

VEGETABLE CROPS HOTLINE

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

Dan Egel, Editor
4369 N. Purdue Road
Vincennes, IN 47591
(812) 886-0198
egel@purdue.edu



No. 522
May 21, 2010

<<http://www.btny.purdue.edu/pubs/vegcrop>>

IN THIS ISSUE

- WIREWORMS IN MUSKMELONS
- THE PURDUE PLANT AND PEST DIAGNOSTIC LAB: THE 'DOCTORS' ARE IN
- STRIPED CUCUMBER BEETLES
- CORN EARWORMS
- INSPIRE SUPER® FUNGICIDE
- INTERCROPPING 'COVER CROPS' AND VEGETABLE CROPS
- TROUBLES WITH PLANT NUTRITION? TISSUE ANALYSIS MAY HELP
- LATE BLIGHT OF TOMATO
- BLACK ROT OF CABBAGE
- GOOD AGRICULTURAL PRACTICES (GAPs) ONLINE PRODUCE SAFETY COURSE

WIREWORMS IN MUSKMELONS - (Rick Foster) - Wireworms can be a pest of seedling melons, causing damage that looks similar to seedcorn maggots until you look closely at the dying plants. The wireworm is the larval stage of the click beetle. There are a number of species of wireworms in Indiana, with life cycles ranging from 1 to 5 years. The click beetles like to lay their eggs in grasses, so melon fields that had previously been sod or had grassy weed problems are more prone to wireworm problems.

Last year we had reports of wireworms feeding on muskmelon fruit Figure 1. When we spoke with growers in southwest Indiana this winter, several of them indicated that they had seen this problem for several years. Below are several suggestions for managing wireworms in melons.

- Be sure to control weeds, especially grasses in your rotation crops.
- When rotating to corn, use a soil insecticide that will control wireworms.
- Diazinon® applied preplant will provide some protection of seedlings.
- Admire® and Platinum® have shown mixed results in control of wireworms but, again, would only protect seedlings.
- Try to keep most of your fruit on the black plastic mulch, since the wireworms will have a harder time finding the fruit.

At this point, we don't have any evidence that spraying an insecticide on the crop when fruit are ripening will provide any protection against wireworms feeding on the fruit. The wireworms tunnel into the fruit where it contacts the ground, so getting an insecticide to that location would be very difficult.

If you have a problem with wireworms in your melon fruit this year, please save the wireworms and call me (765) 494-9572 or email me <rfoster@purdue.edu>. I want to identify the species of wireworms causing the problem so that we can determine the length of its life cycle. That will help in developing management programs for this pest.

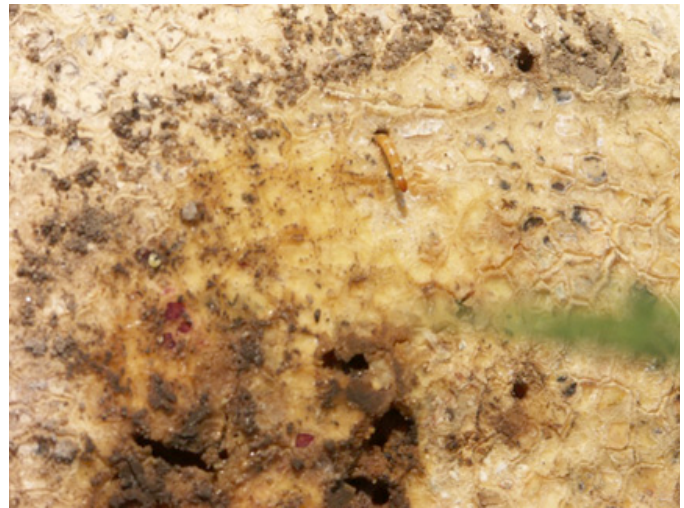


Figure 1: A wireworm can be seen burrowing into a muskmelon. (Photo by Dan Egel)



THE PURDUE PLANT AND PEST DIAGNOSTIC LAB: THE 'DOCTORS' ARE IN - (Tom Creswell and Gail Ruhl) - Plant and Pest Diagnostic Laboratory (P&PDL) - LSPS - Room 101, Purdue University - 915 W. State St. - West Lafayette, IN 47907-2054 - (765) 494-7071 - FAX: (765) 494-3958 - <www.ppd.l.purdue.edu>.

