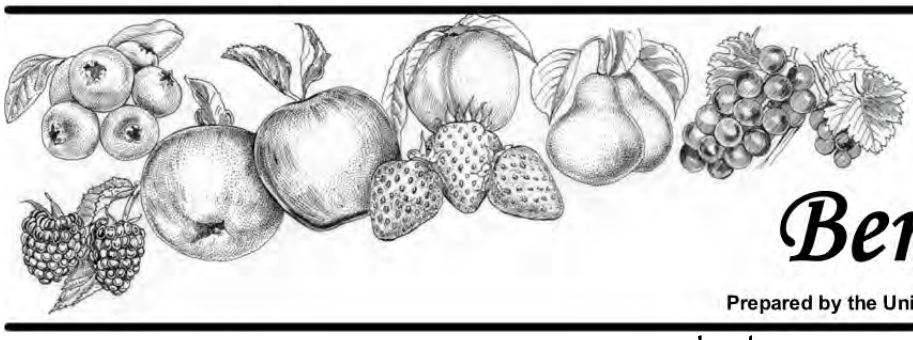

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Berry Notes

Prepared by the University of Massachusetts Fruit Team

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Volume 30, Number 6 - June, 2018

IN THIS ISSUE:

Crop Conditions:

Strawberries: Harvest is underway in June-bearing varieties across the state with good yields expected in most locations. Overwintered Day Neutral varieties and row-covered June-bearing varieties are also being harvested. Weather conditions have favored a lot of Gray Mold infection. Anthracnose fruit rot, leather rot, leaf spots and powdery mildew can also develop during this period. Tarnished Plant Bug pressure has been variable this season. There have been some reports of significant Strawberry Root Worm infestations and also Cyclamen Mites. Watch for potato leafhopper, two-spotted spider mite and root weevil through harvest. Intermittent rain through May has favored disease infections (gray mold, leaf spots), but hasn't been enough to supply needed water to plants. Irrigation (1"-2"/week) during fruit sizing and harvest is important. Drip irrigation is best for this. New plantings are in and keeping ahead of weeds is important as the beds become established. **Brambles**: Summer fruiting varieties in bloom and showing good fruit-set potential. Tarnished plant bug, cane borers, two-spotted spider mite, and potato leafhopper will be active this month. Cane and spur blights can begin to show symptoms this month. Also orange rust has been found in several locations. See more about orange rust in this issue. An open canopy with conditions for good air circulation and spray penetration is a good practice for managing disease. Primocane varieties are showing about 24 inches of new growth. Now is a good time to fertilize all brambles. **Blueberries**: Fruit set is looking exceptional in many locations. Some locations have suffered damage from Gypsy Moth. Cranberry fruitworm and blueberry maggot are likely to be showing up soon. Traps can help identify if and when these pests are present. Putnam scale has been reported in some plantings. See more on scale in this issue. Watch for symptoms of mummy berry, Botrytis blight, anthracnose, and powdery mildew this month. Bird netting and/or bird scare devices should be in place before fruit ripening begins. Keep fields irrigated during fruit sizing and ripening if rainfall isn't enough (1"-2"/week). Also, now is a good time for fertilizer applications. **Grapes**: Varieties of wine and table grapes range from pre-bloom to post bloom and early fruit set. This is a critical time for controlling phomopsis, powdery and downy mildew, black rot, grape berry moth. Shoot thinning should be done now and some varieties my also need shoot positioning and cluster thinning. As with brambles and blueberries, now is a good time to apply fertilizer to grapes.

ENVIRONMENTAL DATA

The following data was collected on or about May 30, 2018. Total accumulated growing degree days (GDD) represent the heating units above a 50° F baseline temperature collected via our instruments for the 2018 calendar year. This information is intended for use as a guide for monitoring the developmental stages of pests in your location and planning management strategies accordingly.

Region/Location	GDD		Soil Temp (°F at 4" depth)		Precipitation (in inches)
	1-week gain	*2018 Total*	*Sun*	*Shade*	*Since 3/1*
Cape Cod	89.5	285.5	68	62	0.28”
Southeast	74	310	74	62	0.30”
North Shore	115	444	61	57	0.11”
East	109	427	69	63	0.26”
Metro West	107.5	441.5	61	59	0.31”
Central	94	316	60	51	0.26”
Pioneer Valley	123	424	67	63	0.20”
Berkshires	191	385	69	62	0.09”
AVERAGE	113	379	66	60	0.23”
n/a = information not available					

(***Source**: UMass Landscape Message #10, June 1, 2018*)

STRAWBERRY

Causes of Strawberry Blossom Blights and Dried Berries

Kathy Demchak, Penn State

The warm wet weather the past couple of weeks together with high humidity is creating perfect conditions for a number of strawberry diseases.

Are your berries turning brown and drying up? Check to see that the pedicle is not damaged. Photo: Kathy Demchak, Penn State

Some growers are noticing that the later blossoms on their strawberries are failing to set fruit, and instead, are just turning brown and drying up.

This can be a little puzzling since the cause often is not obvious. Two things could be happening – one is that the flower itself was infected and colonized by a disease—often botrytis, which is usually fairly obvious once the gray fuzziness becomes apparent. However, a second cause is often that the pedicle (the little stem connected directly to the berry) or the tissue that connects the pedicle to the berry may have been damaged. When this happens, the flow of water and nutrients to the flower bud or developing fruit is stopped as the tissue collapses. The flower bud or tiny developing berry then simply dries up and turns brown. Anthracnose commonly causes this type of blight, especially in anthracnose-susceptible varieties.

So, how can one figure out what might be going on? It is beneficial to take a close look at other clues that are present in the planting and consider other factors such as timing, weather conditions, and variety. If symptoms showed up early while it was still cool and wet, then botrytis could be involved. If growing an anthracnose-susceptible variety, such as Chandler, perhaps anthracnose is the more likely issue. Are there other symptoms present, such as leaf spots, or lesions on runners or caps? Are there symptoms of angular leaf spot (clearing of tissue when holding leaves up to the light, or completely brown or black caps)? While more than one disease may be present at the same time, a severe case of any particular disease is likely to cause multiple symptoms on the same plant, including blossom blights and berries that fail to form. (***Source:** Penn State Fruit Times, June, 2018*)

Flower Thrips in Strawberries

Hannah Burrack and Aurora Teonnisson, NC State University

Biology

Flower thrips (*Frankliniella* spp.) are tiny insects that feed on strawberry leaves, flowers, pollen and fruit. In addition to strawberries, they feed on a variety of other cultivated plants and weeds. Some flower thrips feed on two-spotted spider mite eggs so low levels of flower thrips can be beneficial. To the naked eye, flower thrips look like elongated yellow or brown specks, about a millimeter long, that run rapidly when disturbed. Examination with a hand lens or microscope reveals the adult flower thrips to have two pairs of feathery wings.

