Volume 10 Issue 5

Special Alert:
Scout for Corn Earworm in Vegetable Crops

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Moth flight activity for the corn earworm, also known as tomato fruitworm, has increased during the past week. Pest pressure varies across the state and Delmarva region. The early surge in activity is attributed to the record temperatures during June and July, which have accelerated larval development and shortened the generation time of this insect. Corn earworm has already caused significant damage to ears of sweet corn and early planted field corn. Note that Bt hybrids expressing single or multiple Cry proteins no longer control earworms due to the development of resistance; only hybrids expressing the Vip3a Bt protein provide good ear protection. These hybrids represent a relatively small portion of the planted acreage. Thus, significantly more adult moths are now recruited in corn compared to levels a decade ago.

Corn earworms are strongly attracted to and prefer fresh corn silks for egg laying. Outbreaks in other crops often follow a midsummer drought, which causes the corn to ripen earlier and become less attractive to the moths. As early planted corn fields dry down, moths will move into other vegetable and grain crops.

Corn Earworm in Sweet Corn:

Moth activity as evaluated by blacklight and pheromone trap monitoring indicates the severity of pressure and can inform the timing and frequency of insecticide applications. Generally, an insecticide spray is applied at early green silking as soon as the first moth is captured on the farm, and applications are repeated at 2 to 6 day intervals based on moth pressure. The corn growth stage, weather, Bt trait being used, tolerance for ear damage, as well as the persistence and efficacy of the foliar insecticides being used also help determine the appropriate interval.

Table 1. Regional Scentry heliothis pheromone trap captures.

<table>
<thead>
<tr>
<th>Region</th>
<th>Site</th>
<th>Sampling Date</th>
<th>1-day Total</th>
<th>5-day Total</th>
<th>Weekly Total</th>
<th>Recommended Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern MD</td>
<td>Jarretsvile</td>
<td>8/6</td>
<td>77</td>
<td>77</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Street</td>
<td>8/7</td>
<td>18</td>
<td>18</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Central MD</td>
<td>Beltsville</td>
<td>8/5</td>
<td>113</td>
<td>50</td>
<td>2 (fresh silks), 3 (later stages)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Upper Marlboro</td>
<td>8/5</td>
<td>0</td>
<td>0</td>
<td>Spray at green silk and reassess</td>
<td></td>
</tr>
<tr>
<td>Western MD</td>
<td>Keeveysville</td>
<td>8/6</td>
<td>15</td>
<td>15</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Tuscarora</td>
<td>8/6</td>
<td>13</td>
<td>13</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Eastern Shore</td>
<td>Queenstown</td>
<td>8/8</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Salisbury</td>
<td>8/8</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Southern MD</td>
<td>Bel Alton</td>
<td>8/7</td>
<td>11</td>
<td>11</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Moths are attracted to ears with fresh green silks, where most eggs are laid. Complete silk emergence from all ears generally takes four to eight days after the first silks appear. After spraying at the early silking stage, new fresh silks emerge and are not protected. This means spray intervals should be tightest during fresh silk. In addition, when weather is in the 90s (°F), it takes 2 days for eggs to hatch and 2 hours for small larvae to move down the silk channel and begin feeding on the ear tip, where they are protected from foliar sprays. Thus, when moth pressure is high, it is critical to maintain a residual level of insecticide on silk tissue at all times. Sprays may be required up until 5 days from the final harvest date. However, if the weather is hot, pest populations are increasing, and more than five days have elapsed since the last spray, it may be necessary to apply a final treatment within 5 days of the final harvest. Recent temperatures and captures in parts of the state mean you should be mindful of corn earworm pressure, which may be higher than in recent years. Monitoring pressure using on-farm traps provides the most accurate information for making management decisions. We
recommend using 2 pheromone traps and replacing the lures frequently, especially during periods of hot weather.

Sweet corn growers mainly rely on timely and effective insecticide sprays to minimize ear damage by corn earworm and other ear invading insects, and it is important to rotate insecticide classes within a season. The cheaper pyrethroid (Group 3A) products have been the popular choice but their control efficacy has significantly declined due to resistance in corn earworm populations. When first introduced, pyrethroids provided greater than 95% control of corn earworm, but currently control efficacy has declined to around 50% due to resistance development. The reality is that pyrethroids no longer provide enough ear protection on many farms, so growers need to consider incorporating other modes of action into spray programs. Spray mixtures of Lannate (carbamate insecticide, Group 1A) plus a high rate of pyrethroid have become a common practice to circumvent the potential resistance problem. This is particularly true if sap beetles and stink bugs are also a target, but be mindful that this will harm beneficials. The diamide chlorantraniliprole (Coragen and a component of the pre-mix Besiege) provides excellent control. Coragen (Group 28) is also less harmful for beneficial insects, such as minute pirate bugs that may consume earworm eggs in the silks. Spinosyns (Group 5; e.g. Blackhawk, Radiant) have some efficacy when incorporated into a spray program but cannot be relied on exclusively. No matter the insecticide used, to achieve effective control the first spray should be timed at early silking, followed by sprays on a prescribed schedule based on moth pressure, with adequate spray coverage of the ear zone. ALWAYS read and follow instruction on the pesticide label; the information presented here does not substitute for label instructions.

