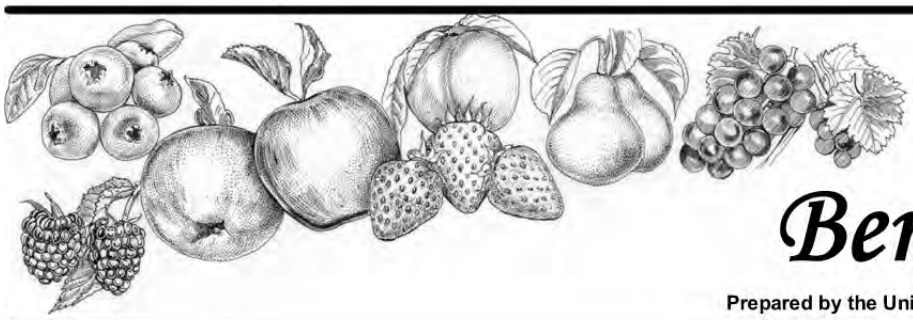

UMass Extension
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Berry Notes

Prepared by the University of Massachusetts Fruit Team

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Volume 30, Number 7 - July, 2018

IN THIS ISSUE:

Crop Conditions:

Strawberries: Harvest is complete in June-bearing varieties across the state with many reporting good yields and quality, some reporting poor size due to dry conditions. Day Neutral varieties have begun ripening fruit. Newly planted fields are sending runners that should be swept into rows prior to rooting. Potato leafhopper can be found in many new plantings (see IPM Berry Blast from June 27 for more on PLH). Strawberry bed renovation for fields being kept over for next year is the main activity now. Prompt renovation will be important for keeping SWD populations down this year. See more on this in the Strawberry section. **Brambles**: Summer fruiting varieties are being harvested now. Many are reporting very good fruit set and yield. Irrigation is needed to maintain good fruit size and quality in these dry conditions. Two-spotted spider mite, Japanese Beetle and potato leafhopper are active now and may need to be controlled. SWD are active now and growers should be following a comprehensive management plan (see June 27 Berry Blast or our SWD Info page for specifics). An open canopy with conditions for good air circulation and spray penetration is a good practice for managing SWD. Primocane varieties are reaching full height. This is a good time for tipping blackberries and black raspberries to encourage lateral growth rather than excessively long primocanes. **Blueberries**: Fruit is ripening a little ahead of normal and harvest may have begun in some areas. There have been reports of Cranberry Fruitworm infestations again this year. It is too late now to control this pest except by hand removing damaged clusters. Farms with noticeable damage this year should be ready for control during the green fruit stage next season. Japanese Beetle is showing up now and may require control prior to harvest starting in some varieties. Consult labels for pre-harvest intervals before spraying. Blueberry Maggot damage has also been reported and may be hard to distinguish from SWD damage; both cause the fruit to soften and rot. **Grapes**: All varieties are in green fruit stage now. See below and recent New England Grape Notes for post bloom disease management recommendations. Leaf pulling can be done now to open the fruit zone for light penetration and also to improve spray coverage. Waiting until veraison to leaf pull can result in sunscald on fruit. Watch for Grape Berry Moth in high risk vineyards.

ENVIRONMENTAL DATA

The following data was collected on or about June 27, 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	98.5	645.5	69	64	0.37"
Southeast	n/a	654	76	66	0.28"
North Shore	79.5	745	63	60	0.79"
East	101	855	67	64	0.39"
Metro West	97.5	762.5	62	60	2.98"
Central	97	697	62	55	2.11"
Pioneer Valley	106	851	72	54	0.61"
Berkshires	101	797	68	60	1.18"
AVERAGE	167	751	67	60	1.09"

n/a = information not available

Drought conditions update: According to July 3rd data shown on the map dated July 5, 2018 (accessed by using the link below), Massachusetts is experiencing level D0 - 'Abnormally Dry' - in all areas of the following counties: Berkshire, Franklin, Hampshire, Hampden, Worcester, Middlesex and Essex. The western half of Norfolk County is also rated D0. The northwestern fifth of Franklin County is D1 - 'Moderate Drought'. http://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?MA (link is external)

(***Source**: UMass Landscape Message #14, June 29, 2018*)

STRAWBERRY

Strawberry Bed Renovation Review

David Handley, UMaine Extension/Highmoor Farm

Bed renovation should begin as soon after harvest as possible. The earlier the beds get renovated, the more time runner plants have to develop, which means larger crowns and more flower buds for next year. Early renovation also improves weed management by tilling in many weeds before they go to seed, and can help with insect, mite and foliar disease control by interfering with life cycles at a critical stage of development. The first step in the bed renovation process is to determine which beds should be carried over for another year and which should be plowed down and put into a crop rotation. Beds that did not suffer much from winter injury, had good production and a good plant stand with no major weed, insect or disease problems should be carried over for another year. Beds that do not meet these criteria should be plowed down and seeded to a suitable cover crop to reduce weed, insect and disease problems that have developed, and to increase soil organic matter content. Ideally, beds that are plowed down should be rotated out of strawberries for at least three years. If properly managed, crop rotation will greatly reduce pest problems and improve the vigor and longevity of strawberry beds without the need for soil fumigation.

Renovating a strawberry bed is basically a thinning process to promote healthy new growth that can support a good crop next spring. While some parts of the following renovation scheme may be modified for individual situations, all beds should undergo the following steps once harvest is complete.

Broadleaf weed control: If perennial broadleaf weeds such as dandelion, shepherd's purse, daisy or goldenrod are a problem and/or a high population of annual broadleaf weeds such as lambsquarters, sorrel or pigweed are present, hand-pull as many as possible, especially within the plant rows, and/or apply 2,4-D amine (Formula 40®), or clopyralid (Spur®).

