

# VEGETABLE CROPS HOTLINE

A newsletter for commercial vegetable growers prepared by the Purdue University Cooperative Extension Service

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**BACTERIAL FRUIT BLOTCH OF WATERMELON** - (Dan Egel, [egel@purdue.edu](mailto:egel@purdue.edu), 812-886-0198) - This disease has been observed in Indiana on seedless watermelon. The initial leaf symptoms of bacterial fruit blotch are not responsible for defoliation or yield losses. However, the irregular, necrotic lesions can be diagnostic for the disease (see Figure 1). The fruit phase of the disease can be very damaging. The primary symptom is a dark green, irregular blotch that occurs on the top of the watermelon fruit (see Figure 2). (Other cucurbits can also be affected by bacterial fruit blotch.) Older fruit lesions will have a necrotic area in the center of the lesion. Sometimes the rind will crack and white ooze will come out of the fruit. Although bacterial fruit blotch will seldom invade the fruit farther than the rind, the fruit may start to rot from other organisms. Damage results in rotted or defaced fruit.

The bacterium that causes bacterial fruit blotch may be seed borne. The causal bacterium may survive in the greenhouse on benches, flooring or transplant trays. All greenhouse surfaces and tools should be cleaned and disinfested seasonally.

Bacterial fruit blotch will spread rapidly in warm, moist conditions. Rains or overhead irrigation will quickly spread this disease. No resistance to this disease

has been reported in commercial varieties. Growers who observe leaf lesions may want to apply a copper product to try to slow the spread of the disease. Actigard® is also labeled for bacterial fruit blotch. The active ingredient in Actigard® is designed to activate plant defense responses. There are quite a number of label restrictions such as to avoid applying to stressed plants. See Actigard® label for more. Fruit become infected about two weeks after pollination. Thus, if there is a significant amount of young fruit in a field, it may be worth applying copper. It is always a good idea to practice fall tillage and rotate away from cucurbit production for 2 to 3 years.

Current research suggests that fruit lesions will not expand after harvest unless secondary infection has taken place. However, it is a good idea to cull those fruit with lesions. In addition, equipment that comes into contact with affected fruit should be regularly disinfested. If possible, chlorinate any water used in post-harvest operations. (Originally published 6/16/2014 at <http://veggiediseaseblog.org>)



**Figure 1.** Leaf lesions of bacterial fruit blotch of watermelon are not responsible for yield loss, but can help to diagnose the disease early. (Photo by Dan Egel)



**Figure 2.** Lesions of bacterial fruit blotch of watermelon are often dark green and water soaked. (Photo by Dan Egel)



**POTATO LEAFHOPPER** - (Rick Foster, [fosterre@purdue.edu](mailto:fosterre@purdue.edu), 765-494-9572) - Populations of potato leafhoppers continue to be high on a variety of crops. The vegetable crops most commonly attacked are beans and potatoes, but they can also damage cucumbers, eggplant, melons, pumpkins, and squash. The pale green adults will usually quickly fly away when you disturb the plants, but the nymphs, which also cause considerable feeding damage, will be present on the underside of the leaves. Leafhoppers feed on the phloem with their sucking mouthparts, but also inject a toxin into the plants in their saliva that causes a condition known as hopperburn. Be especially watchful if your vegetables are near an alfalfa field that is being harvested, as the leafhoppers may move from the alfalfa into your vegetables. Fortunately, leafhoppers are relatively easy to control with insecticides.



**CORN EARWORM** - (Rick Foster, [fosterre@purdue.edu](mailto:fosterre@purdue.edu), 765-494-9572) - Corn earworm pheromone trap catches are quite variable around the state (<http://extension.entm.purdue.edu/cornearworm/index.php>), ranging from 0 to around 20 per night. The variability is why it is important to have your own trap. We are probably at about the peak of the first generation. Normally we will see a lull in earworm moth catches during much of July, with populations increasing in August either from the emergence of the second generation or from moths migrating from the South. Again, the arrival of the second generation and especially the migration is

highly variable, so we have to use traps to know when those events occur.

At this point in the season, before the neighboring field corn silks, I recommend that you spray when your sweet corn has fresh green silks present and you are catching any moths in your trap. When numbers are fairly low, I would make the first spray at about 70% of your plants silking. When counts get high, beginning at a lower percentage seems reasonable. Remember as you spray, that you are only protecting those plants that have silks showing. Eggs hatch in about 3 days, so that is often the benchmark used for how often to spray. If moth counts are low, you might stretch that interval to every 5 days or if they are extremely high (> 100 moths per night), you should probably lower the interval to 2 days. Generally, you can stop spraying when most of the silks have turned brown.

