primary host for *M. coronaria* is apple (*Malus pumila*), other species such as *Malus baccata* and *Chaenomeles spp.* are also known to host in this fungus and serve as inoculum sources. *M. coronaria* overwinters in fallen leaves on the orchard floor (EPPO 2013). Ascospores cause first infections in spring. They form in the overwintered cup-like fungal structures that form on the leaf litter from last year. It is not known whether apothecia can form in NY conditions. It has been reported that in Korea apothecia do not form and that the fungus overwinters as asexual spores (conidia) on fallen leaves (Back and Jung 2014). Nevertheless, ascospores are inoculum for primary infections while, conidia are asexual spores produced in acervuli. Acervuli are plate-like spore groups visible as small round specks after leaf epidermis is ruptured by pushing spore masses. Conidia can cause several secondary infections during the season. To express as blotch, leaf infections require extended period of moisture i.e. leaf wetness, high relative air humidity, and temperatures between 20 to 25°C (EPPO, 2013). It seems that in Europe and probably in NY as well, infections start sometime in May or around first or second week of June. Typical symptoms usually express 40 - 45 days after the infection (Lee et al. 2011). In the orchard, spores disseminate by rain and wind. Trade with nursery material that bears infected leaves allows introduction of MLB in new distant regions. Since apple fruit are rarely infected, introduction by infected fruit into new orchards or regions is probably of low risk (EPPO, 2013).

Figure 2. (A) Marssonina Leaf Blotch defoliation on Rome trees in Highland NY in September 2018 (Photo by Acimovic S. G., 2018). (B) Depressed spot caused by Marssonina coronaria on an apple fruit (Photo by Lindner L., Research Centre for Agriculture and Forestry, Italy. Source: https://gd.eppo.int/taxon/DIPCML/photos). (C) Fruit spots caused by M. coronaria on an apple fruit (Photo by Lebleu F., Source: Arboriculture and special crops FiBL, Switzerland).

There are no labelled fungicides for control of Marssonina Leaf Blotch (MLB) on apple in New York (NY). Various researchers indicate that thiophanate-methyl (Topsin-M), DMI fungicides such as Inspire Super (contains difenoconazole, FRAC group 3), QoI trifloxystrobin (Flint), and Merivon which combines an SDHI fungicide fluxapyroxad (FRAC group 7) and QoI pyraclostrobin (FRAC Group 11), are effective on *Marssonina* fungal species on apple and/or poplar. However, none of these fungicides have labelled use for *M. coronaria* on apples so far in the USA. EBDC fungicides such as mancozeb (Manzate) or metiram (Polyram) are effective but have no labelled use for MLB in apple in the USA and are of very limited utility due to limitation of 77 days pre-harvest interval (PHI). Recent study in China has showed that DMI-s such as tebuconazole, hexaconazole, propiconazole, alone or DMI tebuconazole + benziothiazolinone (from a group of isothiazolinones) were very effective when applied at 20-day intervals, from early July - late August (Dang et al. 2017). The same authors report that Bordeaux mix + tebuconazole, Bordeaux mix + propiconazole, or Bordeaux mix + tebuconazole + benziothiazolinone alternated at 25 days were very effective (Dang et al. 2017). Except Bordeaux mix, none of these fungicide have label for use on apples in USA. However, in general, *Marssonina* has low sensitivity to copper fungicides (Li Y., The Connecticut Agricultural Experiment Station, *personal communication*). Other fungicides used in other countries of the world for this fungus include carbendazim (benzimidazol, FRAC group 1), QoI kresoxim-methyl, and DMI-s flusilazol and prochloraz. However, none of these fungicides have current labels for use on apples except Sovran (kresoxim-methyl), which is not labelled for *M. coronaria*. The main problems with all the above mentioned single-site fungicides is loss of their efficacy due to development of resistance in *M. coronaria* populations and unacceptable accumulation of residues in fruit (Dang et al. 2017). In terms of organic apple production where this pathogen can have a devastating impact, it is essential to prune the tree crown to facilitate good air circulation and to

