Vegetable Crops Hotline

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

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Black Cutworms - *(Rick Foster)* - We have caught record numbers of black cutworm moths in our pheromone traps this year. Trap catches have been higher in the northern half of the state, but trap catches in southern Indiana have still been much higher than normal. We have now accumulated a sufficient number of degree days in southern Indiana that the cutworm larvae should have grown to a point where they can begin cutting plants (Figure 1). Northern Indiana will likely be subject to cutting damage by next week. Black cutworms will feed on a wide variety of vegetable crops, including sweet corn, tomatoes, cucurbits, crucifers, etc. Growers in southern Indiana should be scouting their vegetable fields regularly looking for signs of cutworm feeding, which might include feeding on foliage of plants cut near the soil line. Thresholds are different for different crops. In sweet corn, for example, treatment is justified if 2% or more of the plants have been cut. Insecticides labeled for cutworm control vary by crop, but in general, the pyrethroid insecticides will provide excellent control.

Figure 1: Black cutworm larvae with a penny for scale. Larvae vary in size from 1/8 inch when newly hatched to 2 inches when fully grown. *(Photo by John Obermeyer)*

Corn Earworm - *(Rick Foster)* - As everyone knows, it has been a highly unusual year weather-wise. I caught my first corn earworm moth on April 9, about 2 months earlier than normal. One thing that tells me is that earworms likely survived much further north and in greater numbers during this mild winter than they normally would. As a result, I think it is reasonable to expect greater problems from first generation earworms than we would normally see. Subsequent pheromone trap catches have been highly variable, mainly because the temperatures have bounced around so much. The highest catch we have recorded so far is 26 months, caught in one of my traps in Tippecanoe County on May 3. Remember that earworms will feed on a variety of crops, including sweet corn, tomatoes, peppers, etc. Although the female moths prefer to lay their eggs on corn silks, if no silks are present, they will lay eggs on foliage and the larvae will feed on foliage. Growers should be scouting their vegetable crops on a regular basis looking for earworm feeding. Again, the insecticides labeled for earworm/fruitworm control varies by crop so be sure to check the *Midwest Vegetable Production Guide for Commercial Growers* (ID-56) **http://www.btny.purdue.edu/Pubs/ID/ID-56/** to select the proper insecticide for your crops.

One thing we have learned about earworms in the last couple of years is that when there are few crops available for them to lay their eggs on, the moths will tend to concentrate their eggs on suitable crops. As a result, particularly early in the season, the thresholds that we normally use are often too high. If you have very early sweet corn that is approaching the reproductive stage, I would take a very conservative approach, basically treating during the silking stage if any moths are being caught in the traps. For crops such as tomatoes, peppers, or sweet corn in earlier stages of growth, I would rely on my scouting results to determine if damage levels are sufficient to warrant treatment.

Striped Cucumber Beetles - *(Rick Foster)* - Striped cucumber beetles are out in force in southern Indiana. Cucurbit growers need to be scouting their fields on a regular basis. Growers who used a planting time application of a systemic insecticide such as Admire® or Platinum® can expect 2-3 weeks of control of the beetles. In my research plots in Vincennes that were planted on April 23, we were still seeing excellent control on May 8, 15 days after planting. Muskmelons and cucumbers are sensitive to bacterial wilt, so the treatment threshold for those crops is an average of 1 beetle per plant. Watermelons and squash are not subject to bacterial wilt so the main concern is direct feeding damage, thus the treatment threshold for those crops is 5 beetles per plant. The pyrethroid insecticides provide excellent control of striped cucumber beetles.

Remember that you cannot use endosulfan (formerly known as Thiodan®) on melons, cucumbers, or summer squash after July 31, 2012.

Downy Mildew of Cucurbits - *(Dan Egel)* - This disease has been widespread in Florida this year, causing some producers in the Midwest to worry that downy mildew might soon reach local fields. The following article describes downy mildew of cucurbits, its biology and management. The bottom line is that downy mildew isn't expected in Indiana until later in the season, but read on to find out how to keep track of the downy mildew epidemic that is currently in Florida.