Leaf mowing: Four to five days following the 2,4-D application (or immediately if 2,4-D was not applied) mow off the leaves of the strawberries about 1 ½ inches above the crowns. ***If the planting is weak, it is recommended that this step of the renovation process be skipped***.

Mowing Strawberry Leaves, photo by David Handley

Fertilization: Apply 40 to 60 pounds of actual nitrogen per acre (use the higher rate on sandy soils and fields where growth has been weak). Phosphorus and potassium applications should be made according to soil test recommendations. Soil testing kits and information are available from your county Cooperative Extension office.

Plant thinning: For the single matted row system, strawberry plant rows should not be any wider than 24 inches. After mowing off the leaves, till the sides of the rows to narrow the beds back to a width of 12 to 18 inches. Use the wider setting for varieties that tend to throw few runners or any fields experiencing drought stress. Set the tiller so that it incorporates the mowed leaves and spreads about one inch of soil over the remaining crowns at the same time. This will reduce leaf disease and mite problems, and help stimulate new root growth on the remaining plants.

Pre-emergent weed control: To control annual weeds, apply terbacil (Sinbar® 80WP) according to label directions (2 to 6 oz. per acre). Be sure to follow all label precautions. ***To avoid plant injury, do not use terbacil if you do not intend to mow off the leaves***. Napropamide (Devrinol®) or DCPA (Dacthal®) may be used as an alternative to terbacil at this time, as described below. If you are not using herbicides, regular cultivation, before weeds are more than 2" tall, will be needed throughout the summer.

Strawberry Irrigation, photo by David Handley

Subsoiling: Soil compaction caused by tractor and picker traffic in the field can cause soil drainage problems and interfere with good root development. Using a subsoiling blade between the rows will break up compacted layers of soil and improve water infiltration. Subsoiling is best done late in the renovation sequence to prevent interference from straw and crop residues.

Irrigation: To encourage rapid plant growth and get the most out of fertilizers and herbicides, irrigate the beds regularly. Strawberries will grow best if they receive 1 ½ inches of water per week during the growing season.

Don't forget your plants once these renovation steps are completed. Check the strawberry fields regularly during the summer for pest problems. Finding and managing problems early can prevent major problems next spring. Pay close attention to the following items.

NUTRITION

Following the application of 40 to 60 pounds of actual nitrogen at renovation, another 20 pounds of nitrogen should be applied in mid- to late-August to stimulate flower bud development. One way to determine the nutrient status of strawberry plants during the summer is to have a leaf tissue analysis done. Tissue analysis offers a view of what is happening within the plant, and can spot any nutrient deficiencies. In combination with regular soil tests, tissue analysis will provide a complete picture of a field's fertilizer needs. For more information about tissue analysis contact the Analytical Lab and Maine Soil Testing Service, 5722 Deering Hall, Rm. 407, University of Maine, Orono, Maine 04469-5722, telephone: 207.581.2945.

(***Source***: *UMaine Strawberry IPM News No 6, July 9, 2018*)

Strawberry Root Weevil and Black Vine Weevil

Christelle Guédot, University of Wisconsin Extension

Common Names: Strawberry root weevil & black vine weevil
Order: Coleoptera
Family: Curculionidae
Scientific Name: *Otiorhynchus ovatus* & *O. sulcatus*

Strawberry root weevil (SRW; Fig 1) and black vine weevil (BVW; Fig 2) can be found in strawberry in Wisconsin. SRW adults are 1/5" long, shiny black to light brown with rows of small pits along their back, and a prominent blunt snout (Fig 1). BVW adults are larger than SRW, a little less than ½" long, dull black with yellow small flecks on the back (Fig 2).

Larvae of both weevils are quite similar: they are C-shaped cream-colored legless grubs with a brown head, about 12 mm long. BVW is native to Europe and was first introduced to the US in the early 1900s. In both species, the adults cannot fly; they walk or get carried on plant material or equipment from one location to another. Adults feed at night and remain in the soil or leaf litter at the base of the plant during the day and climb up to feed on leaves at night. BVW adults are polyphagous and feed on over 150 plants.

Another insect feeding on roots is the strawberry rootworm, which was discussed last summer in Wisconsin Fruit News Issue 10. Please, refer to that article for identification, damage symptoms, and management recommendations.

Fig. 1. Strawberry root weevil. (*BugGuide. Photo Credit: Harvey Schmidt*)
Fig. 2. Black Vine Weevil. (*BugGuide. Photo Credit: metrioptera*)

Life Cycle

Adult females lay eggs in the soil where larvae develop, feeding on plant roots. BVW adults feed for 21-28 days on foliage prior to producing eggs. Interestingly, all adults are females that are capable of laying eggs through parthenogenesis (asexual reproduction). Females lay eggs in clusters of ~30 eggs in or on the soil from June to September. As soon as the eggs hatch after 10-14 days, larvae (Fig 3) wiggle down into the soil and start feeding on roots. Larvae will then overwinter in the soil. From April l to June, larvae pupate, and adult begin to emerge. Adults move slowly and should not be confused with swifter predacious ground beetles. There is only one generation per year of each species.

Fig. 3. Strawberry root weevil larva. (*Oregon State Univ. Ken Gray, Insect Image Collection*)

Fig. 4. Strawberry root weevil damage to roots. (*Oregon State Univ. Ken Gray, Insect Image Collection*)

Fig. 5. Strawberry root weevil damage to leaves. (*Oregon State Univ. Ken Gray Insect Image Collection*)

Damage

The main damage is caused primarily by the larvae feeding on the root system (Fig 4) in early spring.

Damaged plants are weakened, stunted, more susceptible to winter injury and diseases, and may see a decrease in yield. Severe infestation may cause the plants to die. While adult weevils chew characteristic notches from the edges of leaves (Fig 5), their feeding is usually minor and does not result in economic loss.