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eliminate leaf litter as the major infection source. Hence, the same recommendations to reduce overwintering apple scab inoculum by degrading leaf litter would help here. If you had a high incidence of MLB, you should reduce inoculum size by promoting biological processes of degradation of leaf litter in fall, spring, or both in fall and spring. The aim of this practice is to quicken the degradation of leaf litter by promoting the activity of microorganisms and worms on and in the soil. In conventional orchards, spray apple leaves on the tree with urea just 1-2 days before the major leaf drop in fall (first severe frost) or as leaf litter on the orchard floor. When leaves are on the branches you will have better coverage with urea. Make sure this practice is done late enough in fall and start of winter to avoid promoting any late growth with sprayed nitrogen. If spraying leaf litter on the ground, the best time is to apply urea in late winter but before bud break. Turn air deflectors of your air-blast sprayer downward and/or turn off top nozzles to allow spray mist to lift loose leaves and coat them with urea. Use rate of 40 lbs of urea / A in 100 gals of water. Once done, you must wash and rinse well your spray equipment since urea can wear up any rubber parts, washers, and gaskets in the sprayer, especially the pump diaphragm. In organic apple orchards urea is not allowed. When ground is without snow cover and it is not muddy, use flail mower to shred leaves to smaller peaces instead. This method can also be used in conventional apple orchards. If practical, rake leaves into row middles from under the trees and remove leaf piles with flail mower mode for scalping the sod (Cox, 2016). Instead of urea, lime can be applied in both organic and conventional orchards at a rate of 2.5 tons/A. If lime is used, it is better to apply it after the leaf drop in fall or early in the winter. Lime increases pH or basicity of soil, thus promoting microbial activity and litter breakdown. Reduction of MLB inoculum with above specified practices does not mean you do not need to spray against MLB next summer. Enough inoculum can always be present in the orchard to cause infection. However, inoculum reduction secures better efficacy of your fungicide sprays and reduces the overall chance for severe MLB infections. Recent research from Germany shows that in organic orchards 10-12 sprays per year of each of the following products: acid clay Myco-Sin, Myco-Sin + sulfur, Funguran (copper hydroxide), Curatio (lime sulfur), or sulfur alone, provide relatively good control if the first spray application is started around 10-12 June (Bohr et al. 2018). These treatments allowed only 4-15% of MLB incidence in 2017 and 5-25% in 2018 efficacy trials. To better time fungicide sprays for maximum efficacy in MLB control in both conventional and organic orchards, use of RIMpro's *Marssonina* prediction model that is based on 10-day weather forecast is highly recommended and especially helpful in orchards that had severe MLB outbreaks in the past (RIMpro B.V., Zoelmond, Netherlands). More information about this model can be found by here: https://www.rimpro.eu/faces/index.xhtml?faces-redirect=true by clicking on the button "Create a new RIMpro account."

Literature

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2018 Northern NY Trap Data and Pest Exclusion with Hail Netting

Michael Basedow, CCE ENYCHP

During the 2018 growing season, we maintained an IPM trapping network in Northern New York, ranging from Chazy in Northern Clinton County to Rexford in Southern Saratoga County. From May through mid-September, we sent weekly e-alerts of our trap counts for oriental fruit moth, codling moth, obliquebanded leafroller, and apple maggot. Now that harvest is winding down, I would like to review this season's pest trends, and discuss what we observed from our hail netting trials in the Champlain Valley.