As an alternative, the most potent bioinsecticide for sweet corn insect control is provided by transgenic hybrids expressing one or more insect-active toxins from the bacterium, *Bacillus thuringiensis* (Bt sweet corn). Three types of Bt sweet corn are commercially available: Attribute® hybrids (expressing Cry1Ab toxin), Attribute® II hybrids (expressing Cry1Ab and Vip3A), both from Syngenta Seeds, and Performance Series™ hybrids (expressing Cry1A.105 and Cry2Ab2 toxins) from Seminis Seeds. Although these hybrids provide 100% control of the European corn borer, they do not provide enough control of corn earworm and other lepidopteran pests depending on the expressed toxins and thus supplemental insecticide sprays are often needed to ensure quality ears, especially during high moth activity. Attribute® sweet corn still provides good control of fall armyworm during pre-silk growth stages but only moderate ear protection; no effective control of western bean cutworm; and variable but generally poor to fair control of corn earworm. Performance Series™ sweet corn provides very good control of fall armyworm during the vegetative and ear development stages but no effective control of western bean cutworm and only poor control of corn earworm. Timing of supplemental sprays in Attribute® and Performance Series™ sweet corn is less critical and wider spray intervals are generally allowed compared to non-Bt sweet corn under the same insect pressure. In both types, fresh silk tissue is consistently more toxic to newly hatched larvae, causing intoxication and delayed growth; so those larvae that survive are exposed longer before entering the ear. Pyrethroids and other insecticides may actually work better because larvae are weakened by the Bt intoxication. The first spray can be applied at full silk, usually three or four days later than the first application in non-Bt sweet corn. A second spray 3 to 4 days later may be necessary if heavy moth activity continues, and sometimes three applications are needed. Attribute® II sweet corn provides excellent control of all foliage feeding and ear invading worms, thus no insecticidal sprays are required, except for secondary pests such as sap beetles; however, the absence of worm damage that attracts beetles significantly reduces the infestation risk of this pest. Stinkbugs are not controlled by Bt.

**Corn Earworm in Other Vegetables:**
Corn earworm is a major pest of tomato, pepper, snap bean, lima bean, and many other vegetable crops. Sampling plans and thresholds have not been developed for many of these crops, but a general rule of thumb based on trap captures is that treatments may be warranted at nightly captures of 20 moths or more (see information from Virginia Tech), which is occurring in some parts of our state. Visual inspection of the crop to detect eggs and small larvae will help select insecticide materials and determine pressure. Beneficials will feed on the eggs and small larvae. Consider looking for beneficials when scouting and using materials that are less harmful for these natural enemies.

**Image:** Tom Kuhar

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**Image:** Jack Kelly Clark.

Corn earworm feeding on tomato.

Corn earworm eggs turn black when parasitized by wasps.
**Lima beans:** Monitoring should begin at full bloom and samples should be taken in at least 10 locations in the field. Sample by placing a 3 foot drop cloth between two rows and then shaking the plants on both sides of the row over the (sampling 6 total feet of row). Count the fallen larvae and estimate the average size. If you are using a product that is effective on larger larvae, treatment should be delayed until at least 1/3 of the larvae have reached approximately ½ inch in size. The treatment threshold is 1 or more larvae per 6 foot of row. Since the 2008 season, numerous reports of control failures with pyrethroids (Group 3A) used for earworm control have been reported from the Mid-Atlantic region and states to our south. This insect has developed moderate to high levels of resistance to this class of insecticides, so growers need to consider other modes of action. If a pyrethroid (e.g., Asana, Bifenthrin, Hero, Mustang Maxx, Warrior) is used, the highest labeled rate timed for small to medium, rather than large worms, is recommended. Combination products such as Besiege that include a pyrethroid as well as a diamide (Group 28) can be useful to simultaneously manage multiple insect pests. Coragen (Group 28) and Intrepid (Group 18) are effective and are less harmful to natural enemies. Intrepid is an insect growth regulator so applications should target small larvae only. Spinosyns (Group 5; e.g. Blackhawk, Radiant) and carbamates (Group 1A; e.g., Lannate) are also effective. It is important to rotate insecticide classes within a season. ALWAYS read pesticide labels carefully and follow all instructions; the information presented here does not substitute for label instructions.

**Further Resources:**

Mid-Atlantic Commercial Vegetable Recommendation Guide: [http://extension.udel.edu/ag/vegetable-fruit-resources/commercial-vegetable-production-recommendations/](http://extension.udel.edu/ag/vegetable-fruit-resources/commercial-vegetable-production-recommendations/)


University of Delaware insect trapping program: [http://extension.udel.edu/ag/insect-management/insect-trapping-program/](http://extension.udel.edu/ag/insect-management/insect-trapping-program/)


**Snap beans:** A standard drop cloth can be used to detect small larvae as described above, and larval size is an important consideration for selecting spray materials. Treatments may be warranted when captures exceed 20 moths per night and local corn crops are mature. A 5-7 day spray interval may be necessary thereafter. Treatment recommendations are as described above (see lima beans).

**Tomatoes:** Eggs can be detected on the leaves directly below the flower clusters, typically on the highest clusters on the plant. For a reduced spray approach, inspect 20-30 plants for signs of eggs, and consider initiating sprays if ~10% of the plants have at least 1 egg, with subsequent sprays at 3 damaged fruit per 100 unripe (Kuhar et al. 2006). Given the number of insect pests (armyworms, hornworms, stinkbugs, etc.) that occur in tomatoes, a 7-10 day interval once fruit begins to set is often used for insect management. Pyrethroids (Group 3A) offer poor to moderate control of corn earworm in the Mid-Atlantic, and will not control heavy infestations or large worms. In addition to the products mentioned above, several other effective insecticide options are labeled for tomato, including Avaunt (Group 22), Proclaim (Group 6), Rimon (Group 15), and Exirel (Group 28). It is important to rotate insecticide classes within a season. ALWAYS read pesticide labels carefully and follow all instructions; the information presented here does not substitute for label instructions.

**Downy Mildew on Cucurbits**

By Kate Everts
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August 14, 2019

Downy mildew was first reported in Maryland on cucumber in June. It has been slow to spread until recently. However, we have now confirmed downy mildew on cucumber, pumpkin, cantaloupe, and butternut squash within the state. Downy mildew has been reported on acorn and yellow squash in adjacent states. All cucurbits should be protected with fungicide applications that target down mildew as long as weather remains conducive to spread. Effective materials are listed in the Mid-Atlantic Commercial Vegetable Production Guide.