Our Lab - The Purdue University Plant and Pest Diagnostic Laboratory (P&PDL) specializes in the identification of plant diseases, insects and plants as well as in the diagnosis of plant-health related problems. The Lab is a central facility for receiving both physical samples and digital images. We are a partner in the National Plant

Diagnostic Network (NPDN), a national consortium of diagnostic laboratories that enhance agricultural security by rapidly detecting and monitoring pest and pathogens introduced into a new region of the United States.

Our Services - We strive to provide accurate and rapid identification of:

- Fungal, bacterial and viral plant diseases
- Insects and other arthropods
- Insect damage
- Unknown plants, including terrestrial and aquatic weeds
- Vertebrate pests
- Environmental/ cultural injury to plants

We serve as a source of unbiased information regarding pest management strategies and provide training for plant and pest related problems.

Our Fees - Our per sample handling fee for routine diagnosis is \$11.00 for in-state samples and \$22.00 for samples originating from out-of state. For information on additional services and testing fees see our website: www.ppd.purdue.edu/services.html.

Our Website - You may download forms, submit digital images for diagnosis and keep up to date on current plant problems and pests on our P&PDL website: www.ppd.purdue.edu.

Top 10 Diagnostic Tips

1. **Time is money:** Don't wait until the problem is widespread to send a sample. Many disease and insect problems are manageable if caught early.
2. **Dead plants tell no tales:** Plants that are totally dead, dry or rotten are useless for diagnosis. Collect and submit declining but not completely dead plants.
3. **What's bugging you?** Collect several examples of insects for ID, just in case some get damaged in shipping or if both males and females are needed. Many can be shipped in vials with 70% alcohol. More details at: www.ppd.purdue.edu/PPDL/physical.html.
4. **More is better:** The main concern may be overlooked if you send only one plant, one insect or a single branch. Send plenty of material or a whole plant if practical. Make sure samples are representative of what you are seeing. Digital images can help too!
5. **Get to the root of the problem:** Many plant problems are related to the roots and soil. Dig plants rather than pull them up to keep roots intact. Include plenty of the small roots and at least a cup of soil. (Complete soil nutrient analysis is available from commercial labs. For details see: www.ppd.purdue.edu/PPDL/pubs/MBP-3.pdf).
6. **A place for everything:** If soil gets on the leaves during shipment it can mask symptoms or even create a "disease" that wasn't there at shipment. Keep soil around roots so they don't dry out. Bag the roots and soil and tie at the main stem (Figure 1). Wrap foliage in newspaper lightly then pull the bag over the rest of the plant and tie the top loosely to keep foliage from drying out. Make sure foliage isn't wet before packaging.



Figure 1: Wrap roots in soil in a bag which can be closed with a twist tie before shipping. (Photo by Dan Egel)

7. **Include details:** The more you tell the diagnostic lab about the situation the better. Please give complete information including name of plant, location, percent affected, symptoms of concern, distribution, soil type and drainage, and fertilizers or pesticides used recently. For Plant ID or Weed ID please give full details requested on submission form.
8. **Fresher is better:** Mail or deliver samples as soon as you can. Store samples in a cooler on hot days until you can deliver or ship them. Avoid mailing samples on Fridays since most plants will start to rot after being in transit over a weekend. A next day delivery service is needed for urgent samples or those that may rot quickly in shipment.
9. **Fragile, handle with care:** Padded mailing envelopes may be used for woody plants which are not fragile but crush proof boxes with crumpled newspaper for padding are preferred in most cases (essential for herbaceous plants and turf samples). Insect vials must be padded to prevent breakage in shipment.
10. **'Heads-up' for priority samples:** When mailing high priority samples call to let us know the sample has been shipped so we will be on the 'look-out'! If you

are personally dropping off a sample and wish to visit with a diagnostician or specialist it is best to call ahead and schedule an appointment time.