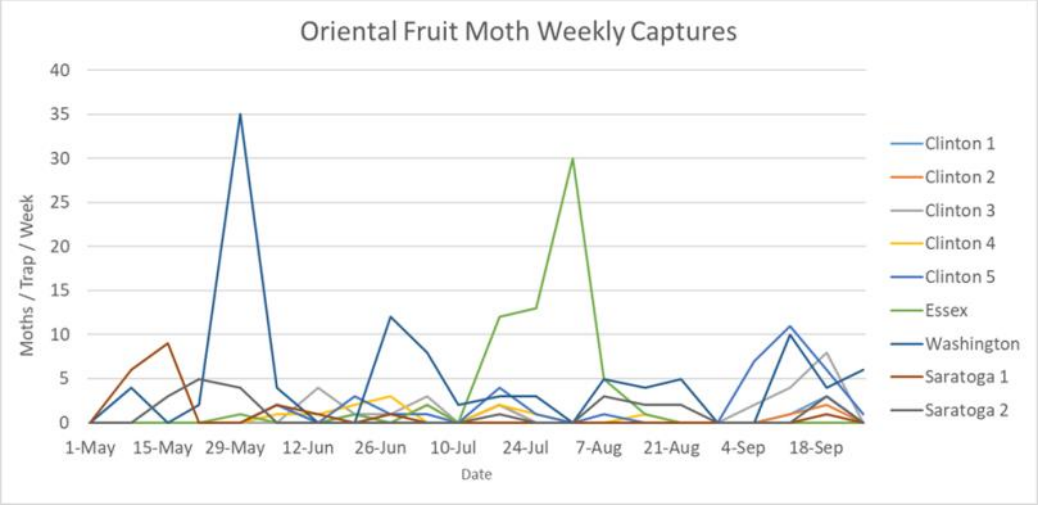

Figure 1. Weekly oriental fruit moth captures at our nine field sites throughout the growing season.

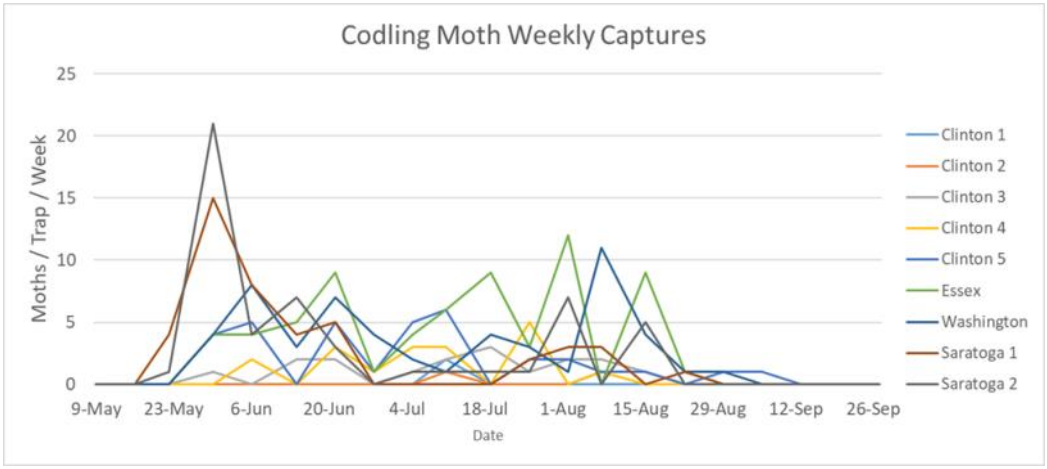

Figure 2. Weekly codling moth captures at our nine field sites throughout the growing season.