For many years, the pyrethroid insecticides have provided excellent control of earworms, but there is an increasing amount of resistance to those products. According to my trials over the last several years, Coragen and Radiant are the alternative products that provide the best control.



**STRIPED CUCUMBER BEETLES AND BACTERIAL WILT** - (Rick Foster, [fosterre@purdue.edu](mailto:fosterre@purdue.edu), 765-494-9572 and Dan Egel, [egel@purdue.edu](mailto:egel@purdue.edu), 812-886-0198) - Populations of striped cucumber beetles remain high in many areas of the state and fairly substantial amounts of bacterial wilt are being observed in fields where beetle control was not achieved. We are probably approaching the end of the overwintering generation of beetles, so numbers should start to diminish soon. Wilt symptoms may not show up until about 2 weeks after infection. Fruit on vines that are wilted should not be harvested because they will lack the necessary sugars for proper flavor. Remember that as cantaloupe vines grow, they become less susceptible to bacterial wilt, regardless of the presence of cucumber beetles. After about the time that vines have covered the plastic mulch, cucumber beetles should be managed for feeding damage instead of as vectors of bacterial wilt.



**EUROPEAN CORN BORERS AND BLACKLIGHT TRAPS** - (Rick Foster, [fosterre@purdue.edu](mailto:fosterre@purdue.edu), 765-494-9572) - European corn borers used to be one of the most important pests of a number of vegetable crops, most notably sweet corn, peppers, green beans, and sometimes tomatoes. However, with the adoption of Bt field corn by virtually the entire agronomic community, populations of European corn borers have been greatly diminished and serious damage from this old pest is relatively rare in most areas of the state.



Purdue Pest Management Program for many years maintained blacklight traps at each of the eight Purdue Ag Centers (PACs) to monitor populations of several insects, including corn earworm, European corn borer, and armyworm. Last year, we placed corn earworm pheromone traps at each of the PACs because the information from the pheromone traps was more useful and accurate than from the blacklight trap. Since corn borers had dropped in importance, we made the decision this year to stop running the blacklight traps. This decision was based on the time and expense of maintaining the blacklight network, plus the Postal Service was beginning to rebel at our shipping smelly boxes of decaying insects. We have now placed armyworm pheromone traps at each of the PACs and we believe that will provide us with superior information for that pest as well.

There are no pheromone traps available that we think work well for European corn borers. There are a few pockets around the state where, for whatever reason, corn borers are still a problem. Our decision to stop using the blacklight traps has left those growers with a void of information. There are several methods those growers can use to monitor corn borer activity in lieu of blacklight trap information: 1. Leave your porch lights on at night and see if corn borers are flying to the light, 2. If you are driving at dusk or later, watch for moths flying across in front of your headlights. There is a good chance those are corn borers because they spend the day-time hours outside the field and move into the field to lay eggs at night, 3. Walk through weedy areas near your fields during the day because that is where corn borers hang out in the daytime, mating and drinking dew from the plants. If you see them fly up as you walk through those areas, then you know they are active.



**FUNGICIDE RULES** - (Dan Egel, [egel@purdue.edu](mailto:egel@purdue.edu), 812-886-0198) - The following are some rules to follow to make fungicide applications more effective.

1. Most foliar diseases require leaf moisture for infection to take place. In addition, many diseases require water splash to spread disease from leaf to leaf and plant to plant. Most foliar diseases will be more prevalent when there have been lots of rain and dew periods. Therefore, apply fungicides more frequently when there has been lots of rain. Cantaloupe and watermelon growers can follow the Purdue University program MELCAST to help schedule fungicides.
2. Although fungicides should be applied more frequently when it rains, it is not necessary to re-apply fungicides every time it rains. Most fungicides have good stickers so that they are not washed off each time it rains.
3. If at all possible, apply a fungicide application

before it rains, not after. Since rain is associated with increased foliar disease, apply the fungicide so that the plants will be protected from the spores splashed from leaf to leaf. A general rule is to apply a fungicide if it appears that it will dry before it rains.