STRIPED CUCUMBER BEETLES - (*Rick Foster*) - Striped cucumber beetles are out in many areas of the state. If you have cucurbits in the field, you should visit your fields at least 3 times per week to catch the beetles as soon as they arrive. Young plants tend to be especially susceptible to beetle feeding and/or bacterial wilt, so detecting the infestation early is important. Treatment with a foliar insecticide is recommended when populations exceed an average of 1 beetle per plant on muskmelons, cucumbers, and young pumpkin plants. Cucurbit crops that are not susceptible to bacterial wilt, watermelons and squash, should be treated when populations exceed 5 beetles per plant, or if young plants are being defoliated. The pyrethroid insecticides (Ambush®/Pounce®, Asana®, Baythroid®, Brigade®/Capture®, Mustang Max®, Warrior®) continue to give us the best control of earworms. Resistance is still a concern but we have not seen major problems the last couple of years. If problems develop with the pyrethroids, we will get the word out as soon as possible. Alternative chemistries that should be considered, if resistance is an issue, are Belt®, Coragen®, and Radiant®.



CORN EARWORMS - (*Rick Foster*) - It is now time to put up your corn earworm pheromone traps (Figure 1). To keep tabs on moth activity, look at our trapping data at: <<http://extension.entm.purdue.edu/cornearworm/index.php>>. Insecticide treatments should be applied when corn is in a vulnerable stage (green silks present) and 10 or more moths per night are being caught in your pheromone trap.



Figure 1: A corn earworm pheromone trap beside an experimental plot at the Southwest Purdue Agricultural Center in 2009. (*Photo by Dan Egel*)

The optimal time to make the first insecticide application against earworms is when approximately 70% of the ears have silked. Additional sprays should be

made every 2-5 days until silks start to turn brown. The interval between sprays is dependent on the number of moths being caught in traps and the temperature. Sprays should go on more frequently when lots of moths are being caught and/or temperatures are high, but never more often than every 2 days. During this time of year, spraying every 5 days is usually adequate.

The pyrethroid insecticides (Ambush®/Pounce®, Asana®, Baythroid®, Brigade®/Capture®, Mustang Max®, Warrior®) continue to give us the best control of earworms. Resistance is still a concern but we have not seen major problems the last couple of years. If problems develop with the pyrethroids, we will get the word out as soon as possible. Alternative chemistries that should be considered, if resistance is an issue, are Belt®, Coragen®, and Radiant®.



INSPIRE SUPER® FUNGICIDE - (*Dan Egel*) - This fungicide now has a national (section 3) label that includes Indiana for the cucurbit diseases powdery mildew, Alternaria leaf blight, anthracnose, gummy stem blight, Plectosporium blight as well as other diseases. Cucurbits listed on the label include muskmelon, watermelon, cucumber, squash, pumpkin and zucchini. There are several similar formulations of Inspire®, therefore cucurbit growers should check to make sure the label lists their crop(s) of interest.

Inspire Super® is a premix of difenoconazole (group 3) and cyprodinil (group 9). Like all systemic fungicides, Inspire Super® should not be applied in back to back applications-instead this product should be alternated with fungicide products of a different mode of action. (For more information on alternating products for fungicide resistance management see Table 25 on page 47 of the *Midwest Vegetable Production Guide for Commercial Growers 2010, ID-56* <www.btny.purdue.edu/Pubs/ID/ID-56> or the *Muskmelon and Watermelon Fungicide Guide for Indiana 2010, BP-134-W* <www.extension.purdue.edu/extmedia/BP/BP-134-W.pdf>). Other restrictions include: Inspire Super® can only be applied by ground, apply no more than 80 fl. oz. / A per year and Inspire Super® may not be applied within 7 days of harvest.

Cucurbit growers should find Inspire Super® effective against powdery mildew, gummy stem blight and anthracnose. Inspire Super® is the only systemic fungicide labeled on cucurbits that is labeled and effective against both anthracnose and gummy stem blight. Note that chlorothalonil (e.g., Bravo®, Echo®, Equus®) and mancozeb (e.g., Dithane®, Manzate®, Penncozeb®) products are contact fungicides useful against both anthracnose and gummy stem blight and are excellent products to use in alternation with systemic fungicide products. Neither chlorothalonil nor mancozeb products are effective against powdery mildew.