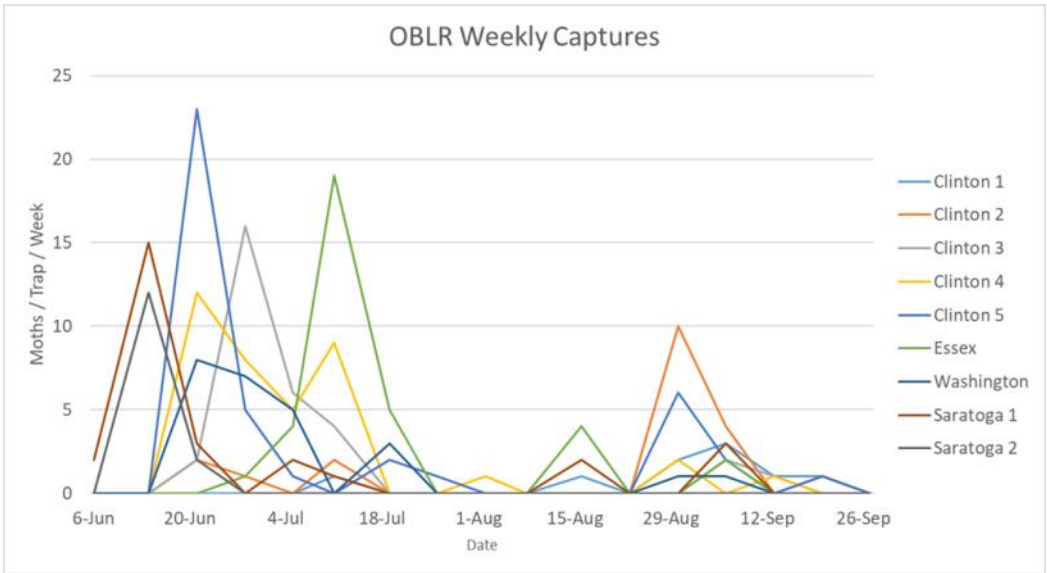

Figure 3. Weekly obliquebanded leafroller captures at our nine field sites throughout the growing season

2018 Trap Data Compared to the Four Year Average

This year we once again monitored four key pest populations, and are now comparing their numbers to our captures from the previous three seasons. Compared to the four year average (2015-2018), we were below average for OFM catches this season in Northern New York. Moth activity was greatest in Washington County the week of May 30th. There was also a notable spike in activity in Essex County in early August, however all of our other sites never caught above eleven moths/trap/week (Figure 1).

Trap catches for codling moth were also below our four year average, with catches never exceeding six moths/trap/week in our Clinton County traps (Figure 2). The highest capture

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was 21 moths/trap/week in Saratoga County the week of May 30th.

OBLR captures were also relatively low this year, at nearly half the four year average. We saw two relatively distinct flight periods; one centered on late June, and another from late August to early September (Figure 3).

Apple maggot catches were high in the Champlain Valley this season, at nearly twice our four year average. We had many weeks of catches above the economic threshold of five flies per trap (Figure 4), which necessitated timely insecticide applications throughout the latter part of the summer.

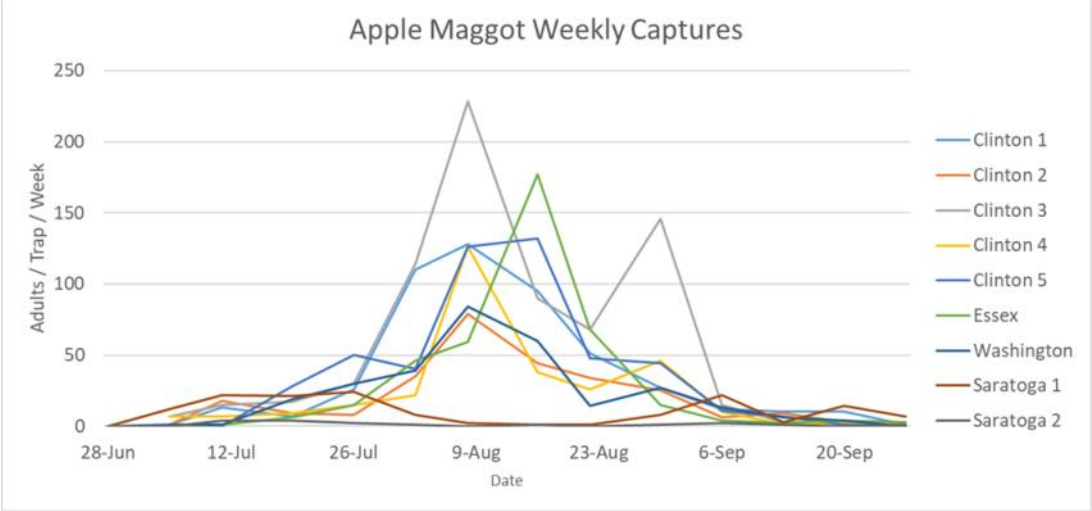

Figure 4. Weekly apple maggot captures at nine field sites throughout the growing season.