4. Contact fungicides like mancozeb or chlorothalonil products only protect foliage they come into contact with. Systemic fungicides, on the other hand, move within the plant and may stop infections inside a leaf. However, most systemic fungicides do not move more than a few centimeters toward the growing point of the plant, or from one side of the leaf to another.
5. All fungicides, whether labeled contact or systemic, protectant or curative, will do a better job of slowing plant disease if applied before the disease starts, or at least, before a disease becomes too severe. Remember, no fungicides will turn brown areas on a leaf to green.
6. Systemic fungicides, those with a single mode of action, if applied again and again in sequence, may cause the disease fungi to mutate into a form resistant to the fungicide. Always alternate fungicide applications from one FRAC code (MOA code) number to another. Contact fungicides like chlorothalonil and mancozeb are very unlikely to cause such mutations and therefore may be applied in sequence.
7. Apply fungicides for those diseases you suspect may show up in your field. It is not necessary to re-apply a fungicide immediately just because a disease shows up, unless it is one that is not covered by any of your fungicides. Some symptoms may turn out to be non-disease problems, like a low pH, or a disease like Fusarium wilt for which no foliar fungicide will help.
8. Some diseases, such as downy mildew and Phytophthora blight may require specialized fungicides. It may be wasteful to apply specialized fungicides all season long for diseases that are not a threat.
9. For the most part, copper products are more effective against bacterial diseases than they are against fungal diseases.
10. Always check the label for safety information like protective equipment, regulatory information like re-entry interval, and efficacy information like what crops and diseases are on the label. Remember, the label is the law.

(Originally published 6/24/2014 at <http://veggiediseaseblog.org>)



**MAGNESIUM AND MANGANESE: TWO DIFFERENT PLANT NUTRIENTS** - (Liz Maynard, [emaynard@purdue.edu](mailto:emaynard@purdue.edu), 219-531-4200) - Magnesium and manganese are sometimes confused because the words sound similar. They are both plant nutrients, but they are not interchangeable. This article will discuss quantities required by plants, tissue sufficiency ranges, symptoms of deficiency and toxicity, and methods for supplying the nutrients.

Magnesium (I think of think mag wheels and magazines) is abbreviated Mg. It is considered a macro-nutrient because plants need it in fairly large quantities. Magnesium is part of chlorophyll and many enzymes in plant cells require magnesium in order to function.

In dried tomato leaves, a magnesium concentration of 0.4% to 0.6% is considered adequate at the time of first harvest. For cantaloupe at early fruiting, leaf concentration between 0.35% and 0.8% is acceptable, and for watermelon at midgrowth, 0.6% to 0.8%. Most other vegetables have similar requirements.

Several numbers on a soil test report are useful for determining whether application of magnesium is advised. The level of magnesium is one. Soil levels of magnesium are commonly determined by extraction with 1 N neutral ammonium acetate. On a sandy soil, magnesium is recommended if the magnesium level determined with this method is less than 35 ppm. On a fine textured soil, application is recommended if the magnesium level is less than 50 ppm.

The relative amount of magnesium compared to other positively-charged nutrients like potassium and calcium is also important. If magnesium is less than 3% of the exchangeable bases, application is recommended. Or, if the percent exchangeable potassium is greater than the percent exchangeable magnesium, application is recommended.

Magnesium is contained in dolomitic limestone. In fields where dolomitic lime is used regularly, magnesium is usually high. If the soil test indicates magnesium is needed and pH also needs to be raised, dolomitic limestone is a good choice.

If soil pH is OK, and magnesium is needed, broadcast magnesium at 50 to 100 lbs./A, or band 10 to 20 lbs./A. Magnesium can also be applied as a foliar spray at 1 to 4 lbs./A.

Magnesium sulfate is a common source of magnesium. Epsom salts is magnesium sulfate, containing 10% magnesium.

Magnesium deficiency is most common on acid sandy soils. Symptoms include yellowing between leaf veins, starting on older leaves (see Figure 3). Suspected magnesium deficiency can be confirmed with soil and tissue tests. Excess magnesium can interfere with uptake of other nutrients so it makes sense to apply only when it is needed. If magnesium deficiency is confirmed during the season foliar applications may be beneficial.

Manganese is abbreviated Mn. It is classified as a micronutrient because plants need it in small amounts.

It is required for many of the enzymes and reactions that occur in plant cells.

For cantaloupe at early fruiting, manganese content of 20 to 200 ppm in recently mature dried leaves is considered sufficient; for other vegetables the published sufficiency range is of a similar order of magnitude.

Manganese deficiency and manganese toxicity can both be problems in Indiana vegetable production. Deficiencies are most likely to occur on black sandy soils near the Kankakee River in northwest Indiana and depressional heavy soils in Adams, Allen, Wells, and neighboring counties in northeast Indiana. Deficiencies are more likely when soil pH is above 6.2 to 6.3 because manganese is less available at higher pH.

Symptoms of manganese deficiency appear first on young leaves. The young leaves are chlorotic (yellow) between the veins. Other nutrient deficiencies or toxicities can cause similar symptoms, so a tissue test is needed to confirm the cause of the symptoms.