Adult female thrips lay their eggs into the leaf of a host plant. The tiny (< 1mm) yellow or white larvae hatch 2-14 days later. Availability of pollen and warm temperatures greatly facilitate larval development which can be completed in as little as 3-5 days. Once mature, larvae spend a pre-pupal and pupal stage in the soil before returning to the plant to feed and reproduce as adults.

Western flower thrips (Frankliniella occidentalis), one of the species that may be found in strawberries.
P.M.J. Ramakers, Applied Plant Research, Bugwood.org

Damage in strawberry

Flower thrips' tiny mouthparts pierce and suck plant juices from the outer layer of plant tissue. This feeding does not seriously damage strawberry leaves, but thrips feeding can cause misshapen blossoms and bronzing of the fruit near the leaf cap. Such feeding damage is rare in North Carolina, and when it does occur, usually happens late in the season.

Bronzing and cracking of fruit surface from Thrips feeding. (photo courtesy of Nate Norse, Nourse Farms)

Thrips feeding has not been shown to impact fruit set, and thrips feeding does not cause deformed fruit.

Sampling and thresholds

Strawberry blossoms can be held over a piece of white paper and beat against it so that thrips fall onto the paper. Note that even adult thrips are very small, so a handlens may be useful for distinguishing them from other arthropods. Treatment thresholds for North Carolina have not been established, but work in California indicates the insecticide treatment should be considered only after populations exceed 10 thrips per blossom.

Management options

Conventional

Conventional foliar insecticides are available for control of flower thrips. Refer to the *North Carolina Agricultural Chemicals Manual* for materials recommended for use in North Carolina and the Southern Region Small Fruit Consortium *Strawberry IPM Guide* for regional recommendations.

Organic

OMRI approved foliar materials are available for control of flower thrips. Refer to the *North Carolina Agricultural Chemicals Manual* for materials recommended in North Carolina and the Southern Region Small Fruit Consortium *Strawberry IPM Guide* for regional recommendations.

Biological

Minute pirate bugs, such as the insidious flower bug (*Orius insidiosus*), feed readily on flower thrips. These insects occur naturally in North Carolina, and purchasing additional bugs for release is unlikely to be cost effective. Some predatory mites are available for release against thrips (*Amblyseius swirskii*), but these mites have not been widely tested in strawberries.

More Information

Western Flower Thrips - UC IPM Online
Flower Thrips in Ornamentals - NCSU Dept. of Entomology Insect Notes
North Carolina Agricultural Chemicals Manual
Strawberry IPM Guide - Southern Region Small Fruit Consortium

(***Source**: NC State Strawberry Factsheet Series, May 2014*)

Slug Damage to Strawberries

Emily Hoover, University of Minnesota

Identification

Slugs have fleshy slimy legless bodies that are predominantly different shades of gray. Slugs are basically snails with a reduced shell located internally. Their head contains two pairs of feelers; a larger pair above carries the eyes and a lower pair below is used for smelling. Most slugs in strawberries range in length from 1/4" to 1 1/2".

Typical slug.
Photo: Jeff Hahn, University of Minnesota

Important biology

Slugs have a layer of slime to protect their skin from desiccation. As they move, they leave a slime trail which can be used to identify their presence. They prefer moist habitats and locations where they can escape the sun. They feed at night or on dark, overcast days. Slugs lay their translucent eggs under plant debris or in the soil, where the moist conditions provide for optimum development of eggs and young. Continuous straw mulch in a strawberry patch provides such an ideal habitat. Slugs seek out straw mulch and other types of mulch to lay their eggs in the fall and these eggs will hatch in the following spring with the slugs feeding on strawberries in the spring and early summer.

Evidence of slug activity comes in two forms, slug movement and slug feeding. Slugs continually produce slime on which they move and it is a dried slime trail that indicates their travel the previous night.

Slugs have an anatomical structure called the radula which contains small teeth made of chitin. The radula is a rasping organ which scrapes or cuts food before being ingested, and it is the structure that damages the strawberry fruit.

Damage

Slug damage on strawberry.
Photo: Ontario Strawberry IPM, OMAFRA

Slugs create varying size holes in the strawberry fruit. The damage can vary from minor practically unnoticeable scraping on the surface of the fruit to significant cavities equal to half of the fruit. When present in large numbers significant damage can be done to the fruit.

Management

Monitoring

Slugs hiding under board.
Photo: Jack Kelly Clark, University of California

Slugs should be monitored during and after bloom. In the day look for slime trails in the patch or place wooden boards in the straw underneath which slugs will congregate. Pick up the boards to see monitor slug populations. Keep especially vigilant for slugs during extended periods of overcast and rainy weather. In the evening use a flashlight to check for slugs.

Cultural

Remove potential hiding places for slugs such as weeds vegetation and debris.

Water plants early in the morning to permit all day drying, which avoids creating a moist habitat ideal for slugs.

Place drip irrigation tape close to the plants and avoid creating wet mulch situations which are ideal habitats for slugs.

If you plant in rows keep the width of the rows narrow (12 to 18 in.) to allow quicker drying

Place traps, such as wooden boards and rolled-up newspapers in the patch. Check traps first thing in the morning every day and dispose of the slugs.

Create a slug trap by pouring beer into a shallow pan buried so that the edge is at ground level. Slugs are highly attracted to smells emitted from fermentation processes, and will fall into the pan and drown. Check and renew the trap every couple of days.

Pesticides
Baits need to be considered as a part of a cultural program and employed in conjunction with other methods. Baits alone will not effectively control slugs.

Baits need to be applied prior to the ripening of the berries because the slugs prefer ripe berries to slug bait.

The patch should be irrigated prior to placing the baits to create a situation that will encourage the slugs to be more active. Apply the bait in the late afternoon or evening close to the time when the slugs will begin activity. Sprinkle some bait in protected area where you think the slugs might be hiding such as areas close to walls or fences and in areas which you think the slugs might have to traverse to get to the patch.

Iron phosphate
Baits that contain iron phosphate don't kill as many slugs as those with metaldehyde, but seem to protect the crop well enough. Iron phosphate baits are cleared for organic production and are safe around children and pets. Baits break down after rains or irrigation. Iron phosphate kills more slowly than metaldehyde and the slugs will seek a hiding place and die there. You may not see slug casualties when you use iron sulfate.