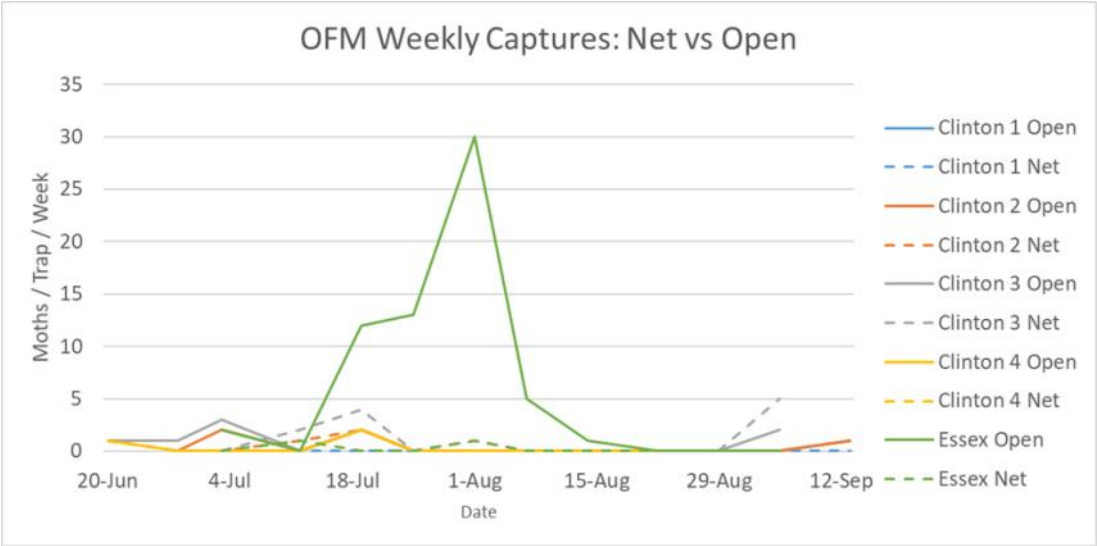

Figure 5. Weekly OFM captures from netted (dashed lines) and uncovered (solid lines) field sites.

Netting versus Uncovered Trap Captures

This season, we also set up netting trials in orchards in Clinton and Essex counties, where growers were already utilizing Drapenet hail netting for hail protection. Our objective was to determine if hail nets could also be used to exclude insect pests as part of an integrated pest management program, and what impact netting might have on fruit injury due to pest damage. Traps were placed in rows that were later covered with Drapenet hail netting, and duplicate traps were placed in nearby uncovered rows. Trees were covered with nets shortly after fruit thinning, occurring in the second to third week of June in most of our trial sites. While oriental fruit moths usually begin flying prior to this date in the Champlain Valley, we had very few moths in our traps prior to the nets being put up. Using a regression model to compare the amounts of moths found between the netted and uncovered treatments, we found the traps under the netting had significantly fewer OFM (Figure 5). At one site, OFM counts were lower under the net during the two weeks OFM were caught at the site. Two sites had reduced captures under the net in all but one of the weeks when OFM were present. Another site had lower OFM under the net just one of the four weeks OFM were present; while a final site had lower moth numbers under the net just two of the six weeks when OFM were present. With that said, OFM captures were low throughout the growing season in all but one of our netting study sites (no more than 5/moths/week).

Using a similar regression model, we found that codling moth catches were also significantly reduced under the netting. Excluding weeks where CM were not caught in either trap at a site, traps from trees under the netting had consistently fewer CM at four of the five sites (Figure 6). At the other site (Clinton 3), there was a single week where CM captures under the netting were equal to the uncovered row, one week where captures were higher under the netting, and seven weeks where captures were

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lower under the netting. In general, CM counts were relatively low throughout the season.

Our regression model found that traps in netted trees also captured significantly fewer OBLR. In weeks where OBLR were present, captures were consistently lower under the nets than in uncovered rows at three of the five sites (Figure 7). The other two sites each had one week where we caught a single OBLR under the netting, while the uncovered traps caught none. OBLR captures were also relatively low throughout the growing season.

Apple maggot trap captures were significantly lower under the netted trees. In four of our five sites, weekly captures were lower in the netted rows in weeks when flies were present (Figure 8). At the other site (Clinton 4), we caught fewer flies in the netted trees in seven of the ten weeks.