**Further Resources:**

Mid-Atlantic Commercial Vegetable Recommendation Guide: [http://extension.udel.edu/ag/vegetable-fruit-resources/commercial-vegetable-production-recommendations/](http://extension.udel.edu/ag/vegetable-fruit-resources/commercial-vegetable-production-recommendations/)


University of Delaware insect trapping program: [http://extension.udel.edu/ag/insect-management/insect-trapping-program/](http://extension.udel.edu/ag/insect-management/insect-trapping-program/)


**2019 Mid-Atlantic Commercial Vegetable Production Recommendations**

On-Line at: [Commercial vegetable Guide](#)
Potassium and Other Factors Needed for High Quality Tomatoes

By Jerry Brust
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Tissue tests taken in tomato fields over the last 6 weeks show that fields with good levels of potassium (K) (>3.2%) have overall lower levels of fruit ripening problems than fields with below recommended levels of K (< 2.5%). Figure 1 shows an example of a tomato with good levels of K, while figures 2 and 3 show what often happens when K levels are too low. Tomatoes like the one in figure 2 can still occur in fields with high K levels because about 60% of the fruit ripening problems can be explained by the lower levels of potassium in the plants, but that still leaves about 40% that potassium levels do not explain. What are some of these other factors? One of them is the cultivar grown, some cultivars are just more prone to fruit ripening problems then others and the best way to find the ones that work in your growing system is to trial several cultivars over the years.

Another factor is the weather. Intense heat and high humidity along with very intense sunny days or heavy downpours will take a toll on plants and can reduce the quality of the fruit. The first few clusters of fruit that are produced on a vine usually look the best as these clusters are found deep inside the plant and shielded from rain and intense sun.

As the later clusters mature they are often exposed (fig. 4) and can end up with sunscald, rain check (fig. 5) or other fruit ripening problems. Good canopy coverage will help with protecting these later clusters of fruit. One other thing that will help with these exposed fruit is using a 30% shade over the top 1/3-1/2 of the plants. I know most growers will not use this but it has been shown to increase the marketable yield of tomatoes by 20-50% depending upon the year and the shade cloth can be used for many years. Other factors impacting fruit quality include diseases and other nutrient deficiencies such as phosphorus, nitrogen and boron. So while there are many factors that go into producing a lovely red tomato potassium levels, cultivar selection and weather play the biggest roles and their impact can be mitigated to produce the best fruit with the best investment.
Leafhopper Damage Found on Fruit and Vegetables

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Potato leafhoppers *Empoasca fabae* started out showing up early in the season in our area in unexpected numbers and now they are showing up again in vegetables (eggplant and potato) fruit crops (raspberries) and hops where they are causing some problems (figs 1, 2, 3). Unlike earlier in the season when most of the leafhoppers were adults most of the ones found now are nymphs (fig 4). Potato leafhoppers (PLH) prefer warm, dry conditions and are commonplace in southern states where they overwinter; leafhoppers do not overwinter in our area, but the milder the winter the better able they can overwinter close to us. PLH are generally first seen in late April or early May but are arriving on average 7-10 days earlier in our area than just 20-30 years ago. Females lay 2-4 eggs per day in the leaf stems or veins of plants. In 7 to 10 days nymphs emerge. Nymphs undergo five instars and reach maturity in about 2 weeks. The newly emerged nymph is nearly colorless with red spots that fade. Nymphs then become yellow, finally changing to pale green in the third and later instars. There are 3-4 generations each summer. Leafhoppers are capable of very rapid population increases so scouting is important to control the pest to avoid damage to crops. Alfalfa and a few other forage legumes are the primary hosts for the potato leafhopper and once the first cutting of the forage is done, PLH will move into other susceptible crops.

**Damage:** The most obvious symptom of potato leafhopper feeding is hopper burn. Hopper burn is the yellowing of the leaf margin (figs 1-3). This damage is followed by leaf curling and necrosis. Hopper burn occurs because potato leafhoppers feed by sucking the juices out of leaf veins and blocking the veins with a toxin in their saliva. Once hopper-burn is seen the plant has been damaged, which will either reduce yield or the quality of fruit.
Squash Vine Borers and Pumpkins
By Jerry Brust
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On a recent visit to a farm I saw bright yellow leaves in a pumpkin field and wondered if this could be Cucurbit yellow vine decline that was first seen two years ago (fig. 1). Upon closer inspection of the plants it was found to be an old nemesis of pumpkins and squash - the squash vine borer. Borer moths lay eggs mostly at the base of pumpkin and squash plants starting in late June and going through the first few weeks of July. Eggs hatch and borers quickly move their way into the base of the pumpkin stem where they feed inside the stem (fig. 2) disrupting water and nutrient flow to the rest of the plant (fig. 3). Insecticide sprays need to be directed to the base of the plant for several weeks. Usually the best method of control is a cultural one - rotation. Squash vine borer overwinter in the same field they fed in. Come next spring and summer they emerge and look for the nearest cucurbit field.

The question is how far away does the next field have to be from this years? In this case the grower rotated to a field that was ¼ mile from their other pumpkin field that was lightly infested the year before with squash vine borer (there are no other pumpkin fields around this farm for at least 3 miles). I know growers often do not have enough land to rotate much further than a ¼ mile. Last year’s field was not plowed or worked over the off-season or this spring so the overwintering pupae survived in large numbers and upon emergence were able to locate this year’s pumpkin field. How much of a yield decrease is not known at this time, but plants with feeding signs at their base were marked and will be followed to harvest to see what the yield reduction is. I guess the bottom line is a ¼ mile is probably not far enough of a rotation from even a lightly infested field and pumpkin fields that had even a light infestation of squash vine borer need to be worked in the fall and spring to destroy as many overwintering squash vine borers as possible.