(***Source**: adapted from Univ. of MN Pest Mgt for the Home Strawberry Patch*)

RASPBERRIES/BLACKBERRIES

Orange Rust on Brambles – an ongoing saga

Cassandra Swett, University of Maryland

We all get a little rusty as we get older, but one thing that we don't want to see getting rusty is our brambles. There are several rust diseases that affect brambles. I'm just going to focus on orange rust, which is the most important rust disease in the northeast. We are definitely seeing a bit of orange rust this year, with the cool wet springs. You'll see this disease on blackberries, black raspberries and purple raspberries. Orange rust does not affect red raspberries.

This is an unusual fungus—it grows systemically throughout the whole plant. So once a plant is infected, it will stay infected the rest of its life, and be a persistent source of inoculum for other plants. Over time, orange rust stunts and weakens plants so they will not bear fruit, but plants do not typically die. All in all, not a disease you want in your bramble field.

Orange rust stunting black raspberry plant. Note the "spindly" elongated shoots. Photo credit: Mike Ellis

Orange rust is caused by two species:

1. *Arthuriomyces peckianus*, which is more common in the northeastern US.
2. *Gymnoconia nitens*, which is more common in southern states and primarily effects blackberry.

When To Control Orange Rust:
Life Cycle
Infection by orange rust occurs when:

- it's persistently wet (for more than 12 hrs in a day)
- and between 43° F and 72° F.

The fungus cannot infect if it's hot for most of the day or if it's very dry. Above 85°F the fungus cannot infect at all.

The life cycle of orange rust is much more complex than your typical fungal pathogen, so I'm just going to boil it down to the simple take homes:

- **First:** In a new field, orange rust can come in on infected plants, or can spread from nearby brambles—either other fields or wild brambles.
- **Second:** Rust overwinters on infected leaves on the soil surface and on old canes, so if rust gets established your field, it will likely persist at low levels through the life of the planting.
- **Third:** There are two periods of infection that are important to control:
  - about 3-4 weeks in the spring, around the time of shoot emergence, after the last frost.
  - about 3-6 weeks in the fall, from the time when primocane growth slows until first frost.

Understand that these are estimates—what really determines infection is the weather—again, persistently wet and between 43°F and 72°F.

- **Fourth:** It is important to protect both leaves and emerging shoots / buds. The time of year and history of the field can inform you about whether you need to protect leaves, buds or both.

In the spring
Protect against leaf infections if you are detecting rust for the first time; if you have a history of rust in your field, also protect against emerging shoot / bud infections.

In the fall
Protect only against emerging shoot / bud infections. This has to do with the type(s) of spore present in your field:

- If you **Have Not** had rust in your field in recent years, you should not have the overwintering spores, which infect buds. You should only have spring spores, which only infect leaves.
- If you **Have** had rust in your field in recent years, then you probably **Do Have** overwintering spores, which infect buds.

Control Methods

Scout and remove infected plants in the spring

Once a plant is infected, it must be removed. Otherwise it will continue to provide inoculum, allowing spread to other plants. It does not do much good to keep it, because after a couple of years the plant will stop yielding.

Spring is a critical time to scout for and remove orange rust-infected plants in the field, because this is the only time you will see the bright orange spores. Scout early, as soon as new shoots start are emerging, after the last frost. Be particularly diligent when it's a wet spring—this year is a great example. The disease is easily identified as orange pustules on the underside of young leaves. You will not be able to detect orange rust after sporulation ends (early to June, onwards).

Scout for orange pustules on the underside of young leaves, early in the spring. Photo credit: Mark Bolda

Chemical control
Chemical control is an important compliment to removal. Once you remove all infected plants, you will want to spray to prevent the spores from infecting new plants.

When to spray
Weather can be a good indication that you need to spray—it has to be wet and between 43°F and 73°F to get infection. It is typically too cold between November and March and too hot between June and mid-August. In our region, the critical control periods for chemical protection are:

- About 3-4 weeks in the spring, around the time of shoot emergence, after the last frost.
- About 3-6 weeks in the fall, from the time when primocane growth slows until first frost.

Spring protection
Apply fungicides upon first discovery of the blisters, preferably before they burst open and release spores.

If the field has a history of the disease, sprays should be initiated before blisters appear.

Direct this application to the foliage, since you are preventing leaf infections.

If you have had rust in previous years, **Also** do a spray directed to the base of the cane, to protect the developing buds from getting infected by overwintering spores.

Fall protection
Apply fungicides if you detected rust in the field in the spring. Direct towards the base of the cane, to protect the developing buds (both floricane and primocane); for floricane varieties—also spray the primocane shoots, to protect the buds on next year's floricane.

What to spray
- Rally (formerly called Nova) (myclobutanil)
- Pristine 38 WG (pyraclostrobin + boscalid)
- Cabrio 20EG (pyraclostrobin).

Fungicide recommendations for orange rust control, from the **2016 Midwest Fruit Pest Management Guide, developed by the Midwest Fruit Workers Group.** The page numbers refer to the Management Guide—a link to the guide is provided here and in Resources below, if you would like to get more information.

See Raspberry Leaf Spot and Septoria Leaf Spot of Blackberry and Raspberry—page 115.

Material	Rate/Acre	Comments
Rally 40WSP (Rally was formerly called Nova)	2.5 oz.	For late leaf rust and powdery mildew, begin applications when disease first appears and repeat on a 10 to 14 day schedule. See Cabrio, Pristine, and Rally for Control of Orange Rust, page 114.
Cabrio 20EG	14 oz.	See notes on Abound, Cabrio, and Pristine, pages 114 - 115.
Abound	6.2 - 15.4 fl.oz.	
Pristine 38WG	18.5 - 23 oz.	See Pristine 38WG (page 115) about Pristing mixing instructions.
Quilt Xcel	14 - 21 fl.oz.	30 day PHI
Tilt	6 fl.oz.	

When to spray

Apply on a 10-14 day schedule--use the shorter interval in wet weather. Alternate Rally with Pristine and Cabrio to prevent fungicide resistance. Do not apply more than two sprays without alternating. An example of a 14 day-interval program for northern MD, would be:

In the spring—Starting after the last frost, at shoot emergence:

- April 10: Rally 40WSP (Nova)
- April 24: Cabrio 20EG
- May 8: Rally 40WSP

In the fall—When primocane growth slows, until the first frost:

- September 20: Rally 40WSP
- October 4: Pristine 38WG
- October 18: Rally 40WSP
- November 1: Cabrio 20EG

Note that with high disease pressure, you would want to spray on a 10 day interval over these same time periods.