When manganese deficiency occurs during the growing season a foliar application is the best way to correct it. Manganese can be applied to the foliage at 1 lb./A of Mn. Manganese sulfate (23-28% Mn) is a suitable source for foliar application; there are also others. Fungicides containing manganese also supply the nutrient to the crop.

Prior to planting, a soil test for pH and manganese content can provide information about whether a soil application of manganese is recommended. In mineral soils, the critical soil test value is 6 ppm at pH 6.3 and 12 ppm at pH 6.7. If a soil application is needed, it is best to apply the manganese in a band.

For additional information about manganese fertilizer sources and application methods, see *Manganese Deficiencies in Indiana Soils* (AY-276-W) at <http://www.agry.purdue.edu/ext/pubs/AY-276-W.pdf>.

Manganese toxicity is most likely on acid soils. Wet conditions can increase the likelihood of toxicity because manganese is converted to a more soluble form in saturated soils.

Symptoms of manganese toxicity are frequently observed on cantaloupe and watermelon in southwest Indiana (see Figure 4). On cantaloupe the symptoms are small yellow spots on the upper surface of older leaves, and watersoaked rings around dead spots on the underside of lower leaves. On watermelon symptoms are dark brown spotting on the lower surface of older leaves, followed by vein browning. Cantaloupe are more sensitive than watermelon.

I don't have a recommendation for in-season correction of manganese toxicity. If soil pH is low, the recommendation for future years is to increase pH by liming the soil. This will reduce availability of manganese and help prevent problems in future years. Liming the soil to a slightly acid pH also makes other nutrients more available to plants. While there are lime products that can be applied during the growing season, I don't know of any studies showing that they will make a difference



in our production systems once manganese toxicity has been observed.



**Figure 3.** Magnesium deficiency in cantaloupe. (Photo by Rick Latin)



**Figure 4.** Manganese toxicity in cantaloupe. (Photo by Rick Latin)



**FRUIT SET IN ZUCCHINI** - (Liz Maynard, [emaynard@purdue.edu](mailto:emaynard@purdue.edu), 219-531-4200) - I have heard reports of small zucchini fruit dying and rotting or falling off the plant. Zucchini, like other squash, pumpkins, melons and cucumbers, have separate pollen-producing (male) and fruit-producing (female) flowers. Cool weather promotes production of female flowers at the expense of male flowers. It's not cool now, but we certainly had cool weather earlier this spring when flowers of early squash plantings were still developing. It is likely that those conditions resulted in production of more female flowers and fewer male flowers than usual. As a result, some of the female flowers did not get pollinated and the fruit will abort. Other factors that could limit

pollination include inadequate supply of pollinators (usually bees) or weather unfavorable for pollinator activity.

Figure 5 shows a plant in a field with this problem. Note the two female flowers just opening, one recently closed, and a fourth towards the front of the plant, with dried petals and a small fruit that appears to be aborting. There is one male flower (closest to the camera) just starting to open, two at the bud stage, and a few stalks where petals have fallen off. Normally I would expect to see more male flowers.

I don't know of any solution to the problem at this point. Aborted fruit can be removed so that it does not rot in place and promote disease on later fruit. Some growers may be able to market the unpollinated fruit before it starts to abort.



**Figure 5.** Zucchini plant with an abundance of female flowers. (Photo by Liz Maynard)



#### **REMEMBER FOOD SAFETY WHILE TENDING CROPS**

- (Scott Monroe, [jmonroe@purdue.edu](mailto:jmonroe@purdue.edu), 765-427-9910) - Statewide, it appears that the spring planting season has come to a close and that it is time to tend the crops. As crops are growing, required tending may present the chance for contamination by a foodborne pathogen. When tending crops, growers should keep in mind the following recommendations:

1. All farm workers should be trained in basic sanitation and field hygiene. Whether the worker is an employee, part of the family, or both, it is critical that all individuals who work with the crop receive this annual training. Sanitation and hygiene training doesn't need to be burdensome. Take 30 minutes before the start of work and go over basic principles such as hand washing, toilet locations, and how to deal with cuts and open wounds. Once the training is complete, *document* that it took place. Record

the date, the topics of the training, and have each worker sign the document to indicate that they were present. Cornell has some excellent materials that can help you get started. The materials can be purchased at <http://www.gaps.cornell.edu/educationalmaterials.html>

