VEGETABLE CROPS HOTLINE

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

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IN THIS ISSUE

APPLYING FUNGICIDES EFFECTIVELY - *(Dan Egel)* - I am often asked questions about fungicide application. Here are a few questions and answers that you may find useful.

- Should I apply fungicide before or after a rain? The answer, if at all possible, is to apply fungicides before it rains. Rain causes leaf wetness which is necessary for most plant diseases. Rain also splashes spores from one leaf to the next. If the fungicide is applied before a rain, a greater percentage of the leaf surface is protected from spores. After it rains, the spores may have splashed to places on the leaf which do not have fungicide. If it looks like the fungicide may have a chance to dry, go ahead and make the application.
- Do the heavy rains that much of Indiana experienced earlier this spring influence fungicide timings now? No. Wet soils do not influence foliar disease. Fungicide application frequency should be influenced by the amount of leaf wetness caused either by rain or dew. Most fungicide application intervals will vary from 7 to 14 days. Apply fungicides more often in times of rain and heavy dews. Timing is where the Melcast system can help for melon growers in southern Indiana.
- What is the best time of day to apply fungicides? If fungicides are to be tank mixed with insecticides, the application should not be made while bees are still active. If fungicides are to be used alone, avoid spraying in the heat of the day.
- What is the best way to apply fungicides? Vegetable growers may have heard that hollow spray tips and high spray pressures make the most effective spray methods. However, I haven't seen any differences between either hollow cone tips and flat fan tips and spray pressures from 30 to 150 psi in controlling Alternaria leaf blight of muskmelon. Similar results have been found in other plant/disease systems.
- Here are a few other things to remember about effectively applying fungicides. Soilborne disease such as Fusarium wilt or root knot nematode are not generally controlled with fungicides. Similarly, fungicides are designed for application to the foliage, not the soil. Finally, it is probably safe to say that the more gallons per acre that are used, the better the coverage and the better the disease control.

COOL TEMPERATURE EFFECTS ON FLOWER AND HEAD DEVELOPMENT - *(Liz Maynard)* - The last week of May brought good growing conditions to Northern Indiana. Vegetable plants that had essentially stopped growing during the previous week of cool weather turned green and started to grow again. The cool weather certainly slowed crop growth, and probably also influenced flower development in a number of vegetable crops.

In cucumber, squash and pumpkin, cooler temperatures promote development of female flowers rather than male flowers. For some summer squash, this may mean some female flowers open before any male flowers are open. If that occurs, the fruit may not set.

Pepper fruit shape is affected by low temperatures. Night temperatures 45 to 50°F during flower development can cause the fruit to be smaller than normal and somewhat flattened, sometimes with a point on the blossom end. At night temperatures of 55-60 pollen may not develop properly with the result that fruit is small and seedless.

Tomato flower clusters respond to low temperatures with increased branching and larger flowers when exposed early in development (weeks before buds are visible). Temperatures of 60 day/50 night 4 to 5 weeks before flowering of a cluster may increase the amount of catfaced fruit (large, misshapen fruit with large blossom-end scars) on that cluster. A week or two before flowering, temperatures in the low 40s can interfere with pollen development, leading in turn to low fruit set.

Even cool season crops may respond adversely to the recent cool weather. Broccoli and cauliflower may prematurely form heads when they experience cool weather and poor growing conditions soon after transplanting. This is called buttoning. The heads will be small and will prevent further growth of the plant. Buttoning is most likely to occur on older transplants.

CALL PURDUE EXTENSION TOLL-FREE - *(Liz Maynard)* - Purdue Extension has a toll-free phone number for your convenience. Dial 1-888-EXT-INFO (1-888-398-4636) during regular business hours. The person who answers the phone can transfer you to any Purdue staff member on campus, at the Regional Centers, or in County offices. If you have a question and aren't sure who to ask for, the person who answers the phone can direct you to the right person. We look forward to hearing from you!

INSECT NUMBERS IN MELONS AND CUCUMBER DURING THE EARLY SEASON - *(Frankie Lam)* - Heavy rain during the early season caused a delay in scheduling for all planting activities. Most growers across the state will have their crops trans-

planted late this year. The insects that commonly attack melons and cucumber in the early season are seedcorn maggot, striped cucumber beetle, and aphids.