Some notes on these fungicides

- Rally may have a bit better curative activity than the others because of its greater systemicity, which would make it the material of choice during or after a rainy period with inoculum already present. Do not apply more than 1.5 lbs (24 oz.) of Rally per year (label restriction)
- Since Pristine has two active ingredients, it has the broadest spectrum of activity.
- Avoid applying strobilurins (Cabrio or Pristine) more than three times each season, to prevent resistance development.
- While Abound (azoxystrobin) is labeled for use on brambles, it does not have orange rust (or any other rust for that matter) on the label.

Resistant cultivars

Red raspberries are all resistant. If you have persistent orange rust problems, this may be a good option.

Blackberry varieties reported to be resistant include: Choctaw, Commanche, Cherokee, Cheyenne

Susceptible blackberry cultivars include: Navaho, Ouachita, Chickasaw, Chester, Triple Crown. All black and purple raspberries are susceptible

Note: Triple crown is reported as resistant in Kentucky trials, but it appears to be susceptible in our region.

Site selection

Avoid planting near woodlots or riparian corridors that have wild brambles.

Clean planting material

Getting plant material from a clean source is critical to preventing establishment of orange rust in your field.

Resources

For additional information on orange rust and other bramble diseases:

- *Orange Rust on Brambles*, by Mike Ellis. Ohioline.
- *Midwest Fruit Pest Management Guide 2016* Produced by the Midwest Fruit Workers Group, out of Purdue University. Fungicide recommendations for bramble disease control.
- *Midwest Small Fruit Pest Management Handbook* Produced by Richard C. Funt, Michael A. Ellis, Celeste Welty, out of The Ohio State University. Comprehensive information on orange rust biology and cultural control.
- *Mid-Atlantic Berry Guide* Produced out of Penn State.
- Swett Lab: Berry Pathology

(***Source**: Penn State Fruit Times, July 1, 2016*)

Potato Leafhopper in Brambles

Sonia Schloemann, UMass Extension

ID/Life Cycle: Leafhoppers are small, green, bullet-shaped insects which take flight quickly if disturbed. The nymphs are lighter colored and do not fly. They are easily identified by their habit of moving sideways when disturbed. Potato leafhoppers don't overwinter in New England but are blown up every year from the south on storm fronts. There are multiple generations every year.

Damage: The potato leafhopper feeds on the underside of leaves leaving small chlorotic areas and causing a downward cupping of the leaves. Most feeding is the upper, more succulent leaves on primocanes and often causes a stunting of those canes.

Management:

Monitoring: Scouting is especially important in new raspberry/blackberry plantings and on primocane fruiting varieties. Scout by brushing the leaves with the hand and looking for small adult leafhoppers flying off. Examine the underside of injured leaves to see if nymphs are present. There are no thresholds established for potato leafhoppers. Consider control if there are one or two nymphs per leaf and leaf curl is evident.

Control strategies:

See New England Small Fruit Management Guide **for more information on recommended materials and rates**

Cultural/Biological: Follow recommended practices in table below.

Chemical:

- Apply recommended insecticides when large populations of nymphs are noted on the leaves or symptoms become apparent.
- If repeat applications are needed, rotate insecticides from different IRAC groups to reduce the chance of resistance development in the pest.

Conventional(PHI)	Organic OMRI listed (PHI)	Cultural Practices
Assail 30SG (1) Actara 25WDG (3) Admire Pro (3) Malathion 57EC (1) Malathion 8F (1) Sevin XLR Plus (7)	Aza-Direct (0) AzaGuard (0) Neemix (0) Safer Brand #567 (0)	Avoid proximity to alfalfa plantings, which provide a major source of potato leafhopper population build-up.

-- Read labels thoroughly for application rates and restrictions

BLUEBERRIES

Fruitworm Flight Activity Started, Egglaying Predicted in Earliest Blueberry Sites

Rufus Isaacs, Michigan State University

Monitoring and degree-day models can inform spray timings.

As petal fall starts in blueberries and fruit starts sizing, the new berries can be infested by two fruitworm species—cherry and cranberry fruitworm. Within the past 10 days, sites in southwest Michigan have reported the biofix for cherry fruitworm moths, which is usually flying a week or more before cranberry fruitworm. Over the Memorial Day weekend, the first reports of cranberry fruitworm moth activity was reported from Grand Junction, Bloomingdale and from our monitoring traps at the Trevor Nichols Research Center in Fennville, Michigan. Grand Junction is usually much more advanced in development than sites closer to Lake Michigan or further north. With the current high temperatures and warm nights, we expect that fruitworm activity will progress rapidly.

There are two degree-day models for these pests online at Michigan State University Enviroweather. For Grand

Junction, assuming the cranberry fruitworm moths were trapped on Friday evening, May 25, the model is predicting egglaying to start yesterday. With further good weather today and tonight, growers with a history of fruitworm challenges in their blueberry fields should protect their fruit using one of the options registered for use during bloom, as we described in "Fruitworm control in blueberries" from MSU Extension, published May 15, 2018.

One of the most effective options for this timing and these pests is Intrepid 2F, which can be applied at 12 ounces per acre with a spreader sticker to improve coverage and also reduce the loss during the upcoming rainfall. Intrepid is relatively rainfast, so we expect this application to retain activity unless there is very intense rain after the application. New fruit that develop in the coming weeks from current flowers will not be protected (this is not a systemic insecticide), so high pressure fruitworm sites may require additional treatment before full petal fall when there are more insecticide options for fruitworm control. (***Source**: Michigan State Univ. Fruit Crop Alerts, May 29, 2018*)

Checking Blueberry Fields for Scale Infestation

***Rufus Isaacs**, Michigan State University*

A few isolated cases of scale infestation have been reported in the past few weeks in west Michigan, and this would be a good time to be checking blueberry fields during regular scouting to see whether scale is present in your farm. These are small insects that survive on older woody canes through winter, grow in spring usually under protective covers, and then start egglaying in spring and summer followed by those eggs hatching into a crawler stage that spread throughout the plant looking for new places to settle and feed.

These scale insects are covered with a white covering that is evident on this mature blueberry cane.

Scales have piercing mouthparts they use to suck sap from the plant, and the honeydew they produce can be tended by ants, so looking for ants crawling up and down the canes is another approach for detecting these scales. Blueberries are most often susceptible to Putnam scale, Lecanium scale or Terrapin scale, but the current specimens seem to be Azalea bark scale based on our preliminary identifications.