CDMS
Pesticide Labels and MSDS On-Line at:
http://www.cdms.net/
Cover Crops Provide Important Services for Vegetable Growers
By Gordon Johnson
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Vegetable growers should take time to revisit their rotations and plans for the next growing season. Decisions on fall rotational crops or cover crops will need to be made soon.

Services that cover crops provide:

**Returning organic matter to the soil to maintain soil health.** Vegetable rotations are tillage intensive and organic matter is oxidized at a high rate. Cover crops help to maintain organic matter levels in the soil, a critical component of soil health and productivity. Brassicas and winter legumes provide the most biomass followed by ryegrasses and then rye.

**Providing winter cover.** By having a crop (including roots) growing on a field in the winter you recycle plant nutrients (especially nitrogen), reduce leaching losses of nitrogen, reduce erosion by wind and water, and reduce surface compaction and the effects of heavy rainfall on bare soils. Cover crops also compete with winter annual weeds and can help reduce weed pressure in the spring.

**Providing fall and early winter cover and then winter killing.** The use of winter killed cover crops are very useful when early spring (March or April) plantings of vegetable crops such as potatoes, peas, cole crops, early sweet corn, or early snap bean crops are being planned. By winter killing, cover crop residue is more manageable and spring tillage and planting can proceed more quickly.

**Reducing certain diseases and other pests.** Cover crops help to maintain soil organic matter. Residue from cover crops can help increase the diversity of soil organisms and reduce soil borne disease pressure. Some cover crops may also help to suppress certain soil borne pests, such as nematodes, by releasing compounds that affect these pests upon decomposition. One system would be planting mustards in August or early September, tilling them into the soil to provide some biofumigation in October, and then planting a small grain crop for winter cover. Spring planted mustards can also work ahead of later spring planted vegetables.

**Providing nitrogen for the following crop.** Leguminous cover crops, such as hairy vetch or crimson clover, can provide significant amounts of nitrogen, especially for late spring planted vegetables. Hairy vetch is particularly well suited for no-till systems and can provide full nitrogen requirements for crops such as pumpkins and partial requirements for crops such as sweet corn, tomatoes, or peppers.

**Improving soil physical properties.** Cover crops help to maintain or improve soil physical properties and reduce compaction. Roots of cover crops and incorporated cover crop residue will help improve drainage, water holding capacity, aeration, and tilth. The use of large tap rooted cover crops such as forage radish or oilseed radish are particularly well adapted to these uses.

**Setting up windbreaks in the fall for spring planted vegetables.** Small grain crops will overwinter and grow tall enough in to provide wind protection for spring planted vegetables. Rye has been the preferred windbreak because tall types are still available, and it elongates early in the spring. While barley is also early, tall varieties are not generally available. Wheat and triticale are intermediate and later.

**Developing no-till, bio-strip-till, and bio-bed preparation systems.** There is much opportunity to increase the use of no-till and bio-tillage systems. The key will be selecting the right cover crop for the desired system. Rye, crimson clover, subclover, tillage radish, spring oats, and other cover crops have been used successfully for no-till vegetables. One innovative system that uses a combination of winter killed covers and standard covers is bio-strip-till. In this system, a high biomass cover crop such as rye or vetch is planted with strips of forage or oilseed radish in rows where spring planting will occur. Another system uses rye strips with forage radish planted where the beds will be next year.

Drainage, water holding capacity, aeration, and tilth. The use of large tap rooted cover crops such as forage radish or oilseed radish are particularly well adapted to these uses.

**Small Grains**
Rye is often used as a winter cover as it is very cold hardy and deep rooted. It has the added advantage of being tall and strips can be left the following spring to provide windbreaks in crops such as watermelons. Rye makes very good surface mulch for roll-kill or plant through no-till systems for crops such as pumpkins. It also can be planted later (up to early November) and still provide adequate winter cover. Wheat, barley, and triticale are also planted as winter cover crops by vegetable producers.
Several mustard species have biofumigation potential. Turnips and mustards can be used for fall cover but not volatilization. Allows much of these available toxicants to escape by incorporating mowed plant material into the soil quickly, releasing nematicidal chemicals into the soil. Failure to plow down the residue immediately. Never mow down like chemical. Mow rapeseed using a flail mower and it is the leaves that break down to release the fumigant-like chemical. Mow rapeseed using a flail mower and subterranean clover can provide from 80 to well over 100 pounds of nitrogen equivalent. Remember to inoculate the seeds of these crops with the proper Rhizobial inoculants for that particular legume. All of these legume species should be planted as early as possible – from the last week in August through the end of September to get adequate fall growth. These crops need to be established at least 4 weeks before a killing frost.

Winter Annual Legumes
Hairy vetch, crimson clover, field peas, subterranean clover, and other clovers are excellent cover crops and can provide significant nitrogen for vegetable crops that follow. Hairy vetch works very well in no-till vegetable systems where it is allowed to go up to flowering and then is killed by herbicides or with a roller-crimper. It is a common system for planting pumpkins in the region but also works well for late plantings of other vine crops, tomatoes and peppers. Hairy vetch, crimson clover and subterranean clover can provide from 80 to well over 100 pounds of nitrogen equivalent. Remember to inoculate the seeds of these crops with the proper Rhizobial inoculants for that particular legume. All of these legume species should be planted as early as possible – from the last week in August through the end of September to get adequate fall growth. These crops need to be established at least 4 weeks before a killing frost.