Inspire Super® will be an important new tool for cucurbit growers for the control of foliar diseases. However, Inspire Super® will not solve all foliar disease problems. If one chooses to use Inspire Super®, do so with care. Read and follow the label carefully, alternate the product with the appropriate product and call me if you have questions. The publications mentioned above may be found at <www.ag.purdue.edu/btny/Extension/Pages/VegetablePathology.aspx> or call (812) 886-0198.



INTERCROPPING 'COVER CROPS' AND VEGETABLE CROPS

- *Lori Hoagland* - A variety of benefits can be achieved by intercropping a 'cover crop' into a vegetable production system. These include weed suppression, increased water infiltration, provision of supplemental nutrients, reduced nutrient leaching, habitat for beneficial insects, and protection of vegetables from wind-blown soil. The cover crop will also improve the health of the soil, reduce erosion and reduce compaction by machinery where the cover crop is planted. Rotating vegetable crops with cover crops strips will allow vegetable crops to benefit from the improvements in soil health provided by the cover crop. Drawbacks of intercropping a cover crop include the cost of the cover crop seed, and the careful management required to prevent competition from the cover crop with the vegetable crop. Cover crops can also prevent the soil from drying and warming in the spring, and additional irrigation may be required in dryer areas. However, the improvement in the health and productivity of vegetable crops and reduced input costs that can be achieved through integration of a cover crop will generally outweigh the costs if managed appropriately.

A number of management strategies can be used to intercrop a cover crop in a vegetable crop system. The cover crop may be planted in fall or early spring, followed by the creation of strips for planting vegetable crops using tillage, herbicides, or roller crimping. This strategy works well for transplanted crops like brassicas and tomatoes, but is not suited for hilled crops such as potatoes or crops planted in narrow rows. A cover crop can also be drilled in between the rows of a vegetable crop prior to, or after planting the vegetable crop. Mowing is often used in either of these strategies to reduce competition by the cover crop, and to release nutrients held by the cover crop. Lastly, in crops that can tolerate direct competition by a low growing cover crop such as sweet corn or squash, a cover crop like clover may be broadcast over the vegetable crop after the second or third cultivation.

The choice of a cover crop species will depend on the goals that the grower hopes to achieve through the integration of a cover crop. For example, planting a crop with a deep taproot like alfalfa will aid in relieving soil

compaction and accessing nutrients deep in the soil profile. A mixture of perennial rye and hairy vetch can suppress weeds, enhance soil organic matter and provide nitrogen for the vegetable crop. Annual ryegrass is highly effective as an erosion fighter because of its extensive soil-holding root system, and will also protect vegetable crops from wind-blown soil and keep the mud out of the harvest. Rotating vegetable crops with brassica cover crops can help suppress soil-borne pathogens that may reduce the productivity of a vegetable crop.

A wide variety of resources are available to assist growers in choosing which cover crop species to plant, and which management strategy to employ. *Managing Cover Crops Profitably*, published by the Sustainable Agriculture Network, is an excellent resource currently in its third edition. It is now available on-line at: <www.sare.org/publications/covercrops/covercrops.pdf>.

Extension also has a variety of resources for growers interested in integrating cover crops into their vegetable production systems. For example, *Vegetable Farmers and Their Innovative Cover Cropping Techniques*, is a collection of short videos highlighting innovative strategies currently being used by vegetable growers in the northeastern U.S. These videos can be found at: <www.extension.org/article/18439>.



TROUBLES WITH PLANT NUTRITION? TISSUE ANALYSIS MAY HELP

- *Liz Maynard* - Fertilizing vegetables often seems easy until there is a problem. Once symptoms of deficiency, imbalance, or excess occur it is too late to fully correct the problem this season and reduced yield or quality are the result. Nutritionally related tomato fruit coloring problems like yellow shoulder disorder and blotchy ripening are some examples of how market quality can be reduced. The point of this article is to remind producers that plant tissue analysis for essential mineral nutrients is an effective way to monitor crop nutrition during the growing season, can help guide decisions to minimize problems this season, and aid in planning an improved strategy for next year.