2. If not previously tested, now is a good time to test irrigation water. Water used for irrigation should meet EPA standards for recreational water use. Several certified labs around the state offer testing services for irrigation water. A list of certified labs may be obtained by contacting the Indiana State Department of Health (ISDH) or visiting their website at <http://www.state.in.us/isdh/22450.htm>.
3. As crops grow, frequent trips to the field are necessary for vine turning, hoeing, or staking. Make sure all equipment taken to the field has been stored in a secure place and is cleaned prior to use. Vine turning sticks for cantaloupe and watermelon crops are generally made of wood or cane. Thorough cleaning of sticks at the beginning of the day and prior to entering a new field will help prevent the introduction of a foodborne pathogen. Wooden tomato stakes should be inspected and washed prior to going to the field. Hoes, knives, and other weeding equipment should also be cleaned regularly and kept in good condition.
4. Being in the field for weeding, staking, or turning vines also presents an opportunity to monitor for animal activity. As trips are made to and from the field, be sure to note (and document) the level of wild and domestic animal activity in the field. Look for obvious signs of manure or tracks. While it is difficult to keep all wild animals out of the field, frequent scouting for animal activity will make it easier to see when populations are rising and introducing excessive contamination risk into the fields.
5. Cultivating equipment should be inspected and cleaned prior to going to the field. A daily check of equipment for leaking hoses, broken glass, or other hazards can reduce the risk of something happening in the field. Sprayers should be kept in good condition and filled only with clean water that meets the same standards as water being used for irrigation.

Remember that small steps taken during the growing season can go a long way towards reducing the overall risk of contamination by a foodborne pathogen.



**GAPs A to Z TRAINING AVAILABLE ONLINE** - (Liz Maynard, [emaynard@purdue.edu](mailto:emaynard@purdue.edu), 219-531-4200) - Purdue's Good Agriculture Practices A to Z training is available as an online course. Individuals may take the course from their own broad-band connected computer. The course meets current requirements of the Indiana State Department of Health for training in Good Agricultural Practices that is required of fruit and vegetable producers who sell fresh produce to groceries, restaurants, institutions, and other buyers who are not the end consumer. Individuals who take the course and complete online assessments successfully will receive a certificate to document that they have taken the course. The cost of the course is \$30. Individuals may register for the course at [www.distance.purdue.edu/gaps](http://www.distance.purdue.edu/gaps).

This course is based on GAPs A to Z workshops Purdue has offered around the state and in webinars over the last three years. Course participants view recorded presentations about health and hygiene, water, animals and animal products, sanitation on the farm, documentation and recordkeeping, and farm food safety plans. In order to receive a course certificate, participants must answer assessment questions at the end of each topic and get at least 90% correct. Participants can watch presentations and retake assessments as many times as necessary. Access to course materials expires after three months. If the course isn't completed within three months of registration, participants will have to reregister and repay for the course.

For more information about the online course, contact Scott Monroe at [jsmonroe@purdue.edu](mailto:jsmonroe@purdue.edu) or 765-427-9910. For more information about the ISDH registration and training requirement for wholesale fruit and vegetable producers, visit <http://www.in.gov/isdh/25773.htm> or contact an ISDH Farm Food Safety Consultant at 317-234-8569.



## UPCOMING EVENTS

**Organic Vegetable Tour at EcOhio Farm.** Tuesday, August 5, 2014, 9:00 A.M. to 12:00 P.M. EDT. 2210 S. Mason Montgomery Rd. Mason, OH 45040. Learn about organic vegetable production, fertility management, on-farm participatory research, and evaluating soil health on your farm. Free, but pre-registration is encouraged. Register at: [https://jfe.qualtrics.com/form/SV\\_djnhP-gOmIqiMJBH](https://jfe.qualtrics.com/form/SV_djnhP-gOmIqiMJBH). If you have any problem registering please contact Lori Jolly-Brown at 765-494-1301.



# Organic Vegetable Tour at EcOhio Farm



## Tuesday August 5th 9 a.m. – 12 p.m.

EcOhio Farm is a unique partnership between the Cincinnati Zoo and GreenBEAN Delivery. To learn more, check out the following video <https://www.youtube.com/watch?v=TqcDzAl6wiA>.

EcOhio is one of three farms who have partnered with Purdue University researchers to investigate how organic fertility amendments interact with soil factors to influence nutrient release, pathogen incidence, and vegetable productivity. Join us to learn about:

- Organic vegetable production
- Organic fertility management
- On-farm participatory research
- How to evaluate soil health on the farm

**Address:** 2210 S. Mason Montgomery Rd. Mason, OH 45040

**Cost:** Free, but pre-registration is encouraged. To register follow this link:

[https://purdue.qualtrics.com/SE/?SID=SV\\_djnhPgOmlqiMJBH](https://purdue.qualtrics.com/SE/?SID=SV_djnhPgOmlqiMJBH) If you have any problem registering please contact Lori Jolly-Brown at 765-494-1301

**For more information contact:**

Lori Hoagland or Liz Maynard

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