Two of my muskmelon studies were transplanted on April 20. In one field there was a relatively high seedcorn maggot infestation, while the other field was partly under water for about 3 weeks and it had to be re-planted in mid-May. Cool, wet conditions in the early season favor the development of seedcorn maggot. If growers had transplanted muskmelons before the end of April, probably they might also have noticed a relatively high infestation of seedcorn maggot. From late April to mid-May, wilting of these early transplanted muskmelons in fields might have been due to the infestation of the maggot, frost, or flooding. The only method to verify the infestation of seedcorn maggot is to dig up the wilting plant, split the crown and the main root with a pocketknife, and carefully examine for the presence of maggots (Please read the article in the Vegetable Crops Hotline May 2, 2002).

My other studies on melons and cucumber were transplanted in mid- or late May. During the later weeks of May, some of these newly transplanted fields had a relatively high infestation of striped cucumber beetles. The numbers of striped cucumber beetles in the fields were 3 beetles/plant in muskmelon and 1 beetle/plant in cucumber. The economic threshold of the striped cucumber beetle is 1 beetle/plant. However, during the first few days of June, the beetle numbers in the field dropped dramatically. Scouting the same fields on June 4, the numbers are 0.6 beetle/plant in muskmelon and 0.1 beetle/plant in cucumber. It seems that starting in early June we are already at the time between two beetle populations. The next population of striped cucumber beetle should begin in mid-July.

Starting the last week of May, small colonies of aphids were found in muskmelons and watermelons near Vincennes. Check the underside of leaves of melon plants located on your field border first, because most infestations will start at the borders of the field. If aphids are found on the field border, then also check inside the field. Leaves damaged by aphids have a distorted, cupped appearance. Melons with heavy infestation have a mottled appearance or necrotic spots on leaves and stunting of the plants. All aphids can transmit viral diseases to cucurbits. Mark the infested areas with flags and re-check the field after 5-7 days. If the aphid population is not increasing, predator insects and/or parasitized aphids are found, no treatment is necessary. If the infested area is expanding, then spot spray the infested areas and 100 feet beyond the edges of infestation. Thiodan, Endosulfan, Phaser, Dimethoate, Capture, Fulfill, and Actara are insecticides recommended for aphid control. Be certain to read the label carefully before using any pesticide.

Are In-season Nitrogen Applications Needed? - *(Liz Maynard)* - Sidedressing or topdressing nitrogen is often planned as part of the nutrient management program. Before planting, only part of the nitrogen need by the crop is applied and the remainder is applied a few weeks after planting as the crop begins rapid growth. In other cases, the need for a sidedressing of nitrogen may not be so clear. When some of the nitrogen is supplied from soil organic matter, manure, compost, or a legume green manure, the amount of nitrogen that will become available. Also, when it will become available is difficult to predict exactly. Nitrogen release rates from these sources depend on soil temperature and moisture. Under warm, moist conditions, nitrogen may be released quickly enough to supply an adequate amount to the crop. In a different year, even with the same application rate, cooler soil temperatures may delay nitrogen release enough to slow crop growth.

Heavy spring rains following preplant nitrogen applications can also make it difficult to predict whether additional nitrogen is needed. The amount of nitrogen lost from soil due to wet weather depends on several factors: soil type, form of nitrogen applied, soil temperature and moisture, quantity and distribution of rainfall, duration of saturated soil conditions, and whether and when plastic mulch was used. For a more detailed discussion of this, see the article entitled 'Soil Nitrogen Loss' in this issue.