Monitoring

Look at plantings in the spring for smaller, less vigorous plants and examine the roots for grub presence. In early summer, when adults begin to emerge, inspect leaves for leaf notching from adult feeding, especially on sucker growth near the ground. The presence of adults on top of foliage can be confirmed after dark on warm calm nights using a flashlight. You can also look for adults in plant debris at the base of the plant during the day. Laying a small piece of cardboard next to strawberry plants provides a refuge that can be checked easily in the early morning for the presence of adults. In the fall, you can look for areas with weak growth that redden prematurely. Although an old threshold, for BVW, between 2-8 larvae per strawberry plant (20x20cm soil sample including damaged plants) was determined to cause economic damage. If grubs are found in the spring, insecticides should be applied after harvest, when adult weevils emerge and start feeding but before egg laying occurs.

Biological control

Nematodes, such as *Heterorhabditis* spp. and *Steinernema* spp., may provide some control of weevil larvae when applied as a drench (following label directions) in the root zone where grubs are present.

Cultural control

Cultivation of the soil in early spring before planting can eliminate overwintering larvae. Cereal cover crops can be planted in rotation, as small grains are not hosts for root weevils.

Chemical control

If the use of an insecticide is warranted, for optimal control it is best to spray at night, between dusk and midnight, on warm, calm evenings when adult weevils are the most active feeding on foliage. For BVW, because adults require foliage feeding for 3-4 weeks before laying eggs, the first foliar application targeting adults should be made three weeks after detection of the first adult. Adults do not all emerge at the same time, thus a second foliar spray should be applied three weeks after the first one.

A list of available insecticides to control weevils in strawberry is provided in the following table. This is not an exhaustive list of insecticides. For other fruit crops, be sure to read the label to make sure they are registered for that specific crop in Wisconsin. There are many other trade names available, and we do not recommend these that are listed above other options. All product recommendations can be found in the 2017 Midwest Fruit Pest Management Guide. Additionally, you should always fully read and follow the label before spraying any pesticide.

Class (IRAC code)	Trade Name	Active ingredient	PHI* (days)	Effectiveness
Neonicotinoids (4A)	Platinum	Thiamethoxam	50	Good on grubs and adults
	Admire Pro	Imidacloprid	14	Excellent on grubs
Organophosphate	Lorsban	Chlorpyrifos	21**	Good on grubs and adults

** Pre-Harvest Interval (PHI)*

*** Restrictions vary, check the label for details.*

(***Source**: Wisconsin Fruit News, Vol. 2, Issue 4 – May 26, 2017*)

RASPBERRIES/BLACKBERRIES

Pruning Caneberries (Brambles) to Minimize SWD Habitat within the Planting

Juliette Carroll, Cornell University

Examine your caneberry plantings for conditions that promote SWD infestation and take steps to eliminate them. Although we cannot change the weather, we can alter conditions in the planting to reduce the cool, dark, humid areas preferred by SWD. Pruning and training systems can help maintain an open canopy to increase sunlight and reduce humidity. This will make plantings less attractive to SWD, will reduce SWD activity, and will improve spray penetration and coverage.

Bumblebee pollinating pruned and trellised raspberry. Photo: Gregory Loeb, Cornell Univ.

Pruning tactics for caneberries (raspberries and blackberries) have been developed to achieve excellent fruit yield and open the canopy. Knowing different pruning strategies will help you manage SWD. Added benefits include improved fruit color and flavor promoted by sunlight, easier picking by workers and customers, and easier weed management.

Caneberries (brambles) grown in the Northeast include red and black raspberries and blackberries, all are susceptible to SWD infestation. However, fruiting season differs among cultivars, which influences the risk of infestation.

- **Summer bearing varieties develop berries on floricanes** that grow the prior year and overwinter. Fruit ripens and is harvested in early to mid-summer, prior to SWD population buildup, lowering the risk of infestation.
- **Fall bearing varieties develop berries on primocanes** that grow, flower, and fruit in the same year. Fruit ripens and is harvested in late summer and early fall when SWD populations are high and risk of infestation is extreme.
- **Plants developing berries on floricanes and primocanes haven't had floricanes removed after fall fruiting**. Fruit ripens and is harvested from early to mid-summer on the floricanes and from late summer to early fall on the primocanes. The risk of SWD infestation will be low early in the harvest season and will increase as the summer progresses and the SWD population builds up.

Pruning suggestions for summer bearing varieties

Summer raspberries – maintain 4-5 healthy floricanes per foot of row.
Blackberries – maintain 3-4 healthy floricanes per foot of row or hill.
Black raspberries – maintain 6-8 floricanes per hill.
Everbearing – maintain 4 primocanes and 4 floricanes per foot of row.

Floricanes should be held upright with a trellis to facilitate spray coverage and air circulation. Holding fruiting canes to the outside on a V-trellis will keep them to the outside of the growing primocanes and facilitate spray coverage and harvest.

Prune out the smallest primocanes beginning when they are 12 to 18 inches high to select and keep the biggest and best canes. Keep a few more than the suggested cane density per foot of row or per hill. Begin removing spent floricanes in July along with any late emerging primocanes. In November, laterals on black raspberry and blackberry primocanes can be cut back to 3 or 4 buds.

Pruning suggestions for fall bearing varieties

Maintain 4-6 primocanes per plant on a trellis.

Encourage early fruiting by placing row covers over the row after mowing in the spring. Remove the row covers when the primocanes are 18 inches tall. This will bring on flowering about two weeks early and help avoid or minimize SWD damage.