Isolated detections of scale in blueberry fields have been reported in west Michigan. Now is a good time to check fields during scouting for scale.

If scales are detected, the best option for control is to identify the timing of the crawlers emerging from under the protected waxy covering. This can be done using double-sided tape checked each week, and this can identify when an in-season scale control product could be used.

Other strategies that are important for preventing outbreaks of scale in the first place include regular pruning of old canes, a dormant oil application in the early spring and protecting scale-parasitizing wasps through careful selection of insecticides.

Please send reports of scale to your local [State University Extension fruit educator], and if you have specimens that need identification, remove an infested piece of stem and send to [UMass Diagnostic Services].

A close-up image shows multiple scales clustered in a depression on a blueberry cane. Removal of the white covering from two scales in the bottom left of the image reveals the dark purple female scale and the numerous pink eggs.

(***Source**: Michigan Fruit Crop Advisory June 7, 2016*)

Shoot Blight In Michigan Blueberries

Timothy Miles and Mark Longstroth, Michigan State Univ.

Photo 1. *An advanced example of blossom blight transitioning to shoot blight where the infection has moved to the stem and causing dieback.*

Twig blights in blueberries:

Weather conditions have been wet in Michigan and blighted twigs have been found in blueberries (Photo 1). Tip dieback and blighted blossom clusters are the first symptoms growers and scouts find of shoot blights. Various fungi such as anthracnose (*Colletotrichum acutatum*), phomopsis (*Phomopsis vaccinii*), botrytis (*Botrytis cinerea*) and bacteria canker (*Pseudomonas syringae*) can cause twig blight. Anthracnose (*Colletotrichum*) is often to blame for twig infections during wet seasons. *Colletotrichum* infections can be observed by allowing diseased shoots to produce orange spore masses in a plastic bag. Samples can also be submitted to Michigan State University Diagnostic Services for a positive identification.

Scouting for twig blights

To scout for blighted twigs, follow these instructions:

- Pick 10 random bushes throughout your field (include both border bushes and internal ones).
- Count the number of recent brown or dead young twigs/flower clusters.
- If your count is higher than 10 blighted blossoms/twigs per bush (a moderately high incidence), consider applying a fungicide, especially if rain is in the forecast. Note that twigs that are in bloom are the most susceptible to infection.

A wet spring may result in more shoot and twig blight. What can you do?

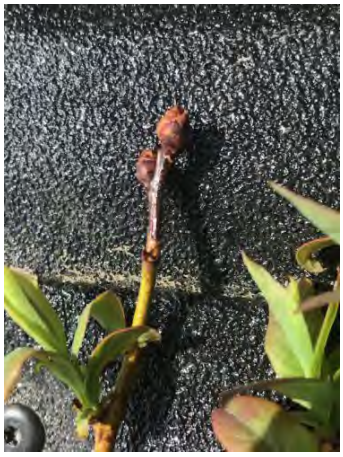


Photo 2. *Tip blight observed in Bluecrop in May 2018. Photo by Bill Foster, CPS.*

Control methods for twig blights

Chemical options:

Controls are the most effective if they are applied prior to twig blight infections. A twig blight sample this spring was positively identified by MSU Diagnostic Services as bacterial canker. There are no fungicides that control bacteria and no antibiotics are registered in blueberries. Copper is commonly used to control bacterial diseases. The timing window for using copper is early in the season soon after bud break and during early shoot growth before bloom.

Bacterial canker is a disease that is favored by cool, wet conditions. Our weather has changed from cool and wet to warm and wet so that our blueberries are growing faster than the bacteria. Any copper spray now would be a useless revenge spray, which would do little good and might mark the green fruit or damage the remaining flowers. If you are concerned about bacterial canker, target it early next spring, not after bloom.

Research on phomopsis twig blight has shown the most infections occur at bud break. Fungicides should be applied to protect the buds at bud break. Many fungicides have good activity against mummy berry and phomopsis.

Colletotrichum infections require warm and wet conditions. They can occur before, during and after bloom (Photo 3). Fungicide applications should target these infections. There is an anthracnose prediction model on MSU Enviroweather.

As we transition from pre-bloom to post-bloom disease control, careful choice of fungicides to control the disease is important. Several fungicides are rated good to excellent at controlling the various fungi that cause twig blight. MSU Extension annually updates E154, "2018

Fruit Management Guide". This resource has good information about fungicide choices based on disease and fungicide effectiveness.

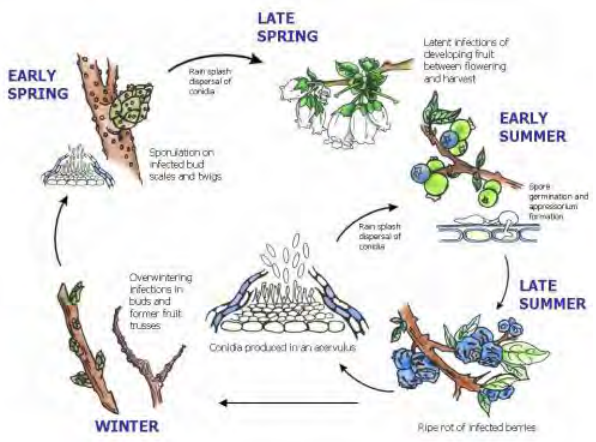


Photo 3. *Life cycle of* Colletotrichum acutatum *(causal agent of anthracnose fruit rot) in blueberries. Source: MSU Extension Bulletin E-3039, illustration by Jennifer Pagan.*

Other control methods

In addition to chemical options, there are several cultural control strategies you can deploy. For example:

- When plants are dormant:
  - Prune out infected canes.
  - Avoid wounding the canes.
- Reduce the spread of spores and infection:
  - Minimize overhead irrigation.
  - Time irrigation to coincide with natural dew formation.

(***Source****: Michigan State Univ. Fruit Crop Alerts, May 29, 2018*)

GRAPE

Expanding the Use of Under-Vine Cover Crops in New York Vineyards – Part I

Alice Wise and Hans Walter-Peterson, Cornell University

Key Concepts

• Growers are interested in alternative under-vine management techniques as part of a movement toward environmental stewardship.

• Under-vine covers crops are an alternative to the use of herbicides or repeated cultivation.

• Researchers and growers have experimented with seeded annual and perennial species under vines.