Brassica Species
There has been an increase in interest in the use of certain Brassica species as cover crops for vegetable rotations. Rapeseed has been used as a winter cover and has shown some promise in reducing the levels of certain nematode in the soil. To take advantage of the biofumigation properties of rapeseed you plant the crop in late summer, allow the plant to develop until early next spring and then till it under before it goes to seed. It is the leaves that break down to release the fumigant-like chemical. Mow rapeseed using a flail mower and plow down the residue immediately. Never mow down more area than can be plowed under within two hours. Note: Mowing injures the plants and initiates a process releasing nematicidal chemicals into the soil. Failure to incorporate mowed plant material into the soil quickly, allows much of these available toxicants to escape by volatilization. Turnips and mustards can be used for fall cover but not all varieties and species will winter over into the spring. Several mustard species have biofumigation potential and a succession rotation of an August planting of biofumigant mustards that are tilled under in October followed by small grain can significantly reduce diseases for spring planted vegetables that follow. More recent research in the region has been with forage radish. It produces a giant tap root that acts like a bio-drill, opening up channels in the soil and reducing compaction. When planted in late summer, it will produce a large amount of growth and will smother any winter annual weeds. It will then winter kill leaving a very mellow, weed-free seedbed. It is an ideal cover crop for systems with early spring planted vegetables such as peas. Oilseed radish is similar to forage radish but has a less significant root. It also winter kills. Brassicas must be planted early to mid-August through mid-September for best effect.

Mixtures to Provide the Best Range of Services
It is important to choose cover crops that provide the maximum service benefits. Research in the regions has shown that generally mixtures of 3 cover crops providing different services maximizes benefits and creates conditions that favor soil microbial diversity. Mixtures of rye with winter legume cover crops (such as hairy vetch) have been successful and offer the advantage, in no-till systems, of having a more rapidly decomposing material with the longer residual rye as a mulch. Other winter legume-small grain, winter legume-Brassics, small grain-Brassica, and small grain-winter legume-Brassica combinations have been successful.

Apple Trees Beware: Watch Out for Marssonina Blotch on Apple Trees
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Last year, Marssonina blotch caught growers off guard late in the season. In 2019, several orchards have been already observing Marssonina blotch on apple trees. This is a troubling disease since it can lead to premature defoliation. Depending on how temperamental Mother Nature will be over the next couple months, growers will need to be mindful of keeping trees protected, especially during frequent heavy rainfall events. This is an easy disease to manage and here are some nuggets of wisdom:

Marssonina Blotch
Marssonina blotch, caused by Marssonina caronaria, is found on leaves and fruit of apple. The disease is widely distributed and has been reported in North America, Europe, and Asia. The disease can cause severe defoliation. Conventional fungicides easily control this disease; therefore, it is considered a minor pathogen in Pennsylvania and Maryland.
Leaf spots first appear on the upper surface of mature leaves mid to late summer. They are 5-10 mm in diameter, grayish, brown, and tinged purple at the periphery. Small black fungal fruiting bodies are often visible on the surface. When lesions are numerous, they coalesce, the surrounding tissue turns chlorotic, and defoliation results. Cultivars do not differ significantly in susceptibility to the disease; however, Rome apple trees are very susceptible.

This fungus can also infect fruit; however, we have yet to observe it in the field. Reports have shown trees with numerous leaf infections most likely will have fruit infections.

Marssonina Blotch Early Symptoms

Marssonina Blotch Late Symptoms

**Marssonina caronari** disease cycle

Similar to apple scab, primary infections are initiated by ascospores produced on overwintered leaves. Mature ascospores are found just before the bloom stage of bud development. Ascospore discharge usually lasts for 3-4 weeks. Rain is required for spore release. Primary symptoms appear in the middle of June, usually on mature leaves. Infection of leaves by conidia takes place most frequently at 68 - 77°F, and symptoms are present within 8 days of inoculation. Defoliation begins about 2 weeks after the symptoms appear. Considering many in the region experienced a wet spring and frequent rain events during the summer, the disease pressure is high this year.

**Disease management**

Most cultivars are susceptible to this disease. Consequently, be mindful of your fungicide applications through harvest. Once the disease becomes established, it is very difficult to get under control and trees will defoliate prematurely quickly. To date, we have observed, Rome, Honeycrisp, and apple scab resistant varieties to be very susceptible if fungicides applications have not been maintained. As a result, reapplication of fungicides after major rain events will be critical.

If you already actively control for apple scab, you will also control Marssonina blotch year to year. Just like for apple scab, disease control is managed through orchard sanitation, pruning, and the use of fungicides. Removal of overwintered leaves on the ground may reduce the inoculum level. Conventional fungicides commonly used for early and summer apple diseases easily keep this disease in check. Anecdotally, sulfur has provided limited control and may only suppress the disease. Consequently, organic growers may struggle the most with Marssonina blotch. Sanitation and dormant copper sprays will be important in these orchards.

Timely Viticulture is an electronic newsletter that is designed to give those in the grape industry a timely reminder of things they should be considering in the vineyard. Since we are all busy it is not meant to be an exhaustive list of things to consider or even a full discussion of the options. It is just meant to think about what is happening and what is coming up, with some comments.

**Harvest (August-September)**

Brown Marmorated Stink Bug (BMSB) - Part 1 (pdf)
Brown Marmorated Stink Bug (BMSB) - Part 2 (pdf)
Brown Marmorated Stink Bug (BMSB) - Part 3 (Fruit Damage and Juice/Wine Taint) (pdf)
Red Leaves in the Vineyard—Diagnosis and Management (html) (pdf)
Spotted Lanternfly (SLF) I - Background (html) (pdf)
Spotted Lanternfly (SLF) II - Scouting and Management (html) (pdf)

**New!**

2016 Sample Wine Grape Spray Schedule (pdf)

Ben Beale, Extension Educator, UME-St. Mary’s County
Cassandra Swett, Ph.D., Assistant Professor, Grape and Small Fruit Pathology

Click on links below to go to:
Dormant | Pre-Bloom | Bloom | Post-Bloom | Mid-Season | Pre-Harvest | Harvest | Post-Harvest
Fungicide Resistance in *Botrytis cinerea* from Brambles in Maryland

By Mengjun Hu
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Plant Science and Landscape Architecture
University of Maryland
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Gray mold caused by *Botrytis cinerea* is one of the most important pre- and postharvest diseases on small fruits such as strawberries and brambles. Control of gray mold largely relies on fungicides. While resistance monitoring has been conducted for *Botrytis* isolates from strawberries in many states, information regarding frequency of resistance to different fungicides in *Botrytis* from brambles is limited in the Mid-Atlantic.