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Pritts, M. 2013. Horticultural strategies for living with SWD. New York Berry News 12(10):1-2. http://www.hort.cornell.edu/fruit/nybn/newslettpdfs/2013/nybn1210.pdf

(***Source**: Cornell University SWD Blog entry, June 27, 2017*)

NEW Raspberry Crop IPM Tool Available

Erica Pate, Ontario Ministry of Agriculture, Food & Rural Affairs

Raspberry CropIPM is now available on OMAFRA's CropIPM website

Looking for pictures of raspberry cane blight? Trying to identify an insect in your raspberry patch?

Check out this link for information on integrated pest management for raspberries. This tool includes information on identification, biology, scouting, and management of raspberry insects, weeds, diseases and disorders.

This tool also includes resources on soil diagnostics, herbicide injury, and a scouting calendar. Use Raspberry CropIPM to help diagnose what you are seeing in the fields.

We also have a CropIPM page for strawberries, tender fruit, grapes, apples and a number of vegetable crops.

Use this tool with Publication 360, Fruit Crop Protection Guide, 2018-2019 to determine your pest management program. (***Source**: Ontario Berry Grower Blog, July 5, 2018*)

BLUEBERRIES

Blueberry Maggot Emergence Sharply up After Rains

Rufus Isaacs and John Wise, Michigan State University Extension,

Traps for blueberry maggot fly should already be deployed in southwest Michigan [and New England] to ensure accurate detection of the early flight of this pest. The first catches were in late June in the far southwestern region of the state, and some unmanaged fields are already showing mature larvae of this pest. Detections of flies in managed fields have been very low, but after the rainstorms that have passed through recently, there has been a spike in catches of blueberry maggot flies. This pest overwinters in the soil, and needs soil moisture to emerge from the ground. With the hot, dry conditions of 2016, most of the emergence seems to have been be delayed, but the rains have changed that for much of the state.

Ensure blueberries are protected from blueberry maggot, a key harvest-season pest.

After emergence, female flies require approximately seven to 10 days to become sexually mature and mate, at which point they will begin laying eggs. Eggs are oviposited under the skin of ripening blueberries, with a single egg deposited per fruit. Eggs hatch in about five days and the maggots begin feeding, completing their development within a single berry. Upon maturity, the maggots drop to the ground, burrowing up to several inches into the soil before pupating. In Michigan's climate, these pupae will not emerge until at least the following growing season.

Blueberry maggot on ripe blueberry.

Although it is late to be starting monitoring now, it can still tell you about distribution of this pest across your farm. Initial adult emergence is best monitored using yellow sticky boards baited with ammonium acetate (or ammonium carbonate) as a food attractant, because newly

emerged females are actively feeding during this pre-oviposition period. These traps should be placed on a stake or hung on an upper branch of a blueberry bush in a perimeter row (south facing side of bushes) with enough foliage cleared from around the trap so leaves don't stick to it. Hang traps with the colored side down in a V-orientation (see photo). Traps should be deployed before first anticipated flight (late June), since most flies are expected to be immigrating from wild or non-sprayed hosts outside the commercial planting. If a resident fly population is suspected from previous infestation, a trap placed inside the field is a good idea to detect internal infestations. Traps optimally should be checked twice weekly starting just before first fruit coloring until the first fly is caught, triggering fruit protection activities.

Monitoring trap with V-orientation for monitoring blueberry maggots.

Blueberry maggot fly on trap with distinctive wing pattern.

After the pre-oviposition period is complete, female flies will begin actively searching for fruit to lay eggs in, and there is a trap available that mimics the visual stimulus of a fruit. A green sphere trap baited with synthetic fruit volatile lure can also be used to monitor fly activity in fields. Again, these traps should be placed in perimeter rows of the field unless there is evidence of a resident population far in the interior. However, if the yellow sticky cards have been used effectively, these should be sufficient to monitor the flies.

Blueberry maggot control has been achieved for many years using broad spectrum insecticides. These kill the adult fly on contact and prevent the insect surviving to the point of being able to lay eggs into the fruit. The organophosphates Malathion and Imidan are highly active on blueberry maggot, with the latter two products having shorter pre-harvest intervals and potential for use closer to harvest. Carbamates such as Sevin and Lannate and the pyrethroids Asana, Mustang Max, Bifenture and Danitol are also active on adult fruit flies. This chemical class is sensitive to degradation from light and heat and highly toxic to natural enemy insects, so this is something to consider depending on the weather conditions in June and July.

The following reduced-risk insecticides are effective at controlling blueberry maggots and also spotted wing Drosophila (SWD). The spinosyn-containing compounds Delegate and SpinTor (non-organic) and Entrust (organic) are highly active on blueberry maggot adults when ingested, and will also control SWD. Of these options, Delegate will provide the best fruit protection from these fly pests. In field trials with high pest pressure and two week application intervals, the performance of the spinosyn insecticides has been rated as good-excellent against blueberry maggot (see table). Performance would be expected to be higher in fields with lower pressure and with less time between applications. Exirel is a new insecticide from the diamide chemical class that has demonstrated excellent control of blueberry maggot in our Michigan State University trials and is also very effective against SWD.

Rimon is registered for use in blueberries at 20 to 30 ounces per acre, and this insect growth regulator can provide an important component of a rotational program against blueberry maggots to minimize the chance of insecticide resistance. Because this insecticide is not toxic to adult flies, but acts to disrupt egg and larval development, it should be applied at the start of fly activity as determined by monitoring traps. Rimon is recommended against blueberry maggots, but provides limited control of SWD.

While the neonicotinoid insecticides such as Admire and Actara are active on blueberry maggots, Japanese beetles and aphids, they are not effective on SWD.