• Some under-vine cover crops, including chicory and fescue species, can reduce vine size and are therefore best suited to vineyard blocks with excessive vigor. Other cover crops such as buckwheat appear to have little to no impact on vine size.

• Impacts on cluster architecture and fruit quality did not manifest as expected in studies on Long Island.

• Application of cover crops under the vines can be accomplished mechanically using equipment that growers may either already possess or that can be purchased and modified relatively inexpensively.

The production of premium wine grapes requires continual fine-tuning of management strategies to adapt to changing weather and pest pressure. Increasingly, growers are favoring sustainable practices with the goal of reducing pesticide and fertilizer inputs. For example, the practice of maintaining herbicide strips under vines has recently been re-evaluated. Both growers and researchers have experimented with under vine cover crops as an alternative floor management technique. Studies with annual and perennial species of cover crops have found them to have varying degrees of impact on vine growth and productivity and improvement of soil health indicators. However, expected fruit quality benefits have not manifested in some of these studies. Two methods of sowing cover crop seeds under the vine row have been evaluated in the Finger Lakes and were found to have potential for use in commercial vineyards. For growers interested in an alternative to herbicides, under-vine cover crops may be an option.

Under-vine cover crops are being tested by growers and researchers as an alternative to weed-free strips maintained with herbicides or tillage. Shown here are weed-free under-row maintained with glyphosate (L), fescue (M) and chicory (R).

Photos courtesey of Justine Vanden Heuvel

Part 1: Under-Vine Cover Crops in Long Island Viticulture

Why use green cover under the trellis? Prior to the late 1950's, New York vineyards were mechanically cultivated. Row middles were disked and grape hoes were used to 'hill up and take away' soil for weed control

several times during the growing season. However, this was detrimental to soil organic matter as well as vine trunks and roots (11) and led to significant soil erosion. By 1964, over 75% of vineyards used herbicides, which were considered relatively effective and economical (10).

As grower diversified into wine grapes, a weed free strip under the trellis maintained with pre and post-emergence herbicides remained standard practice. Recently, cover crops have received more attention for their proven ability to reduce leaching of nitrates and pesticides compared to bare ground (4, 7, 8). This is particularly important on Long Island, where underground aquifers are the sole source of drinking water (5).

Selected cover crop studies in the eastern US. Row-middle cover crops are often used to improve soil structure, biodiversity, and nutrition as demonstrated by a NYFVI project in western New York(1). Experimentation with under-vine cover crops has been more recent.

In Virginia, perennial covers reduced vine vigor, which decreased canopy management costs and improved fruit quality (2, 16, 17). In the Finger Lakes, annual species such as buckwheat and annual ryegrass were evaluated for their impacts on yield, fruit quality and leaching of nitrates and pesticides (3).

In many regions of upstate NY, annual species are preferable because vines are hilled up for the winter. However, on Long Island, where hilling up is not practiced, trials have been conducted with perennial clover and fescue species. Based on collective results from these studies, we offer the following observations on under vine cover crops.

Are cover crops appropriate for newly planted and/or young vines? The first few years in the life of a vine are important for development of an extensive root system and above ground framework (training system) that will sustain the vine for years. Cover crops present too much competition for young vines, particularly in sandy and/or shallow soils. It is advisable to maintain a weed free zone around vines with herbicides and/or hand hoeing for at least 3-4 years, longer if vines are not filling their allotted trellis area.

Figure 1. Under-vine fescue. Photo by Alice Wise

Cover crop species. Unfortunately, few perennial species can thrive in the shady under-vine region. Based on suggestions from cover crop experts, on Long Island we experimented with clover and fescue. Dutch white clover (*Trifolium repens*) seeded @ 10 lbs/acre and red clover (*Triofolium pretense*) have been evaluated in trials. White clover grew to about 12", while red clover grew taller and interfered with the cluster zone. Subterranean clover (*Trifolium subterraneum*) is a low growing winter annual clover that dies back during summer and re-seeds itself (6). In past experiments on Long Island, poor establishment and winter kill occurred. With good preparation and a suitable location, sub-clover is worthy of another trial, particularly since there are new cultivars available. It reportedly has very good weed suppression.

We focused on low growing fescue species to minimize interference with the cluster zone of midwire cordon, VSP-trained vines. A local company sells a no-mow fescue mix comprised of 5 Festuca species, though the specific species and varieties vary from year to year. Seeded at @ 220 lbs/acre, this mix established well in one trial and poorly in another, likely due to a high percentage of weed seed. In one trial, we seeded single species of fescue, including chewing, hard fescue and creeping red fescue, all of which established well.

Annual species are more appropriate when hilling up soil around the base of vines is necessary for winter protection. Cornell associate professor Justine Vanden Heuvel and colleagues have experimented with annual covers in the Finger Lakes including buckwheat (*Fagopyrum esculentum*), tillage radish (*Raphanus sativus*), annual ryegrass (*Lolium multiflorum*), and chicory (*Cichorium intybus*) (3). Results from these studies indicate that different cover crops can have varying impacts on vine pruning weights (Table 1), but little to no impact on fruit composition (Brix, pH, TA).

Table 1. Impacts of different under-vine cover crops on vine pruning weight (Vanden Heuvel 2017)

Little to no impact	Moderate impact	Significant impact
Buckwheat	Tillage Radish	Chicory
Rosette-forming turnip	Alfalfa	Annual ryegrass
	Fescue	

**depending on weed composition*

Candidate blocks for under-vine covers. No-mow fescue is most appropriate for vigorous varieties and/or heavier soils, as it decreases vine pruning weights and nitrogen levels (14, 15, 16, 17). Clover may release nitrogen (N) and therefore is best suited for blocks on sandier soils or with smaller vines. In one Long Island vineyard, clover delayed ripening of Syrah compared to fruit from rows maintained with herbicide (15).

Seeding strategies. Seed in April or early May to ensure plots receive water via rainfall and have adequate time

to germinate and grow before warm, dry summer weather sets in. Small areas can be hand seeded, but larger areas require the use of a hand crank or push spreader. After seeding, scratch in the seed with hoes, or tamp/roll the plots gently to ensure good contact with soil. This is particularly important for feathery light fescue seed. Part 2 discusses mechanical methods for seeding that are relevant for commercial operations.

Figure 2. Under-vine dutch white clover. Photo by Alice Wise

Management. With proper site preparation and seeding, clover establishes well the first season. Escape weeds will infiltrate in the second season. By year three, plots will be primarily weeds. Consequently, periodic re-seeding is required to maintain a stand of clover.