Downy mildew affects cucurbits such as cucumber, muskmelon, watermelon and pumpkin. Symptoms vary per host, but start out as yellow lesions on leaves (Figure 2). Under moist conditions, the leaves rapidly turn necrotic. The fungus that causes downy mildew can be seen on the bottom of the lesions under moist conditions. The fruit are not infected by the fungus.

The fungus that causes downy mildew does not overwinter in Indiana and thus must blow in each year from areas such as Florida where there is living cucurbit tissue year round. Thus, in most years, downy mildew isn't observed in Indiana until August. It is possible, however, that hurricanes and other storms can blow downy mildew up earlier.

Once downy mildew does show up, specialized fungicide products may be required for management. Most of the fungicides that are effective against downy mildew and possibly Phytophthora blight are not effective for other fungal diseases. For this reason, I do not recommend applying fungicides for the control of downy mildew of cucurbits until this disease has been observed near Indiana. More information about fungicides recommended for downy mildew can be found in the *Midwest Vegetable Production Guide for Commercial Growers* (ID-56) **http://www.btny.purdue.edu/Pubs/ID/ID-56/**.

Growers can track the downy mildew disease epidemic as it moves from the southern US northward with the following website: **http://cdm.ipmpipe.org/**. In addition, downy mildew sentinel sites with several cucurbits crops will be planted this year at the Southwest Purdue Agricultural Center in Vincennes and at the Pinney-Purdue Agricultural Center in Wanatah. Specialists will monitor these sites weekly. Growers should scout their fields for symptoms of downy mildew and use the website above to track the epidemic.

Information about downy mildew on pumpkins can be found in the Purdue University extension bulletin BP-140-W. **http://www.extension.purdue.edu/extmedia/BP/BP-140-W.pdf**.

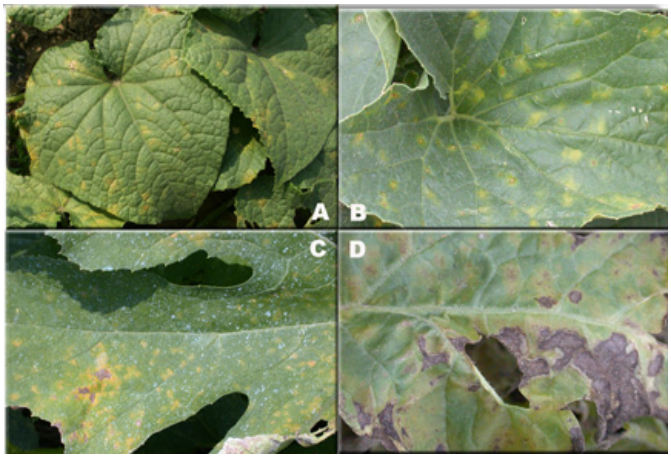

Figure 2: Symptoms of downy mildew on (A) cucumber, (B) muskmelon, (C) pumpkin and (D) watermelon. As of May 10, downy mildew has not been observed in Indiana in 2012. *(Photos by Dan Egel)*

Glyphosate and Plant Disease - (*Dan Egel*) - One cannot help but notice the increase in the use of the herbicide glyphosate (e.g., Round-Up®) on crops genetically modified to be resistant to this herbicide. In the Midwest, the crops mostly likely to be glyphosate resistant are field corn and soybeans.

Many growers have also noticed an increase in the number of articles that appear in the popular press that seem to blame glyphosate for an increase in plant diseases. This issue is complex. This article will attempt to bring growers up to date on what scientists know about the relationship between glyphosate and plant disease.

One area of research has been how glyphosate interacts with manganese, an essential nutrient for plants. It is known that manganese cations can interfere with glyphosate in the spray tank. There is conflicting evidence about whether the genetics of glyphosate resistance or the application of glyphosate in the field triggers manganese deficiency in glyphosate-resistant soybeans. Excellent sources of information on this subject include an article in the April 16, 2010 issue of Pest & Crop (Issue

3) **http://extension.entm.purdue.edu/pestcrop/2010/issue3/PandC3.pdf** and an extension bulletin **http://www.btny.purdue.edu/weedscience/2010/GlyphosateMn.pdf**. These publications put these concerns in perspective.