Properties and relative performance of insecticides labeled for controlling blueberry maggots				
Compound trade name	**Chemical class**	**Optimal spray timing for BBM**	**Residual activity**	**Effectiveness rating****
Imidan	Organophosphate	Within 7 days of the first fly being captured	14+ days	Excellent
Malathion	Organophosphate	Within 7 days of the first fly being captured	3-7 days	Good
Lannate, Sevin	Carbamates	Within 7 days of the first fly being captured	3-5 days	Good
Asana, Danitol, Brigade, Mustang Max, Bifenture	Pyrethroid	Within 7 days of the first fly being captured	7-10 days	Good
Delegate, SpinTor, Entrust*	Spinosyn	Immediately after the first fly has been captured	7-10 days	Excellent, Good, Fair
Exirel	Diamide	Within 7 days of the first fly being captured	14 days	Excellent
Provado, Admire, Assail	Neonicotinoid	Within 7 days of the first fly being captured	10-14 days	Good-Excellent
Rimon	Insect growth regulator	Immediately after first fly has been detected	10-14 days	Good

**OMRI-approved for organic production.*
*** Effectiveness rating of insecticides as noted in MSU Extension bulletin E0154, "2016 Fruit Management Guide."*
(***Source**: Michigan State University Fruit Advisory Blog, July 26, 2016*)

GRAPE

Botrytis Bunch Rot Control

Alice Wise and Hans Walter-Peterson, Cornell University

It is very worthwhile to read the 2017-18 disease overviews from Wayne Wilcox and Bryan Hed, posted at http://ccesuffolk.org/agriculture/grape-program. Briefly, the fungicide options:

1) Rovral, due to resistance in years past, should not be the workhorse of your program. However, if you've been giving it a rest, it may be useful when used on a limited basis. The use of an adjubant improves control. Stylet Oil (assuming prosimitiy to sulfur or captan spraysis not an issue) is a good choice.

3) Vangard, Inspire Super, Scala, is absorbed into the berries, so it's rainfast and has limited postinfection activity. Vangard is highly prone to resistance development. The label allows a max of two applications per season, but keep it to a single spray each year unless you really get into a bind. Inspire Super is a combo product with only 24% cyprodinil (vs. 75% cyprodinil in Vangard. Scala- Same chemistry and mode of action as Vangard, the two have performed similarly in a limited number of head-to-head tests.

5) Elevate, originally sold as a surface protectant, provides good protective activity within the berries. There is a resistance risk – not as significant as that for Vangard. The label allows a max of three applications per season, but European guidelines recommend just one in rotation with unrelated materials.

6) Flint Extra provides control of Botrytis @ 3.8 oz/acre (higher rate vs. older formulation of Flint). Limit Strobie use to a max of two applications per season.

7) Pristine has provided control especially at higher rate of 19 oz/A. Both the strobie and non-strobie component of this "combination product" have activity against Botrytis. Limit strobie use to a max of two applications per season. Has some activity against incidental cluster rot organisms such as bitter rot.

The following materials are either organically approves or are of low toxicity, i.e., have 4 hr reentry, o d PHI

8) Oxidate 2.0 is a surface sterilant. In local trials, it burned out Botrytis sporulation; however, since the fungus is established in the flesh of the berry, new sporulation reappeared within a week. The temporary reduction in sporulation may help to reduce spread, particularly with repeat applications. Perhaps best used in rotation with botrycides. OMRI approved.

9) Double Nickel is a biological material labeled for Botrytis and sour rot control. Wilcox results: in 2015, it did not provide good control of BBR. OMRI approved.

10) Fracture (BLAD), Al-Banda de Lupinus albus doce, a polypeptide derived from germinating sweet lupine plants, it breaks down fungal cell walls. Labeled for

Botrytis; has a 2ee for suppression of sour rot. Wilcox results: control of Botrytis bunch rot comparable to commercial standards. Also saw some activity vs. sour rot. See above-mentioned overviews for details. Pricey.

11) PdD.Ai – polyoxin D salt is labeled as a preventative for application at verasion and 7 days preharvest. Adjuvants may help coverage. Commercial experience suggests it may help with control of cluster rot.

(***Source:*** *Long Island Fruit & Vegetable Update, No. 14, July 5, 2018*)

Protect Grape Clusters from all Major Grape Diseases During Early Fruit Development

Annemiek Schilder, Michigan State University

Young fruit clusters are highly susceptible to all major diseases, including downy mildew, powdery mildew, black rot, Phomopsis and anthracnose. If prolonged cool wet weather prevails during bloom, Botrytis can also gain a foothold in clusters of susceptible cultivars by promoting fungal growth on senescent flower parts. However, if conditions are dry and warm during bloom it is unlikely that bloom will be an important time for Botrytis infection. We have had a mixture of different weather patterns around the state, with warm and dry until recently in the southern part of the state and cool and wet up north. Warm and dry conditions favor powdery mildew, while all other diseases are favored by rainy weather and moderate temperatures.

Young fruit clusters are highly susceptible to all major diseases. Broad-spectrum fungicides and careful scouting for disease symptoms are advised.

Black rot and Phomopsis lesions have been seen for many weeks now and indicate the pathogens are active. Grape anthracnose symptoms are also visible on shoots, leaves and cluster stems of susceptible varieties. Powdery mildew has already been seen on unsprayed Chancellor clusters in East Lansing, Michigan, an indication that this year may be especially favorable to powdery mildew fruit infection. Downy mildew symptoms were first observed about 10 days ago in various parts of southern Michigan and disease pressure is likely to continue. If rains continue in northwest Michigan, this disease may be more common than in most years. Michigan State University Extension [as does UMass Extension], advises careful scouting for disease symptoms on a weekly basis.