One tool to help evaluate whether additional nitrogen will benefit the crop is the pre-sidedress nitrate test, or PSNT. The test measures the amount of nitrate in the soil shortly before the time of sidedressing. If the nitrate level is above a certain value, it is unlikely that additional nitrogen will lead to higher yields. The value depends on the crop, and is determined empirically for different crops and environments. Much of the development of the PSNT for use in vegetables has been done in the Northeastern and Mid-Atlantic states. The critical values suggested by John Howell of the University of Massachusetts are a good starting point for using this test in Indiana. According to Howell, for sweet corn no additional nitrogen is needed if the nitrate level is 25 parts per million (ppm) or greater. For pumpkins, squash, tomatoes and peppers, no additional nitrogen is needed if the nitrate level is greater than 35 to 40 ppm. Although the PSNT has not been evaluated for use on vegetables in the Midwest, it has been studied in field corn in the Midwest, and the response is similar to that in the Northeast. This gives us some confidence that recommendations for vegetables developed in the Northeast will be reasonable in Indiana.

Soil samples for the PSNT should be collected about a week before normal sidedressing. Take 10 to 20 cores 12 inches deep and mix them well. Dry one cup of the composite sample by spreading it thinly on a clean, non-absorbent material. Quick drying will prevent changes in nitrate levels of the sample. Send the sample to be analyzed for nitrate by a reputable soil-testing laboratory that will provide results within one or two days.

Plant tissue or sap analysis can also be used to determine the need for additional nitrogen. Often these methods are used to fine-tune multiple fertigation or sidedress applications. Specific sampling procedures vary depending on the crop. Leaf samples may be sent to a private lab for analysis. As an alternative to sending samples to a lab, some growers are experimenting with portable ion meters, which measure the nitrate content of fresh plant sap squeezed from petioles. When a crop suffers from lack of nitrogen for a period of time, a soil or tissue test is hardly needed to suspect that plants are not getting enough nitrogen. Symptoms of nitrogen deficiency include pale green leaves, premature yellowing and dying of older leaves, combined with slow growth. If roots or stem disease is not preventing nitrogen uptake and are otherwise healthy, the yellowing may due to lack of nitrogen in the root zone of the crop, and an additional application would be beneficial.

If additional nitrogen is needed, it may be top-dressed, sidedressed, or applied through an irrigation system. Urea, ammonium nitrate, calcium nitrate, urea-ammonium nitrate solutions, as well as organic sources such as compost can all be used to supply additional nitrogen. If you have experienced problems with blossom end rot in tomatoes, peppers, or other crops, there may be some benefit to using only nitrate forms of nitrogen such as calcium nitrate or potassium nitrate.

It is possible to apply too much nitrogen. Over application can delay fruit development in crops such as tomatoes and melons. It may promote development of blossom end rot in susceptible crops. If other nutrients are not present in adequate amounts, additional nitrogen

will not increase yields. Broadcast applications may promote weed growth between the rows, and some weeds are stimulated to germinate by high nitrate concentrations. Nitrogen applied that is not used by the crop is wasted, and may contaminate ground water, streams, or ponds.

Soil Nitrogen Loss - *(Liz Maynard)* - Wet springs often lead to wondering whether nitrogen applied to the soil has been lost before plants can take it up. How wet weather leads to loss of nitrogen from the soil and the factors that influence how much nitrogen is lost are critical questions after this early wet weather.

Wet weather leads to nitrogen loss in two ways: leaching and denitrification. Rain percolating through the soil leaches the nitrate form of nitrogen deeper into the soil, and eventually below the root zone of the crop. Leaching losses are greater on light-textured soils and when rains fall over a period of time so that water has time to soak into the soil rather than run off the top. An inch of rain may move nitrogen a foot deeper in a sandy soil; after 4 inches the nitrogen may be down 4 feet and below the root zone of many crops. Leaching losses from rainfall are much reduced when nitrogen is applied under plastic mulch. Since the nitrate form of nitrogen is most likely to leach, the more nitrogen in that form, the greater the leaching losses.

Some fertilizers, such as calcium nitrate and potassium nitrate, contain all the nitrogen in the nitrate form and so are very susceptible to leaching as soon as they are applied. Other materials, such as urea or diammonium phosphate, break down initially to supply nitrogen in the form of ammonium, and then the ammonium is converted by bacteria into nitrate in the process called nitrification. The bacteria are not active in dry or cold soil; most nitrification occurs when soil temperatures are 60 to 86 degrees F. Under typical Indiana conditions, the ammonium will be completely converted to nitrate in a month. With these materials, the longer it has been since application, the more nitrogen will be in the nitrate form, and the greater the potential for losses from leaching.