One possible issue is that glyphosate may cause plants to be more susceptible to disease because of the deficiency of manganese. My experience with vegetable plants is that manganese *toxicity* is more likely than deficiency, especially at low soil pH levels. Manganese toxicity is common with muskmelon and watermelon in southern Indiana. In other parts of the state, manganese deficiency in vegetables does occur from time to time. We don't have any specific information about glyphosate and manganese nutrition of vegetables.

Regardless of how glyphosate might cause vegetables to become more susceptible to disease, there have been many studies to try to determine whether vegetables are indeed more susceptible due to glyphosate use.

Vegetable plants with sub-lethal doses of glyphosate may become more susceptible to disease. For example, in one study, glyphosate applied in a sub-lethal dose did make tomatoes more susceptible to Fusarium wilt. This is not surprising. Knowing this may encourage growers to use extra care when applying glyphosate near vegetables, and to use proper shielding when spraying glyphosate between crop rows. It is not unusual for vegetables to accidentally receive sub-lethal doses of glyphosate when the herbicide is applied between the rows without adequate shielding.

But this is not the primary issue that growers worry about. The bigger question growers ask is: will glyphosate applied to agronomic crops or to cover crops cause more disease in my vegetables grown in the same field next season?

Several types of studies shed light on this question. Some researchers have added glyphosate directly to fungi in the laboratory. A few of these studies have shown that glyphosate actually improves the growth of fungi that cause plant disease. For example, Fusarium spp. and Pythium spp. were reported to actually benefit from glyphosate application. However, these studies do not prove a definite relationship between glyphosate and diseases in the field.

Other research projects have added glyphosate to plants in pots under greenhouse conditions. A few of the greenhouse studies have shown that glyphosate increases disease. Fusarium spp. diseases have been increased in some of these studies. It is not clear, however, that these greenhouse experiments will translate directly to the field.

While some field experiments seem to show that glyphosate may increase plant disease, other studies show no effect. For example, the occurrence of Fusarium head blight in wheat was correlated with the use of glyphosate the previous season. However, similar studies did not show any effect. Several researchers from across the Midwest, including Kiersten Wise of Purdue University, were unable to show any effect of a number of herbicides, including glyphosate, on the disease sudden death syndrome of soybean (SDS is caused by a species of Fusarium).

Fewer studies have been done with vegetables. A study completed in California on the disease Monosporascus vine decline on muskmelon found that killing vines at the end of the season either by applying glyphosate or by cutting vines increased growth of the Monosporascus fungus in the roots. Monosporascus vine decline has not been reported in Indiana. Presumably, disking vines at the end of the season would be a better method of killing the crop.

It is my view that there is no clear link between the use of glyphosate as an herbicide and any increase of plant disease. Although it is possible to find scientific studies that show a link between glyphosate and plant disease, many other studies have not been able to establish a link. In addition, the studies linking glyphosate and plant diseases are complex. For example, one study applied glyphosate to soybeans and found an increase in the levels of the plant pathogenic fungus Pythium spp. in the soil about 2 weeks after application. However, the level of Pythium returned to normal levels about a week later and there was no evidence that next year's crops was affected. No Pythium related disease was observed. Articles in the popular press, however, might leave out such details.

More research needs to be done on this important topic. Meanwhile, there is no reason for growers to make major changes to their operations based on the charges that have been made against glyphosate recently. If growers observe disease problems that they think might be linked to glyphosate use, contact a Purdue University specialist. Such discussions may help us to determine if there is a link between glyphosate use and an increase in plant disease.

Please contact Dan Egel at (812) 886-0198 or **egel@purdue.edu** if you have questions or comments. Full citations for the articles referenced here are available on request.

How Herbicides Work: Part I - (*Liz Maynard*) - Understanding how herbicides work can help the user get the most benefit out of them and minimize injury to the crop and other desirable plants. Herbicides are classified into 16 main groups based on their mechanism of action. The mechanism of action (MOA) describes what process in the plant is disrupted by the herbicide. Herbicides with a similar MOA usually produce similar symptoms and are effective on similar groups of weeds. Herbicides used in vegetable crops include examples of most MOA's. This and future articles in the series will describe MOA and other key characteristics of the common vegetable herbicides. The codes in brackets following

the MOA represent the classification codes according to the Herbicide Resistance Action Committee (letters with subscripts) and the Weed Science Society of America (numbers in parentheses).