The fescues are slow to germinate and growth is slow in year one. Control of escape weeds may be necessary via careful hand weeding or weed whacking. However, in year two, fescue plots fill in nicely. By year three, fescue becomes very dense. The cultivars in our trials grew to ~ 12" before flopping over.

Dandelion, plantain, and other perennial species ready in filtrate cover crops stands, as does crabgrass. Taller weeds such as horseweed can interfere with the cluster zone on VSP-trained vines. Weed whacking or under-vine mowing can be used to trim weeds, which is usually necessary once or twice a season. For established plots, spring mowing will remove tall weeds and weed skeletons. Mowing can be accomplished with a dedicated under-vine mower or a combination of row middle mowing (2 passes/row, mowing close to vines) and weed whacking.

Figure 3. Under-vine mower Photos by Alice Wise

Impact on vine water status. Under-row cover crops may reduce water availability to vines — especially in sandy soils. In 2016-17, we measured vine water status (stem water potential) with a pressure chamber in three commercial vineyards (14).

In one experiment, a high water table at the site mitigated drought stress. In two others, supplemental irrigation was applied prior to the onset of significant drought stress.

In 2017, we installed shut-off valves in irrigation lines to withhold irrigation. However, periodic rainfall fell throughout the summer, so no significant water stress was observed. Though in 2016 drought stress symptoms appeared in fescue plots, we have not yet been able to quantify drought stress with pressure chamber readings.

Vine nutrition. Fescue has consistently reduced vine nitrogen levels and occasionally potassium levels compared to vines maintained with glyphosate (14, 15).

Careful monitoring is required to ensure vines have adequate nutrition. Clover, on the other hand, is a legume that provides nitrogen when incorporated. In one Long Island trial, clover died back during a summer drought triggering a release of nitrogen, evident visually and in lysimeter water samples (15). The unpredictable release of nitrogen from cover crops could be an advantage or a disadvantage.

Vine and fruit impacts. Small increases in fruit quality can translate to large increases in bottle price (9). Excessive vine vigor can lead to unripe flavors and aromas, particularly in reds (12, 13).

Our studies verified that fescue consistently reduces vine pruning weights. In a 2017 trial with Merlot, vine pruning weight, shoot number and cane weight were significantly lower in fescue plots compared to herbicide plots (14).

Judicious irrigation and/or nitrogen can be used to boost vigor if necessary. As for clusters, fescue sometimes reduced berry set but rarely affected other cluster characteristics. In 2017, berries per cluster were significantly lower in fescue vs herbicide plots. This would be an advantage for a compact, rot susceptible cultivar. However, through 5 years of trials in various vineyards, cover crops have not affected berry weights.

Fruit composition tests, including Brix, titratable acidity, pH and methoxypyrazine concentrations (a flavor compound prominent in unripe red fruit) have consistently shown no differences between cover crops and herbicides. Clover provided little or no benefit to fruit quality and quantity with one exception — clover significantly delayed ripening of Syrah compared to adjacent herbicide plots (15).

Cost. It is difficult to define an absolute cost for under vine cover crops because there are so many variables (14). Site preparation is an additional cost incurred with their establishment.

Clover seed is cheaper than fescue seed largely due to the seeding rate (10-20 lbs/acre for clover vs. 200+ lbs/acre for fescue). However, clover requires periodic re-

seeding, thus long-term seed costs are roughly equivalent.

Additional irrigation and nitrogen fertilizer may occasionally be required to offset competition from green covers. On the other hand, savings will be realized through elimination of herbicide sprays. Labor costs of traditional herbicide strips compared to green covers are hard to gauge and depend on the number of herbicide vs. mowing passes required to reasonably maintain the under vine area and the type of equipment used.

Summary. The use of under vine cover crops is most attractive to growers interested in alternative under-vine management and/or in blocks with excess vine vigor. Cover crops require planning, time, effort, and monitoring. This strategy is easy to implement and manage on a small scale. Growers with a large acreage and/or multiple properties may find it more difficult to adopt under vine covers due to the need for occasional maintenance.

Other Considerations

• **Water** – for well-drained soils, particularly on Long Island, it is advisable to have drip irrigation in blocks with seeded covers to avoid vine drought stress, especially if the water table at a given site is relatively low.

• **Rodents** – In some fescue plantings, rodent tunnels have been evident. One grower noted chewing damage on trunks. Mowing may discourage this.

• **Frost** – Green covers should be managed to minimize the risk of spring frost to the vines. In spring, mow to <2" to allow sunlight to warm soil. Tall covers may also block the drainage of cold air.

• **Under-vine mowing** – Depending on your choice of cover crop, height of the fruiting zone, and weed pressure, it may be necessary to mow under the vines. A handful of vineyards on Long Island practice this technique, including the Cornell research vineyard. ***(Source:*** *Appellation Cornell, Issue 33, May 2018)*

POLLINATOR CORNER

Some Simple Tips For Reducing Pesticide Risk To Pollinators

Rufus Isaacs and Julianna Wilson, Michigan State Univ.

With fruit crop bloom season kicking in, it's a good time to review these recommendations.

If the drive rows of your fruit crop contain flowering weeds, it is important to mow them off before applying plant protectants to protect pollinators. Photo: Emily Pochubay, MSUE

We are finally seeing some warm conditions this spring, so honey bee colonies are being brought back to Michigan by commercial beekeepers. We are also seeing wild bumble bees, mason bees, and digger bees starting to emerge from their overwintering. These are all welcome signs of spring, as are the reports of apricot bloom starting in southwestern Michigan.

With bloom season approaching for our fruit crops, we want to remind growers of the main tactics for reducing the risk of pesticides to bees. A lot more detail on this topic can be found in our free Michigan State University Extension publication E3245 "Minimizing pesticide risk to bees in fruit crops". This is a 16-page bulletin available from the MSU Extension bookstore. It contains a series of tables that show the relative risk of the common fruit crop insecticides and fungicides.

The bulletin goes into depth on these topics, but here are some of the basic ideas behind the recommendations for reducing pesticide risk to bees.

Use integrated pest management (IPM) to reduce the need for sprays. Disease models are available at the MSU Enviroweather website and extension recommendations highlight the periods of infection risk that require fungicide applications during bloom. This can potentially reduce the need for treatment during dry springs. Using traps, degree day models, and thresholds for insect pests can also reduce the need for insecticide sprays. Encourage biological control and increase the use of cultural controls where possible.

Avoid pesticide sprays during crop bloom. Diseases and insect pests require active management in commercial fruit production. But orchards and fields of many fruit crops also need bees for pollination, and weakened hives will not provide the same level of pollination as strong ones. So consider the effects on pollinators when selecting pesticides.