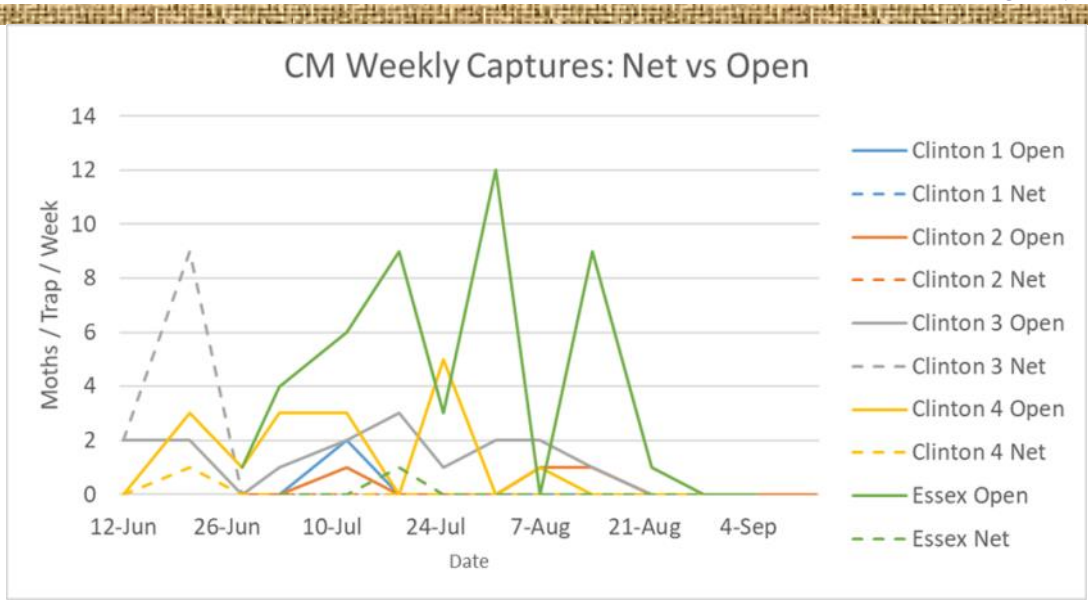

Figure 6. Weekly CM captures from netted (dashed lines) and uncovered (solid lines) field sites.

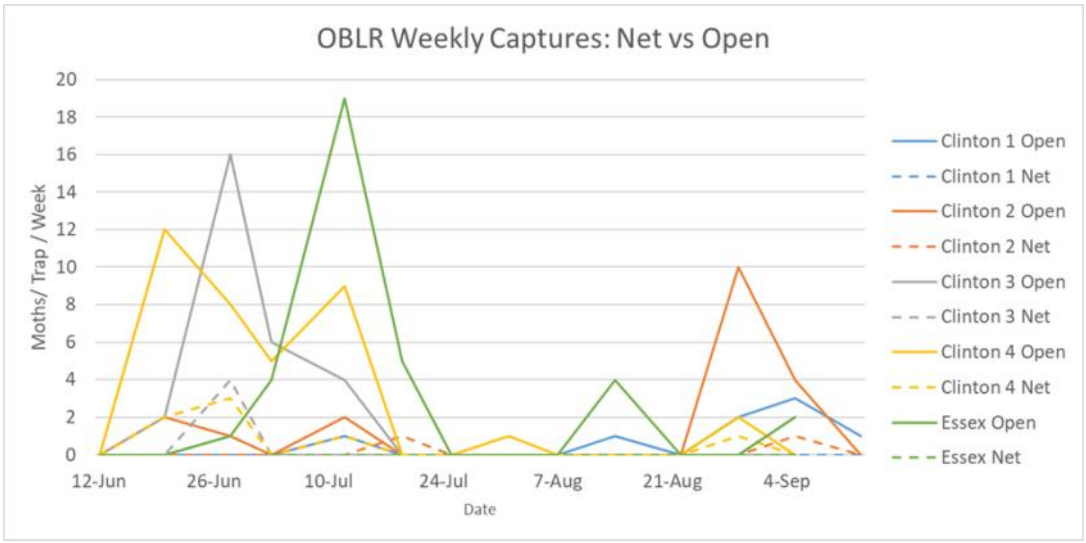

Figure 7. Weekly OBLR captures from netted (dashed lines) and uncovered (solid lines) field