While a variety of on-farm testing methods can be useful, this article will focus on quantitative analyses performed by commercial labs. These analyses typically determine levels of the following nutrients: nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), iron (Fe), manganese (Mn), copper (Cu), zinc (Zn), and boron (B).

For routine analysis, develop a sampling schedule that includes key crop growth stages and reflects the options available for taking corrective action this season. If nutrients are applied regularly through drip irrigation, frequent sampling could be useful. If fertilizer application is only made once a season, sampling once at the standard stage for plant analysis sampling may

be appropriate. Whether the schedule is by the calendar (e.g. every two weeks), or by crop growth stage (e.g. for tomato at flowering, 1-inch fruit, first harvest, main harvest), it is important to record the crop growth stage at the time of sampling. This is because adequate levels of some nutrients change with crop growth stage.

If more than one variety or planting date for the crop exist, choose just one variety and planting date for regular sampling, or create a separate sampling schedule for each one. Varietal differences in nutrient content occur and it will be easier to see trends if the same variety is tested each time.

Select individual plants at random from throughout representative areas of the planting, and collect samples from those plants. The goal is not to determine how an individual plant is doing, but rather how, on average, the bulk of the crop is doing. If there are distinct areas that appear especially vigorous or especially problematic, they could be sampled separately determine whether the visual differences are reflected in tissue nutrient content.

The exact type and number of samples varies depending on the crop. For tomatoes, typically 1 single most recently mature leaf is collected from 20 plants. The most recently mature leaf is the youngest leaf that is fully expanded (has reached its full size), usually about 5 or 6 leaves down from the growing point of the main stem. The leaf is broken off at the natural joint where it attaches to the stem, and for whole leaf samples, the entire leaf midrib and all leaflets are collected. Figure 1 shows two tomato leaves that would be suitable for this type of sample.



Figure 1: Tomato leaves of the size and growth stage suitable for nutritional sampling. (Photo by Liz Maynard)

Diseased, insect-affected, and obviously dusty or dirty leaves should be avoided. If dust or dirt can't be avoided, rinse leaves off with distilled or demineralized water, or gently pat off with a cloth dampened with that water. Don't soak the leaves in water because nutrients may leach out.

Be aware that any foliar sprays of nutrients or pesticides may have left an invisible residue that will influence the results. For instance, application of fungicides containing manganese or copper may increase the reported leaf concentration of those elements.

Check with the lab doing the testing for their guidelines on sampling, sample processing and mailing. Typically leaves should be kept cold or dried, placed in clean, breathable, bags or envelopes and shipped overnight to the lab.

Interpreting tissue analysis results is accomplished with the aid of tables that show expected ranges for particular tissues collected at a particular stage of growth. The laboratory that does the testing may have these tables, and they are also available in **Plant Analysis for Fruit and Vegetable Production from Univ. of Minnesota** <www.extension.umn.edu/distribution/cropsystems/components/5886_32-34.pdf> and **Fertilizer Recommendations for Vegetable Crops in Michigan** <<http://web2.msue.msu.edu/bulletins/Bulletin/PDF/E2934.pdf>>.

Experience with interpreting plant analysis results and knowledge of the context, crop history, and fertilization history are important for effective interpretation.

Should everyone conduct regular crop sampling? Not necessarily. But for those who have experienced suspected nutritional problems in previous years, are using a new production system, or have changed their fertilizer program, implementing regular plant tissue analysis can provide information that will help determine how to solve or avoid a problem.



LATE BLIGHT OF TOMATO - (Dan Egel) - This disease swept into the Midwest and Northeast US in 2009, most likely on infected transplants at large retail garden stores. Over 39 counties in Indiana had late blight infected tomatoes in 2009.

Late blight of tomatoes causes lesions on leaves, stems and fruit. Potatoes are also affected by late blight. The Irish potato famine of the 1840's was caused by late blight. The disease can spread rapidly in cool, wet weather. The summer of 2009 was very cool and wet.