Denitrification occurs when bacteria use nitrate as a source of oxygen and convert the nitrogen to volatile forms, which are lost to the air. Denitrification occurs in saturated soils. Because it depends on bacterial activity, it speeds up with warm soil conditions. In Indiana, saturated soils lose 4% to 5% of their nitrate nitrogen for each day they are saturated. As with leaching, only nitrogen in the nitrate form is lost.

To evaluate the potential for nitrogen loss in a particular field this year, consider the following questions:

- How much nitrogen was in the nitrate form when it rained? Only the nitrate form is lost to leaching or denitrification. If ammonium or urea was applied, it would take about one month for all the nitrogen to be converted to the nitrate form.
- How warm has the soil been since fertilizer application? The warmer the soil, the faster the conversion of ammonium to nitrate, which can then be leached or denitrified. With soil temperatures ranging from 40 to 60°F conversion to nitrate will be slow.
- Was plastic mulch used and when? Little leaching due to rains will occur under plastic mulch.
- What is the soil type? On a sandy soil 5" of soaking rain can leach nitrate beyond the root zone of most vegetables. On a heavier soil it will take more water to leach beyond the root zone.
- How much rain has fallen, and how much at one time? Rains that soak the soil rather than run off will result in more leaching. Periods of soil drying between rains will cause water (and nitrate) to move upwards in the soil.
- How long has the soil remained saturated? Dentrification occurs in saturated soils, but conversion of ammonium to nitrate does not.

The following examples show how some of these considerations might be applied.

Example 1. On May 10, 50 lb. N/A from urea was broadcast on a sandy loam. It rained 2.5 inches May 11, 0.5 inches May 12, and 0.5 inches May 17. Since then only 0.2 inches of rain has fallen. Soil temperatures averaged 50 to 60°F until the last week of May when they increased to the 60 to 80°F range and have stayed there. Most of the nitrogen from this application would likely still be in the root zone. Even though it is a light soil and a lot of rain has fallen, little nitrogen would have been lost because the heavy rains came shortly after application, when soils were cooler and before much nitrogen could be converted to nitrate. The urea itself would not leach. If heavy rains occur from this point forward, it will be a different story. By now the warm soil temperatures have allowed nitrification to occur; soon much of the nitrogen will be in the nitrate form. Soaking rains will move that nitrate deeper into the soil.

Example 2. On April 10, 50 lb. N/A from UAN was applied to beds as they were formed and plastic mulch laid over them. The soil is a sandy loam. Since then, nearly 15 inches of rain has fallen including 4 days with more than 1.5 inches. Soil temperatures have averaged in the 60 to 80°F range under the mulch. In this case, 25% of the nitrogen applied was already in the nitrate form and the remainder would have been converted to nitrate by this time. Although much of the nitrogen would be susceptible to leaching because it is in the nitrate form, the plastic mulch would have protected it from rainfall. Most of the applied nitrogen is probably still in the bed.

Soil pH Requirements for Vegetable Crops - *(Chris Gunter)* - Soil pH is a measure of the degree of acidity (or alkalinity) in the soil. Different vegetable crops have different pH requirements in order to maximize their growth and yield potential. Tomatoes, eggplants, peppers, pumpkins and squash do best in soil with pH 6.0-6.8. Sweet corn, cucumbers and watermelon do best in soil with pH 6.0-6.5. Muskmelon, however will perform best in soil with a pH of 6.3-6.8.

Determining your soil pH starts with a soil test from a reputable soil testing service. Soils that are too acid restrict nutrient uptake for elements like phosphorous and potassium, while releasing other minerals like aluminum and manganese at toxic levels. Alkaline soils frequently result in deficiencies of elements like manganese, boron and iron.

Soil pH can vary over time due to the addition of chemical fertilizers, breakdown of soil organic matter, the removal of calcium and other minerals by the crop, and rainfall, which leaches liming materials from the soil. For these reasons, managing soil pH should be part of your yearly crop decision-making process. For more information on the pH requirements of specific crops and soil pH maintenance, please refer to the Midwest Vegetable Production Guide (ID-56) <http://www.entm.purdue.edu/entomology/ext/targets/ID/index.htm>.