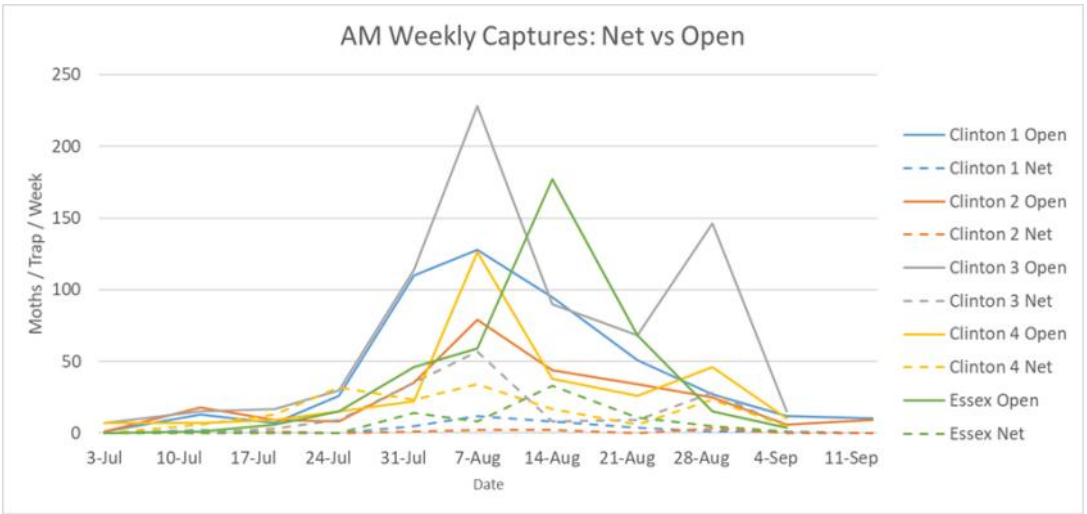

Figure 8. Weekly AM captures from netted (dashed lines) and uncovered (solid lines) field sites.

Fruit Injury

In addition to comparing the total number of captures at our five sites, we also conducted fruit injury ratings in July and August at the four sites in Clinton County. 300 fruit were rated for pest damage from the netted and uncovered sites, respectively. We also rated damage from plum curculio, tarnished plant bug, San Jose scale, and European apple sawfly. All blocks had been treated throughout the season with each orchard's standard pest management program, so injury was very low in the netted and uncovered blocks in July and August. We saw no significant

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differences in pest injury for any of the pests in either survey.

Concluding Thoughts

So, with all this in mind, is there any chance of using hail netting for physical pest exclusion? While the netting reduced the number of pests captured in our traps most weeks across our sites, the pests were often still there. Netting may help reduce pest numbers enough to reduce the total number of sprays needed for some pests, particularly for pests where spray decisions are based on well-established economic thresholds, like apple maggot.

From our general observations, sites with the most effective exclusion had their nets tightly tied to the lower limbs and trunks of the trees. At sites that achieved less effective control, netting was attached loosely to the lower limbs, so pests were better able to enter the net from under the canopy. Canopy shape may also play a role, as the site with the best control applied netting to trees grown to a tall spindle training system, while netted trees at our other field sites were larger central leader trees, which had very wide openings at the bottom.

As a final note, this study contains one year of data from a year of relatively light moth pest pressure. Further studies should be conducted to determine the full extent of the use of netting for exclusion purposes.

Acknowledgements

This work was sponsored by the Northern New York Agricultural Development Program project "Identification and physical exclusion of key pests in apple orchards in Northern New York." Thanks to Andy Galimberti for his assistance in this project, and to our cooperating orchards.