Thus, a total of 74 *Botrytis* isolates collected from black raspberry (30), blackberry (11), and red raspberry (33) fields in Maryland were tested for resistance to cyprodinil (an active ingredient in Switch), fludioxonil (one active ingredient in Switch), fenhexamid (Elevate), iprodione (Rovral), thiophanate-methyl (Topsin M), pyraclostrobin (Cabrio), boscalid (Pristine), benzovindiflupyr (Aprovia), pentaipyrid (Fontelis), isofetamid (Kenja), or pydiflumetophen (Adepidyn). Note that these active ingredients are color coded by their FRAC codes (same color represents the same FRAC code).

As a result, resistance was detected in all of the fungicides tested with variable frequencies (figure 1). For example, high frequency of resistance was found to pyraclostrobin and cyprodinil, whereas low frequency of resistance was found to isofetamid and pydiflumetophen.

![Figure 1. Frequency of resistance to multiple chemical classes of fungicides.](image)

Although gray mold is a common fungal disease on many small fruit, some newer fungicides labeled for gray mold control have not yet labeled for the use on brambles. For example, Fontelis (pentaipyrid), and Merivon (fluxapyroxad; pyraclostrobin) used on strawberries are not currently available for brambles. Interestingly, resistance was detected to benzovindiflupyr, pentaipyrid, and pydiflumetophen, which have not been labelled on brambles. These results may suggest the movement of *B. cinerea* isolates between different host plants in the same or different fields.

Given a variety of small fruits typically grown at the same farms in Maryland, the sustainable management of gray mold and its fungicide resistance is a challenge. Frist, as mentioned above, *Botrytis* isolates from brambles could have come from strawberry fields nearby that have undergone the resistance selection. In this scenario, selection for fungicide resistance in *Botrytis* may have been accelerated due to such “in-season” movement. Second, some bramble cultivars (i.e. primocane cultivars) have a long-growing season, from May to Nov, depending on locations. When limited chemical classes of fungicides meets ever-flowering cultivars in wet and humid climate, it is difficult to not spray each FRAC code no more than twice a season. Third, the raising resistance issues in *Botrytis* further limit fungicide choices.

Taken all together, spray less is a good way to keep the stream of FRAC codes not running out. Maintaining a minimum of two-week interval would be a good start. If no rain is forecasted, the interval can be extended to three weeks or so. Regarding spray materials, multi-site fungicide Captan should be used as a backbone in the spray program, which is much less prone to resistance development. Only tank-mixing Captan with fungicides with less resistance issues such as Kenja (isofetamid) or Switch (fludioxonil) under high infection risk of gray mold. Don't use Kenja or Switch more than 2 times a season. Note that Kenja is in the same FRAC group as Luna Tranquility, you can choose either one to use but preferably no more than 2 times of this group. Again, it is important to always maintain continuous coverage of Captan throughout the season, especially during critical stages (i.e. flowering/fruit ripening).

**AG MARKETING ALERT!**

An article "Mastering Marketing–August 2019: Matching Prices to Market Outlets" has been posted on the web.

To access this article please click on the link below:
[https://extension.umd.edu/learn/matching-prices-market-outlets](https://extension.umd.edu/learn/matching-prices-market-outlets)

If you have any questions or comments about this article or have clients or colleagues that would value receiving it as well, please contact Ginger Myers at gsmyers@umd.edu or sbarnes6@umd.edu

**AG MARKETING**

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![AG Marketing Logo](image)
When to Plant Plasticulture
Strawberries, New Varieties to Trial
By Gordon Johnson
Extension Vegetable & Fruit Specialist
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In some years, later planted ‘Chandler’ strawberries have out-yielded earlier plantings. This illustrates the dramatic effects that fall and winter temperatures can have on plasticulture production.

‘Chandler’ has been our main plasticulture berry and has shown consistently high yields. For most of Delaware, the recommendation has been to plant ‘Chandler’ the second week in September. However, ‘Chandler’ is more sensitive to fall and winter temperatures than other varieties and in warmer conditions ‘Chandler’ will put on too much growth, leading to small berries the following spring; therefore, knowing when to plant is difficult. If you could accurately predict fall and winter temperatures, you could adjust planting dates, but of course this is not possible.

One strategy has been to make multiple plantings of ‘Chandler’ one week apart starting the second week in September. This will insure that a part of the crop will come out of winter with the proper number of crowns (not too many, not too little). Unfortunately, this means that part of the crop will be low yield and part will have small berries.

Another strategy is to switch to varieties that are less susceptible to putting on too much growth. This is where the variety ‘Camarosa’ may have a fit, as it is less temperature sensitive than ‘Chandler’ in the fall and is not prone to putting on excessive growth. ‘Camarosa’ can increase mid-to-late season spring sales when ‘Chandler’ quantity and quality declines as the temperatures increase.