It is possible for fruit clusters to be infected by powdery mildew without seeing any foliar infections first, so protect the fruit of susceptible cultivars even if no powdery mildew has been seen on the leaves. In addition, downy mildew infections of flower clusters may occur before leaf infections as well, particularly in cv. Chancellor, whose clusters are highly susceptible to downy mildew. In 2009, we first observed downy mildew on Chancellor clusters in Fennville during the first week of June and in 2010 during the second week of June. Growers are strongly advised to protect flower and fruit clusters from infection by all grape pathogens using effective fungicides. The risk of infection is especially high if we have multiple rain events and moderate temperatures, resulting in prolonged wetting of foliage and developing fruit. Only the powdery mildew fungus does not need wetness but it thrives in shady areas under high relative humidity.

In general, aim to protect the clusters from the major diseases from immediate pre-bloom until four to five weeks after bloom. As the berries develop, they become naturally resistant to most diseases and the need for fungicide protection diminishes. This happens quite rapidly for downy mildew (two to three weeks after bloom), whereas for powdery mildew it is about four weeks after bloom. Concord grapes become resistant to black rot at four to five weeks after bloom, but some wine grape varieties may remain susceptible to black rot for up to eight weeks after bloom. Be aware that the cluster stem (rachis) and berry stems can remain susceptible longer than the berries in most cases. Also, if there is variability in cluster ages due to spring frost injury, the period of susceptibility will be extended. The only disease in which berries remain susceptible throughout their development is Phomopsis, but the risk of infection diminishes after bunch closure because spore numbers drop off then. In the case of Botrytis, berries actually become more susceptible closer to harvest, especially in tight-clustered varieties. However, Botrytis may gain a foothold in clusters at the end of bloom by growing on senescing flower parts during cool, wet weather and then hangs out until becoming active again after veraison.

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becoming active again after veraison.

Depending on the susceptibility of the grape cultivars that you are growing, broad-spectrum fungicides or fungicide combinations are most appropriate at this time of the growing season to get the broadest control. A good option would be a tank mix of a sterol inhibitor (e.g., Rally, Tebuzol) plus a protectant (e.g., Manzate, Ziram). Remember that Manzate has a 66-day PHI and that in juice grapes produced for Welch's, Manzate cannot be used after bloom. In addition, broad-spectrum fungicides such as Pristine, Abound, and Sovran or pre-mixes such as Revus Top and Quadris Top are useful at this time. Pre-mixes Luna Experience and Inspire Super are good options for wine grapes where efficacy against Botrytis is also desired, however, they do not work against downy mildew, so a downy mildew fungicide may need to be added (e.g., Phostrol, Presidio, Revus, Forum, etc.).

For organic vineyards, a tank-mix of a protectant biocontrol agent (e.g., Double Nickel 55, Serenade) plus a plant defense booster (Regalia- giant knotweed extract) is the best option. For grapes that can tolerate these products, sulfur is a good powdery mildew fungicide and copper will protect vines against downy mildew in addition to suppressing other fungal diseases. (***Source**: Michigan State University Fruit Advisory Blog, June 27, 2017*)

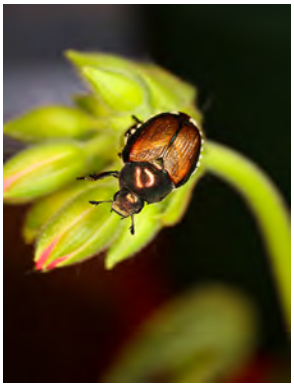
Japanese Beetles

Joseph A. Fiola, University of Maryland

Japanese beetles can periodically be a significant pest in Maryland vineyards. They create large holes in the younger leaves of vines and cause severe lacing and even fruit damage in heavy infestations. The population build up is typically periodic and cyclic and may require control tactics in years of large infestations. Always be extra careful with young vines as they cannot tolerate severe defoliation.

Identification and Biology

- Japanese beetles (scarab beetle family) are approx. ½ inch with metallic green bodies and copper-colored wings.
- They are voracious feeders and attack the foliage of numerous woody and ornamental species (roses are a preferred food) as well as grapevines.
- They have a very broad list of alternate species they feed on and have been known to fly for up to 5 miles.
- Adults emerge from the soil and begin moving into vineyards in late June.
- They remain present for about 2 months during which they feed, mate, and the female lays eggs in the soil.
- Japanese beetles become established in an area (in the turf) and populations rapidly build up over a couple of years.
- Once established, the chances of eradicating them from an area are slim.



Damage

- They tend to feed on younger leaves.
- In an extreme infestation without control vines can be completely defoliated.
- They tend to be more damaging during droughty seasons.
- The tolerance of younger vines is much less because total leaf area can easily be defoliated which can lead to increased winter damage and vine death.

Scout and Manage

- Scout for damage and the presence of beetles from early-late June through mid-late August.
- Because they are constantly emerging and moving into the vineyard, constant scouting and vigilance is required and control measures may be needed quickly and even frequently.
- Since they typically arrive from outside the vineyard, you can sometimes find arrival hot spots where you can target and concentrate control if needed.
- The usual threshold for making a spray application is about 15% of the leaves damaged.
- Remember that well-established vines can tolerate significant foliar feeding by Japanese beetles, when it is the upper younger leaves that are above the top catch wire and about to be hedged off anyway.

Control*

- If you have a few in the vineyard, just "squish" them on the leaf. There is evidence that the dead beetles may repel others.
- The materials labeled for controlling Japanese beetles are Assail®, Actara®, Avaunt®, Belay®, Danitol®, Imidan® (14 day REI!), Neemix 4.5 plus Trilogy, and Sevin®.
    - Remember that frequent, repeated sprays of Sevin® will also kill many beneficial insects (including mite predators) which can then lead to a mite outbreak. Again this is exacerbated in hot dry weather.