Apply pesticides after sunset or before sunrise, or when air temperature is below 50°F. This is one way to reduce direct exposure of pollinators to pesticides. It can be challenging on large farms or when spring weather provides a slim window of suitable conditions, but some beekeepers have reported improved colony health at farms that have adopted this practice.

Select the least toxic pesticides and formulations when possible. The MSUE Fruit Pest Management Guide (E154) provides information on relative risk to pollinators, natural enemies and predatory mites in some tables. This information is based mostly on toxicity to honey bees, and it can be a good way to compare among products. Also, see the tables in the E3245 mentioned above. When there are multiple formulations of the same product available, select the liquid or dissolvable formulations over dusts as those can be picked up with pollen by bees and taken back to the hive.

Reduce drift onto areas outside crop fields. Reducing drift is part of the state pesticide training, because it is critical for avoiding unintended effects on wildlife, water sources, etc. Bees will gather pollen and nectar from flowers outside crop fields, and the wild bees will also nest there, so it is important to keep the application where it was intended. Springtime sprayer calibration, targeted application, and nozzle selection to reduce fine droplets can all help keep sprays where they are intended.

Remove flowering weeds from crops. Access to a diversity of food sources is helpful for bee development, but if the drive rows in your fruit planting contain a carpet of blooming dandelions, clover or other bee-attractive flowers, plan to mow them before spraying to help reduce pesticide exposure – **not just during bloom, but through the entire growing season**.

Provide bee-friendly habitat away from crops. These can be trees, shrubs, wildflower plantings, or unsprayed flowering cover crops that bees like to visit. Wild bees also need places to nest and develop their offspring. A separate guide on this topic is online in another free bulletin available for free download at Establishing Wildflower Habitat to Support Pollinators of Michigan Fruit Crops.

Develop and implement a pollination contract with your beekeeper. Pollination contracts are often sealed with a handshake agreement. But a written agreement can clarify how many colonies will be delivered, where and when by the beekeeper and what the grower should do to alert the beekeeper if there are treatments being applied nearby. Example contracts are easily found online as a way to get started. (***Source**: Michigan State Univ. Pollinators & Pollination Blog, May 1, 2018*)

GENERAL INFO

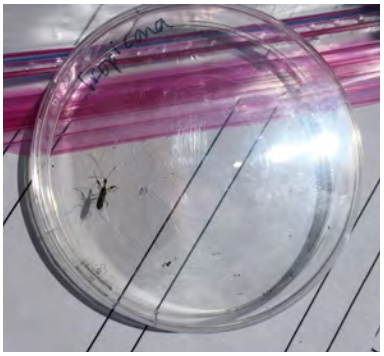
Some Recent Finds:

Cyclamen Mite damage to strawberry flowers

Blackberry Psyllid (note curling leaves)

Gooseberry Splitting

Grape Plume Moth Larvae



Long Necked Seed Bug (2018) & damage to strawberry (2017)

UPCOMING MEETINGS:

June 6, 2018 – *Maine Fruit Twilight Meeting*, Pineland Farm, 752 Mayall Rd., New Gloucester, ME. 5:00-7:00. 2 pesticide credits. For more information contact Pamela St. Peter at pamela.stpeter@maine.edu.

June 7, 2018 – *UNH Grower's Meeting on Plastic Mulch & Irrigation*. 3:00 – 7:00. Brookdale Fruit Farm, 38 Broad St., Hollis, NH. 4 pesticide Credits. For more information, contact George Hamilton at: george.hamilton@unh.edu or click here for event flyer.

June 13, 2018 – *UConn Extension Hands-on Small Fruit Scouting Primer*. 3:00pm (just before twilight meeting below). Bishops Orchard, 520 New England Rd, Guilford. Picture Guides and hand lens will be available. 2 pesticide credits.

June 13, 2018 - *The CT Pomological Society Annual Summer Twilight meeting*. 6:00pm. Bishops Orchard, 520 New England Rd, Guilford. 2 pesticide credits. Free but please RSVP for dinner planning purposes by emailing Michaele Williams at michaele.w@bishopsorchards.com.

June 14, 2018 – *RI Fruit Growers Association/UMass Fruit Team June Twilight Meeting* at 5:30. Barden's Family Orchard, 56 Elmdale Rd., North Scituate, RI. $20 for non-members of RI Fruit Growers Assoc. 2 pesticide credits. For more information contact Heather Faubert at hfaubert@uri.edu or Jon Clements at jon.clements@umass.edu

June 19, 2018 – *UMass Respirator Train the Trainer and Fit Test Workshop*, 1:30pm-3:40pm. Best Western, Marlborough, MA (181 Boston Post Road Route 20 West). Workshop fee is $30 per person. More info at: http://www.umass.edu/pested/training_workshops/2018_Respirator_Fit_Train_the_Trainer_Workshops.htm

June 20, 2018 – *New Hampshire Tree Fruit Meeting*, 5:30 – 7:30. Pine River Orchards, 314 Pine River Rd Effingham NH. At this location, we will be discussing business management practices for a small pick-your-own orchard while we tour Joe and Cindy Daigle's orchards. Pesticide credits pending. For more information, contact George Hamilton at: george.hamilton@unh.edu

June 25, 2018 - *UMass Extension Fruit & Vegetable Twilight Meeting*, 4:00 - 7:00. Kimball Fruit Farm, 184 Hollis St., Pepperell, MA. Topics Covered - Hydroponic Tomatoes, Sprayer Calibration for Fruits & Veggies, Spotted Wing Drosophila. 1.5 pesticide credits. For more information go to: http://ag.umass.edu/vegetable/events/fruit-vegetable-twilight-meeting.

July 10, 2018 – *Massachusetts Fruit Growers' Association/UMass Extension Fruit Program Summer Meeting*.

July 11, 2018 – *New Hampshire Tree Fruit Meeting*, 5:30 - 7:30. Alyson's Orchard, 615 Wentworth Rd., Walpole NH. Storing Honeycrisp Protocol will be presented by Jon Clement of UMass Cooperative Extension. Pesticide credits pending. For more information, contact George Hamilton at: george.hamilton@unh.edu

July 24, 2018 – Organic Weed Managemement Twilight Meeting. 4-7pm. Langwater Farm, 209 Washington St North Easton, MA. For more information and to register for this free event, go to: https://ag.umass.edu/vegetable/events/twilight-meeting-organic-weed-management.

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