‘Sweet Charlie’, the early berry that also can put on a second late crop, is normally planted 7-10 days ahead of ‘Chandler’. It is not an option to replace ‘Chandler’. Another strawberry that should be considered by growers is Albion, a day-neutral variety. It too is not sensitive to when it is planted in the fall. While much less productive in the main ‘Chandler’ season, it has some unique properties that make it valuable to growers. First, it will give some early production, ahead of ‘Chandler’. Second, even though production is lower, it produces evenly over an extended period of time from April through early July. In general it will give 5-6 weeks more production than ‘Chandler’. It is a large, firm berry that, while not as sweet early in the season, has good quality in May and June. It requires much more nitrogen than ‘Chandler’ to produce adequately sized plants and production.
A new issue of Branching Out is now available! Sign up for our online "The Woods in Your Backyard" course or the General Forestry Course. Read about some woodland myths and new strategies for planting hardwoods. Our regular features include profiles of the American mink in the Woodland Wildlife Spotlight and Japanese knotweed in Invasives in Your Woodland, as well as the events calendar and the Brain Tickler challenge.

The Summer 2019 issue is available here: https://go.umd.edu/Summer_2019
Download your PDF copy from our website: Branching Out Vol. 27, No. 3 ~ Summer 2019

Branching Out, Maryland's Forest Stewardship Education newsletter, is published four times per year by University of Maryland Extension. Branching Out provides educational information and current news and events, and is intended to reach anyone interested in forest stewardship including landowners and natural resource professionals.

We encourage you to share this free newsletter with others and to invite them to subscribe at: http://extension.umd.edu/woodland/subscribe-branching-out
You can review past issues of Branching Out by visiting: http://extension.umd.edu/publication-series/branching-out

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August Update from the Walsh Lab
Microbiological Water Quality Profile
By Carol Dianne Allen
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In April we started tracking generic E. coli populations in two surface water sources – Paint Branch and Seneca Creeks. If a farm were depending on water from one of those streams for overhead irrigation, the Microbiological Water Quality Profile would be invaluable in determining relative safety and/or potential risk of using that water. The Microbiological Water Quality Profile (MWQP) takes the water data you have been getting back from the lab (generic E. coli in either MPN/100 ml or CFU/100ml) and calculates the generic mean as well as the statistical threshold. Cornell University has generated an Excel spreadsheet that can do all of that intimidating math for you. It can be found here: https://cvp.cce.cornell.edu/submission.php?id=370

This month we would like to take you step-by-step through the process of using this tool. When you open up the spreadsheet, be sure to click on the “Enable Editing” message found near the top heading of any page to be able to make changes. You will now be able to navigate all of the features of the document. Notice there are tabs located in the lower left corner. Start with the Introduction tab (click on it) to read the background information on the MWQP. The next tab gives an example of a completed MWQP and the last two are Protected MWQP and MWQP. You might find it helpful to “Save As” a copy (or copies) to your computer at this point, labeling each with the name of the water source or sources specific to your farm.

For the sake of brevity, the images below show how the spreadsheet was used to determine the MWQP for the Paint Branch using the MWQP tab. Note that with only 16 of the required 20 samples it is not yet a valid MWQP for the Produce Safety Rule. As this spreadsheet generates the GM & STV steadily as you enter your water sample data, it will still give you an idea of your water quality trends. You have plenty of time to be compliant.

In the middle of the document are a set of specific instructions and some definitions. Your “Initial” water samples will be the first 20 that you enter over the 4-year span. As you progress beyond that point, the entries will be designated as “Annual”. You will be using this spreadsheet for the life of the water source.
Immediately to the left of the spreadsheet is the area of data input (table 1). Equations have been imbedded into the spread sheet that will make the accumulating computations that are necessary for the final MWQP. In a colored area at the top of that section is the Produce Safety Rule Microbial Quality Criteria. Water values below these levels are our goal.

The right-hand information is the area of interpretation. The values from the data table (table 1) are automatically brought over into tables 2 and 3 and the determination of your MWQP is made.

As you can see the current MWQP of the Paint Branch would indicate that it would be too high a risk to use as overhead irrigation without either a period of "die-off" or water treatment. Your values hopefully will be better!

If you are unfamiliar with using Excel spreadsheets, our office would be happy to help you start your own MWQP. Please contact Carol Allen at callen12@umd.edu or call 301-405-4372 for an appointment. We will be happy to help you through this aspect of the Produce Safety Rule of FSMA or any questions you may have concerning GAP accreditation.

*The FDA has extended the compliance dates on agricultural water quality standards to January 26, 2022 or 2023 or 2024 based on the size of the covered farm. More information can be found at: https://producesafetyalliance.cornell.edu/sites/producesafetyalliance.cornell.edu/files/shared/documents/Water-Analysis.pdf
plants as they feed. APHIS and state cooperators continue to work together to assess the affected areas in the states, and to implement a cooperative response program that detects, contains, and suppresses SLF populations.

During 2018, the Pennsylvania Department of Agriculture (PDA) and APHIS confirmed a small SLF population in Dauphin County, Pennsylvania. In addition to Dauphin County, SLF populations remain in all or portions of 13 other counties (Bucks, Berks, Carroll, Chester, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Philadelphia, and Schuylkill) in the State. APHIS and PDA continue to treat populations in support of the containment and suppression strategy for SLF.

Currently, Winchester City and Frederick County, Virginia remain the only known infested areas in Virginia. APHIS continues to work with the Virginia Department of Agriculture and Consumer Services (VDACS) to treat the infested area in support of containing SLF. APHIS and VDACS continue to perform intensive survey work throughout the State.

Since June 2018, APHIS and the New Jersey Department of Agriculture (NJDA) have confirmed populations of SLF in five counties (Burlington, Camden, Gloucester, Salem, and Somerset), including previously reported counties of Warren, Mercer, and Hunterdon in the State. APHIS and NJDA continue to perform treatment and survey to contain and suppress SLF.

Since August 2018, APHIS and the Delaware Department of Agriculture (DDA) have confirmed populations of SLF in Northern New Castle County, Delaware. APHIS and DDA continue to treat the SLF population in portions of the County and perform survey work in the remaining portions of the State.

In October 2018, APHIS and the Maryland Department of Agriculture (MDA) confirmed an adult SLF population in Cecil County, Maryland. PPQ and MDA continue to delimit this small infestation and establish treatments in support of the containment and suppression strategy.