- Repeated applications may be needed to control new beetles flying in from surrounding areas.
- Surround® can be used to protect the foliage from feeding and has been very effective in some locations.
- Where Japanese beetle populations are low or beetles are just beginning to be seen and fewer sprays are needed, using a "softer" insecticide can reduce the risk of mite outbreaks.
- Biological control agent Bacillus popillae (milky disease) can protect grassy areas from large larval populations, but it is ineffective against adults entering the vineyard.
- Japanese beetles also have natural predators, including wasps and flies that can parasitize larvae and adult beetles, again emphasizing the important of avoiding insecticides that will harm beneficials.

***Always read the pesticide label for complete information and product safety.**

GENERAL INFO

Small Fruit Leaf Tissue Analysis

Sonia Schloemann, UMass Extension

Leaf tissue testing is an excellent way to monitor plant nutrient levels. With perennial fruit crops, leaf analysis is better than soil tests for determining an optimal fertilization program. While soil tests reveal the quantity of certain nutrients in the soil, leaf analysis shows exactly what the plant has taken up. However, soil tests are necessary for determining soil pH (and lime or sulfur recommendations) and soil organic matter content (SOM). If nutritional problems are suspected in a given planting, it's a good idea to take both leaf and soil tests.

Leaf analysis is helpful for detecting nutrient deficiencies (especially of minor nutrients) before they effect plant health or yield. The best tissue analysis for berry crops comes from green, healthy, whole leaves (except for grapes). Do not submit plant tissue that has disease, leaf burn, insect or hail damage. Keep the material in a cool place (insulated chest) or refrigerate before mailing. Record all foliar sprays in case the results are influenced by nutrient or pesticide applications.

A minimum of 50 leaves from raspberries or strawberries, and 80 to 100 leaves from blueberries should be selected for each analysis. Do not mix leaves from fields with different soil types or management histories. Do not combine leaves from healthy plants with plants that are not growing well.

Strawberry: Strawberry samples should be taken from the first fully- expanded leaves after renovation, about July 15 to August 15.

Raspberry: Raspberry samples should be leaves from non-fruiting canes taken between August 1 and 20.

Blueberry: Blueberry samples should be leaves taken during the first week of harvest, from July 15 to August 15.

Grape: Grape samples should be taken either at bloom or veraison (berry coloring). Bloom samples should be taken from leaves opposite first fruit cluster on a shoot. Verasion samples should be taken from the furthest fully expanded leaf on a current season's shoot. Unlike other berry crops, grape tissue testing is done on just the leaf petioles, so the leaf blades can be discarded.

Place samples in sealed paper bags, clearly labeled with field names. Below is a list of labs that perform leaf tissue analysis:

MASSACHUSETTS

Soil & Plant Tissue Testing Laboratory - West Experiment Station/UMass Amherst MA 01003 Telephone: 413-545-2311 ~~http://soiltest.umass.edu/~~ [***Editor's Note***: *The UMass Soil Lab is currently unable to process plant tissue samples (7/10/18) and we encourage growers to use another New England Lab or one of the Private Labs listed here.*]

CONNECTICUT

UConn Soil Nutrient Analysis Lab, 6 Sherman Place, U-5102, University of Connecticut, Storrs, CT 06269-5102, phone: 860-486-4274, fax: 860-486-4562 email: soiltest@uconn.eduforms and pricing, visit the website at http://www.soiltest.uconn.edu/.

NEW HAMPSHIRE

University of NH Analytical Services Lab - Spaulding Hall, Room G28A, 38 Academic Way Durham NH 03824 (603)862-3200

http://extension.unh.edu/agric/agpdts/soiltest.htm

PRIVATE

Brookside Laboratories - 308 South Main St. New Knoxville, OH 45871 Telephone: 419-753-2448 http://blinc.com

Spectrum Analytic - 1087 Jamison Rd. Washingon Court House, OH 43160 Telephone: 800-321-1562 http://www.spectrumanalytic.com/.

Hops Downy Mildew – an old foe returns

Angela Madeiras, UMass Extension

Hops (*Humulus lupulus*) may seem to be a new crop in the Northeast, but in fact it is not. The first commercial hops producer in the United States was established in Massachusetts in 1648, and our humble state remained the largest producer of hops in the country until New York moved into the lead in the mid-1800s. The hops industry in the Northeast continued to grow until 1909, when an epidemic of powdery mildew devastated the industry. The advent of sulfur-based fungicides around 1920 seemed like the answer to growers' prayers, but the relief proved to be short-lived. A downy mildew epidemic soon appeared and combined forces with Prohibition to end the hops industry in the Northeast by 1930. Production moved to the drier regions of the Northwest, where it has largely remained; today, 75% of commercial hops are grown in Washington State, with Idaho and Oregon combining for 24%.

Front (top) and back (bottom) of hops leaf infected with downy mildew.

Photos: Erin Lizotte, MSU Extension

The American hops industry enjoyed a homecoming of sorts early in the 21st century, when the growing popularity of small breweries and demand for locally grown ingredients led to renewed interest in hops production in the Northeast. According to the recent statistical report published by the Hop Growers of America, production in New York and New England grew from zero acres in 2013 to 501 acres in 2017. Unfortunately, downy mildew of hops has also made a comeback in that short time.

Downy mildew of hops is caused by the oomycete *Pseudoperonospora humuli*. It also infects *Humulus japonicus* (AKA wild hops, which was imported from Asia in the 1800s and became an invasive weed in eastern North America), and *H. americanus* (AKA *Humulus lupulus* var. *lupuloides*). It may also infect some nettles (*Urtica species*). *P. humuli* causes both localized and systemic infections, and may overwinter in crowns and buds. In spring, infected crowns produce distinctive shoots known as primary spikes (see photo below) which may be stunted, yellowed, and have shortened internodes. The leaves may curl downward and turn brown. In cool, wet conditions, purplish-gray sporangia are produced on the undersides of infected leaves. Sporulation occurs when nighttime temperatures are above 41°F; the optimum range is 60-68°F. Humidity levels >70% are required for sporulation, and free moisture on plant surfaces is required for infection to occur. Sporangia are produced in the morning and spread by wind and rain splash to other plants. Infection can occur on wet leaves within 2 hours at 59-84°F. It may also occur at temperatures as low as 41°F if leaves remain wet for 24 hours or more. Leaf infections produce brown, angular lesions. *P. humuli* may also produce oospores in infected leaves, stems, and cones. Oospores are tough-walled structures that may enable the pathogen to survive in soil.