Upcoming Events

Fruit Category Pesticide Exam and Orchard IPM Basics

Date and Location:
1:30 to 3pm, November 27, 2018 – Clinton CCE Office, Plattsburgh, NY

Instructors:
Mike Basedow, ENYCHP Tree Fruit Specialist
Andy Galimberti, ENYCHP Technician

Sponsors:
Northern New York Agricultural Development Program and Eastern NY Commercial Horticulture Program

Agenda:
At this meeting, we will review orchard Integrated Pest Management (IPM), referencing from the NY Private Fruit Category (22) manual. We will first review the core foundations of integrated pest management, and then discuss as a group some of the key pests found in Northern New York orchards.

This meeting will provide training for the private category portion of the NY Pesticide Certification exam, and will also leave attendees better prepared to develop an IPM plan for their farm. Each farm attending will receive a copy of the Private Fruit Category Manual to take home.

This meeting will be held in conjunction with another program running from 10-1, which will discuss general preparation for taking the NY Pesticide Certification Exam. Participants can register for either meeting separately, or for both. Refreshments will be provided from 1:00 to 1:30, with the IPM lecture beginning at 1:30.

Registration:
You can register online at the following link. **https://pub.cce.cornell.edu/event_registration/main/events_landing.cfm?event=NovPesticide_209** or call or email Mike at 518 410 6823 or mrb254@cornell.edu.

2018 CORNELL AGRIBUSINESS

STRATEGIC MARKETING CONFERENCE

Developing Your Brand and Marketing Strategies to Increase Sales

November 7-8, 2018
Lake Placid, NY

Featuring speakers from NYC agricultural businesses:

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- Collaborative approaches to marketing
- Multi-channel selling strategies
- Technology adaption with your brand

Registration, Agenda, and Conference Information
dyson.cornell.edu/outreach/strategic-marketing-conference

Registration fee: $75
Register online by October 31, 2018.
Farmer scholarships available!

Contact
Lindsey Pashow
Cornell Cooperative Extension
Harvest New York
518-569-3073
lep67@cornell.edu

All members of the agricultural community are encourage to attend!

Funded by Stanley W. Warren Teaching Endowment and the Charles H. Dyson School of Applied Economics and Management at Cornell University. Organized by Cornell Cooperative Extension, Harvest New York. Sponsored by CoBank, Adirondack Harvest, Farm Credit East, and Agricultural Marketing Community Economic Development Program Work Team at Cornell University

CoBANK ADIRONDACK HARVEST FARM CREDIT EAST

How To Obtain a Pesticide Applicator License

CCE Clinton Office

6064 Route 22 Suite 5, Plattsburgh

When: Tuesday, November 27th, 10am-1pm

What: Receive an overview of the application, testing process, and key concepts of the materials needed to obtain a private or commercial NYSDEC pesticide applicator license.
Cornell Extension and NYSDEC specialists will be on hand to present information and field questions from participants. Applications for future exam dates will be accepted by DEC staff at the conclusion of the meeting. An optional review of the tree fruit private Category 22 will be offered in the afternoon from 1:30 to 3. Participants can register for either event alone, or for both. The afternoon portion of the meeting is being sponsored by the Northern New York Agricultural Development Program.

Registration link:
https://reg.cce.cornell.edu/NovPesticide_209
Questions? Call CCE Clinton County at 518-561-7450

Tree Fruit Specialists

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Business Specialist

Liz Higgins
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ENYCHP Office

Abby Henderson
Phone: 518-746-2553
Email: aef225@cornell.edu
Open: Mon, Wed, Fri
8:00am-4:00pm

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Eastern NY Commercial Horticulture Program

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Ulster County

All sessions

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4-part series designed for women who are farm owners or farm managers, or who anticipate moving into a decision making position on a farm

November 12—Introduction—Identify your strengths as a farm business manager. Topics: risk management and building a resource network.

November 19—Building Financial Skills—Learn financial management tools. Topics: farm financial statements; crop insurance; tools for business planning; effective use of loans and credit.

December 10—Managing Your Land and Farm Infrastructure—Learn about managing land and infrastructure. Topics: leasing and owning land; assessing farmland quality; choosing infrastructure; farm taxes; other insurance and risk management tools for your farm.

January 7—Managing Your Business, Employees and Planning for Transition—Learn about managing people and planning for the future. Topics: hiring and training employees; conflict management; transition planning.

To register: tinyurl.com/2018-Annies-Project

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