In 2019, APHIS added emergency funding to support North Carolina’s survey for SLF. In addition, APHIS continues to provide emergency funding to monitor, detect, and treat new outbreaks in Delaware, Maryland, New Jersey, New York, Pennsylvania, Virginia, and West Virginia.

A coordinated response effort between federal, state, industry, and the public is necessary to protect crops, forests, and residential landscapes from this invasive pest. APHIS continues to coordinate area-wide responses with the States’ Departments of Agriculture. The affected states are also in the process of deploying a pest management strategy that includes surveillance, treatment and control, and outreach activities to reduce the population and spread of SLF.

For additional information about the SLF program, you may contact National Policy Manager John Crowe at 301-851-2108 or John.F.Crowe@usda.gov.

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EPA Takes Action to Provide Accurate Risk Information to Consumers, Stop False Labeling on Products

EPA is issuing guidance to registrants of glyphosate to ensure clarity on labeling of the chemical on their products. EPA will no longer approve product labels claiming glyphosate is known to cause cancer – a false claim that does not meet the labeling requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The State of California’s much criticized Proposition 65 has led to misleading labeling requirements for products, like glyphosate, because it misinforms the public about the risks they are facing. This action will ensure consumers have correct information, and is based on EPA’s comprehensive evaluation of glyphosate.

"It is irresponsible to require labels on products that are inaccurate when EPA knows the product does not pose a cancer risk. We will not allow California’s flawed program to dictate federal policy," said EPA Administrator Andrew Wheeler. “It is critical that federal regulatory agencies like EPA relay to consumers accurate, scientific based information about risks that pesticides may pose to them. EPA’s notification to glyphosate registrants is an important step to ensuring the information shared with the public on a federal pesticide label is correct and not misleading.”

In April, EPA took the next step in the review process for glyphosate. EPA found – as it has before – that glyphosate is not a carcinogen, and there are no risks to public health when glyphosate is used in accordance with its current label. These scientific findings are consistent with the conclusions of science reviews by many other countries and other federal agencies.

On Feb. 26, 2018, the United States District Court for the Eastern District of California issued a preliminary injunction stopping California from enforcing the state warning requirements involving glyphosate’s carcinogenicity, in part on the basis that the required warning statement is false or misleading. The preliminary injunction has not been appealed and remains in place.

California’s listing of glyphosate as a substance under Proposition 65 is based on the International Agency on the Research for Cancer (IARC) classifying it as “probably carcinogenic to humans.” EPA’s independent evaluation of available scientific data included a more extensive and relevant dataset than IARC considered
during its evaluation of glyphosate, from which the agency concluded that glyphosate is “not likely to be carcinogenic to humans.” EPA’s cancer classification is consistent with many other international expert panels and regulatory authorities.

Registrants with glyphosate products currently bearing Proposition 65 warning language should submit draft amended labeling that removes this language within 90 days of the date of the letter.

For information about ongoing activities in the Office of Pesticide Programs, visit our homepage.

Interest in Urban Farming Assessment

Do you have an interest in urban farming? If so, please complete this short, 5-minute interest assessment survey.

Why take the survey?
The more interest there is for urban agriculture, the more resources and support will be available!

Take the survey here: https://forms.gle/RhQLfRpAAmyjkFmi8

Survey created by Maria Gumerov--AGNR Student Intern at Anne Arundel County Extension Services, 97 Dairy Ln, Gambrills, MD 21054

See the Attachment!

1) Practical Experiences in Nutrient Management Workshop Flier

Vegetable & Fruit News

A timely publication for the commercial vegetable and fruit industry available electronically in 2019 from April through October on the following dates: April 25, May 24, June 13, July 18, August 15, September 19 and October 24 (Special Research & Meeting Edition).

Published by the University of Maryland Extension Focus Teams: 1) Agriculture and Food Systems; and 2) Environment and Natural Resources.

Submit Articles to:
Editor,
R. David Myers, Extension Educator
Agriculture and Natural Resources
97 Dairy Lane
Gambrills, MD 21054
410 222-3906
myersrd@umd.edu

Article submission deadlines for 2019 at 4:30 p.m.
ON: April 24, May 22, June 12, July 17, August 14, September 18 and October 23 (Special Research Edition).

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THE MARYLAND NUTRIENT MANAGEMENT PROGRAM PRESENTS:
PRACTICAL EXPERIENCES IN NUTRIENT MANAGEMENT
A CONTINUING EDUCATION WORKSHOP

September 11, 2019 9:00 am (registration) - 2:30 pm
Western Maryland Research and Education Center (WMREC)
18330 Keedysville Rd, Keedysville, MD 21756

COURSE DESCRIPTION
Hands-on activities to enhance any certified farmer or certified nutrient management consultant’s skill set.

➢ “Grape and small fruit tissue sampling and interpretation” led by Dr. Joe Fiola
➢ “Estimating Hay and Pasture Forage Yields” led by Dr. Amanda Grev
➢ “Manure spreader calibrations” led by the UMD Agricultural Nutrient Management Team

During the lunch break, MDA will have a question and answer session.

CEUs
4 hours of credit toward consultants’ or operators’ continuing education requirement.

WHO SHOULD ATTEND
Certified nutrient management consultants, or operators, and any individual interested in increasing practical crop production and nutrient management knowledge.

Registration Deadline – September 6, 2019

DIRECTIONS will be sent with confirmation.

COST
$30.00 for the day, payable in advance, covers materials, lunch and coffee breaks.

FOR MORE INFORMATION
Call (410) 841-5959

REGISTRATION FORM
MARYLAND NUTRIENT MANAGEMENT PROGRAM
Continuing Education Workshop
"Practical Experiences in Nutrient Management 2019"

Name:________________________________________________________ Certified?  Yes ☐  No ☐
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