Mitosis Inhibitors: [K_1 (3), K_2 (23), K_3 (15)] Mitosis inhibitors prevent plant cells from dividing. The dinitroanilines [K_1 (3)], including trifluralin (Treflan®), ethalfluralin (Curbit®), and pendimethalin (Prowl®) prevent cell division by interfering with the manufacture of microtubules in plant cells. DCPA (Dacthal®) also disrupts microtubules. The acetamides [K_3 (15)], including acetochlor (Harness®), alachlor, dimethenamid (Frontier®), flufenacet (Define®), and s-metolachlor (Dual Magnum®), seem to interfere with the production of very long chain fatty acids in plant cells. This in turn prevents cell division.

All of these materials are applied to the soil to kill weeds as they germinate or soon after. They are most effective against grasses and some small-seeded broadleaf weeds. Many affected weeds never emerge; those that do are usually stunted and do not survive for long.

Some of the materials are applied to the soil surface without physical incorporation (e.g. ethalfluralin), others may be applied with or without incorporation (e.g. s-metolachlor), and others must be incorporated to prevent volatilization (e.g. trifluralin). All of the materials must be present in the zone of weed seed germination in order to be effective. When not physically incorporated, rainfall or irrigation is needed to move the material into the weed germination zone.

For many crops, injury to the crop from these herbicides is prevented by placing the herbicide where it will not contact crop roots, or at least not in a concentration high enough to cause serious injury. So, for instance, ethalfluralin (Curbit®) may be applied to the soil surface without incorporation after direct seeding pumpkins. The pumpkin seed is planted well below the soil surface, and the pumpkin roots will grow down, avoiding the herbicide. If, however a heavy rain washes the ethalfluralin into the root zone of the pumpkins, or the pumpkin seed is planted very shallow, or the pumpkin seeds are not well-covered, the herbicide may contact the roots of the germinating pumpkin seed, causing poor root development and stunted crop growth. Other use patterns permit application only between rows of a crop, or only after a crop is established and only between the rows. This reduces the likelihood that crop roots will contact enough herbicide to cause injury.

Symptoms of injury from dinitroaniline herbicides include short stubby roots with thickened tips, thickened hypocotyls, swelling at the base of grass shoots, and overall stunting. Symptoms of injury from acetamide herbicides include malformation, twisting, and leaves that don't unroll properly in grasses; and leaf cupping, crinkling, and 'drawstring' appearance on broadleaves; as well as stunting.

Mitosis inhibitors have been used in vegetable production for years. They are common in many weed control programs for preemergence control of grasses and small-seeded broadleaves. Effective use requires getting them on in the right concentration, uniformly, in the zone of weed germination, and away from roots or seeds of sensitive crops.

Funding Available from NRCS for Conversation Practices in Three Indiana Watersheds - *(Liz Maynard)* - NRCS recently announced a National Water Quality Initiative that will provide funds to farmers in the Silver Creek watershed, Ell Creek watershed, and Eagle Creek Reservoir - Eagle Creek watershed. The funds can be used to pay for practices such as cover crops, filter strips, and terraces that will improve water quality in the designated areas. Applications for funding in this fiscal year must be received by June 15. Contact your local NRCS office **http://www.in.nrcs.usda.gov/contact/directory/field_offices.html** to see whether you are in one of these watersheds. For more information, see the NRCS site at **http://www.in.nrcs.usda.gov/programs/eqip/nwqi.html**.

Upcoming Events:

May 15, 2012, 6:00 p.m. ET. *Garden of Eatin'* Field Day and Drip Irrigation Workshop, 268 E. 600 N., Fortville, IN. For more info 317-462-1113 or **rballard@purdue.edu**.

May 24, 2012, 6:00 -7:30 p.m. ET. High Tunnel Construction and Maintenance. Harvestland Farm of Aspire Indiana, 6775 State Rd. 32, Anderson, IN. For more info 765-641-9514 or **orick@purdue.edu**.