The oomycete pathogen that causes hops downy mildew. Photo: A. Madeiras, UMass

Primary or basal spikes produced by a systemically infected hops plant in the spring. Photo: OMAFRA Hort Matters

Infected shoots produced by apical meristems are called secondary spikes and resemble primary spikes above the point at which infection occurred. Infection of the apical meristem requires 3-6 hours of leaf wetness and occurs at temperatures of 46-73°F. If *P. humuli* finds its way into the apical meristem, the pathogen becomes systemic, growing down the stem through the vascular system and into the crown, where it can overwinter. A reddish brown discoloration may be visible in crown tissue just below the bark; this should not be confused with the red color found in the centers of healthy crowns of some hops cultivars.

Infection may not kill the plant but it will weaken it. This reduces yield and quality of the cones and the winter hardiness of the plant.

Good cultural practices are essential for successful management of hops downy mildew.

- Grow cultivars that have resistance to downy mildew. No cultivar is completely immune to the disease, but many have partial resistance. These include Cascade, Chinook, Willamette, and Newport. Avoid highly susceptible cultivars such as Nugget, Cluster, and Centennial.
- Start with disease-free plants.
- Reduce humidity in any way possible. Plant in areas with good air flow. If possible, orient rows in the direction of prevailing winds. Mow aisles between rows and manage weeds. Use appropriate spacing between plants and between rows. Avoid overhead irrigation.
- Infected buds may be removed from established plants by crowning (removing top 1-2" of crown prior to bud break) or scratching (removing buds from crowns 1-2" below soil surface).
- Scout regularly for symptoms. Remove infected spikes as they appear throughout the season.
- Remove any plants that are severely diseased.
- "Hill up" soil over crowns after pruning- this encourages root growth and buries diseased shoots.
- Remove crop debris from the hopyard.
- Harvest at the right time. Prune as late as possible, but not so late that it will decrease yield.

Chemical management:

- Forecasting tools for hops downy mildew exist in the Northwest, but a similar tool has not yet been developed for the Northeast. The Network for Environment and Weather Applications (NEWA) does have a forecasting tool for grape downy mildew that hops growers might use to gain some idea of when conditions may be right for P. humuli. See resources below for link.
- Preventive fungicide applications. Preventive applications are preferable, because fungicides have very limited curative capacity.
- Resistance to metalaxyl and fosetyl-Al have been reported in other hops growing regions of the U.S. Employ other active ingredients in areas where downy mildew appears to be insensitive.
- Other fungicides labeled for hops downy mildew include copper, cyazofamid, cymoxanil, phosphorus acids, dimethomorph, and mandipropamid. Rotate active ingredients to deter resistance development.
- Post-harvest sprays are not recommended. If the pathogen has reached the crown, only fungicides

that move down through the phloem (basipetal action) would have any effect. The only fungicides with this type of action are fosetyl-aluminum and phosphorus acids. There is currently no evidence that post-harvest sprays are effective.

Resources:

- University of Vermont Fact sheet: http://www.uvm.edu/extension/cropsoil/wp-content/uploads/DownyMildew.pdf
- Guidelines for Integrated Pest Management for Hops in Connecticut. CAES Bulletin 1050, 8/17. http://www.ct.gov/caes/lib/caes/documents/publications/bulletins/ipm_of_hops_in_ct1.pdf
- Northeast Hop Alliance: https://www.northeasthopalliance.org/
- National Clean Plant Network: http://nationalcleanplantnetwork.org/
- Hop Growers of America: https://www.usahops.org/
- The Network for Environment and Weather Applications (NEWA): http://newa.cornell.edu/index.php?page=grapediseases
- UVM Hops Production Program: http://www.uvm.edu/extension/cropsoil/hops

UPCOMING MEETINGS:

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 12, 2018 – *Tree Fruit Scouting Workshop*, 9:30. Norton Bros Fruit Farm, 466 Academy Rd., Cheshire, CT. Free Event. No RSVP needed.

July 19, 2018 – *New Hampshire Tree Fruit Meeting*. 5:30-7:30. Oxbow Farm Orchard, 800 Stark Hwy, Stark NY. 2 pesticide credits available. Free event. To register, contact Heather Bryant at heather.bryant@unh.edu.

July 24, 1018 – *CT Farm Wine Twilight Meeting*, 5:30 – 7:30 pm. Paradise Hills Vineyard & Winery, 15 Wind Swept Hill Rd., Wallingford, CT. 1 pesticide credit offered. Program is free but RSVP is requested by Tuesday, July 17 for food and planning purposes. Register by emailing Rebecca.eddy@ct.gov.

July 24, 2018 – Organic Weed Management 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.

August 14, 2018 – *UMass Extension Vegetable Program Research Tour and Round Table*. 4:00. UMass Crop and Animal Research Farm, 89 River Rd., South Deerfield MA 01373. For more info and to register, go to: http://ag.umass.edu/vegetable/events/umass-extension-vegetable-program-research-tour-round-table.

August 14-15, 2018 – *North American Strawberry Growers Assoc. Summer Tour*. Watsonville & Monterey, CA. For general information and registration, go to: https://nasga.org/n-american-strawberry-growers-summer-tour.htm#.

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