It is unlikely that 2010 will have perfect weather conditions for late blight. The fungus-like organism that causes late blight has not been able to overwinter our cold Indiana winters. Therefore, the late blight situation that existed in 2009 is unlikely to be repeated.

However, it is always possible that late blight could re-occur in Indiana. Recently, late blight of tomatoes was confirmed in Maryland and Louisiana. More details about these outbreaks can be found here for Maryland <www.hgic.umd.edu/> and here for Louisiana <www.lsuagcenter.com/news_archive/2010/may/headline_news/Tomato-blight-threatening-south-Louisiana-gardens.htm>.

Therefore Purdue University suggests growers be vigilant in looking for late blight symptoms. If you think you have late blight please contact your county educator, Dan Egel or the Plant Pest and Diagnostic Laboratory.

Growers should become acquainted with late blight and possible control measures. A bulletin that explains the late blight situation was published this winter <www.extension.purdue.edu/extmedia/BP/BP-80-W.pdf>. The section of the **Midwest Vegetable Production Guide for Commercial Growers 2010 (ID-56)** <www.btny.purdue.edu/Pubs/ID/ID-56/> that deals with late blight management has been completely updated. Frequently asked questions can be found here <www.agriculture.purdue.edu/aganswers/story.asp?storyID=5496>.



BLACK ROT OF CABBAGE - (Dan Egel) - Recently a cabbage transplant was brought to my laboratory with a chlorotic lesion (yellow spot) on the true leaf. These symptoms were diagnosed as black rot. This disease is favored by warm, humid weather and weather and may spread by splashing rain or irrigation water. Although the weather outside has been too cool for significant black rot development, a greenhouse environment provides the necessary warmth, humidity and over-head irrigation for spread. Fortunately, this diseased seedling was diagnosed and discarded prior to being transplanted outside.

Although bacteria may move from plant to plant in rain splash or irrigation water, longer distance spread may result from the seed borne nature of the disease. The bacterium that causes black rot can be systemic and thus move into the seed.

On mature plants, the typical symptom is a wedge shaped necrotic area with a chlorotic border (Figure 1). The bacterium that causes black rot may survive in crop residue if left un-decomposed.

Using seed that is free of the black rot bacterium is an important disease management tool. Use seed tested for black rot. Seeds may be treated with sodium hypochlorite or hot water, but growers should be careful not to lower the germination of their seeds by such measures. Transplants should be scouted regularly for symptoms or inspected carefully upon delivery. There is some host resistance to black rot. Unfortunately, the use of copper products have not proven very effective. Actigard is labeled for black rot control, but growers should follow restrictions carefully. See the **ID-56** and label for details.



Figure 1: Black rot causes a wedge shaped necrotic (brown) area often bordered with chlorotic tissue (yellow) at the edge of the cabbage leaf. (Photo by Dan Egel)



GOOD AGRICULTURAL PRACTICES (GAPs) ONLINE PRODUCE SAFETY COURSE - (Announcement) - Cornell University will offer a GAPs Online Produce Safety Course from June 2 through June 22, 2010. Registration is now open. The course is limited to 25 people. There will be a \$50 fee for taking this course.

To register, go to the registration page at <www.ecornell.com/gaps>, check the Add to Cart Checkbox and click the Add to Cart Button. The course outline that contains additional information about the course is available here: <www.gaps.cornell.edu/GAPsOPSC%20Reg%20Info.doc>.

The 3-week course is available 24 hours a day for the three weeks. The course provides a solid foundation of GAPs information to assist growers with understanding GAPs, writing a farm food safety plan, and implementing food safety practices on the farm.

If you have any questions about the course, please contact E. Bihn at <eab38@cornell.edu> or at (315) 787-2625.

The next dates for the course will be posted at <www.gaps.cornell.edu> under Events Calendar.

(Note: I just finished taking this course - my first online course - and encourage anyone who has time (about 20 hours over the 3 weeks) and interest to take it. There is opportunity to interact with other students, which in my course included people from vegetable farms across the country, FDA staff, a high school ag teacher, Extension staff, and others. I know this is a very busy time of year for most, but if there is someone in your operation who has time and has potential to become a key player in the area of food safety, this course would be a great introduction to the subject. *Liz Maynard*)