Biological Fungicides - *(Dan Egel)* - Biological fungicides are those compounds that use a fungus or a bacterium to manage plant diseases. Interest has grown in such compounds recently. Consumers have become more concerned about pesticides use and growers are increasingly concerned with the safety of the pesticides they are applying.

The effective use of biological fungicides requires growers to understand how such pesticides work. Read the label carefully. Some biological fungicides may have special requirements. For example, application intervals and timing may be different from conventional fungicides. Special storage conditions may be required for certain biological fungicides.

Biological fungicides may be incompatible with fungicides with a conventional mode of action. Conventional fungicides work by either suppressing or killing disease causing fungi. Effective disease management with a biological fungicide often requires the maintenance of healthy populations of the fungus or bacterium on the foliage before disease strikes. If a biological fungicide is tank mixed or alternated with a more conventional pesticide, the latter may be killing the microbes necessary for effective control for the biological fungicide. Thus, you may be working at cross-purposes.

Before using a biological pesticide with a conventional fungicide, be sure you know whether the two work well together. Company representatives should be able to help you. In addition, the label should be able to help you avoid incompatible combinations.

European Corn Borers - *(Rick Foster)* - First generation corn borer moths are flying and we can presume that they are or will soon be mating and the females looking for places to lay their eggs. This year they will have a difficult time finding suitable egg laying sites. As you all know, the preferred food for European corn borers is corn, which in Indiana means field corn. However, most of the field corn grown in the Midwest contains a chemical that acts as a natural insecticide, at least until it gets about 18 inches high (extended leaf height). The moths are not very attracted to corn that is shorter than this. As you may have noticed, most of the corn in Indiana is nowhere near 18 inches. As a result, the female corn borer moths will be looking for places to lay their eggs.

Vegetables growers (other than sweet corn growers) usually don't worry too much about first generation corn borers because there is usually so much attractive field corn around that the corn borers ignore the vegetables. However, this year I think the vegetables may be more attractive for corn borers to lay eggs on than the short, often sickly looking field corn that is out there. I recommend that vegetable growers keep their eyes open for signs that corn borers may be attacking their crops. European corn borers will attack just about any herbaceous plant that is large enough for them to bore into. Crops that should be watched particularly include early-planted sweet corn, potatoes, green beans, tomatoes, peppers, and pumpkins. However, don't be surprised if you find them feeding on other early vegetables. Obviously, I'm not suggesting that you spray everything just in case the corn borers attack, but I would keep a close eye out for signs of damage. Check ID-56 (Midwest Vegetable Production Guide for Commercial Growers) and product labels before treating with insecticides.

Cutworms - *(Rick Foster)* - Cutworms have been observed feeding on several different crops. Many of these were feeding on weeds prior to tillage. With tillage delayed in many areas, the cutworms have had the opportunity to get quite large on the weeds. When you kill the weeds and put your vegetables in the field, the large and hungry cutworms may do a lot of damage in a short time. Again, be on the look out for damage symptoms.

Powdery Mildew on Muskmelon - *(Rick Latin and Dan Egel)* - Growers who have planted muskmelon varieties that are susceptible to powdery mildew should be thinking about applying a systemic fungicide.

We recommend that growers with early melons apply systemic fungicides 10-14 days before harvest. Another spray is advisable in 14 to 21 days for fields with the potential for a 4 to 6 week harvest period. Powdery mildew is not a serious disease of watermelon.

Systemic fungicides labeled for use against powdery mildew on muskmelon include Benlate, Nova and Topsin as well as the newer chemicals, Flint and Quadris. With the exception of Quadris, we do not recommend any of these chemicals for use against Alternaria leaf blight, anthracnose, or gummy stem blight.

The fungi that cause powdery mildew may become resistant to the systemic fungicides listed here unless precautions are taken. It is important to always alternate between fungicides with different modes of action. Flint and Quadris have the same mode of action and must never be applied in back to back sequence. Similarly, Benlate and Topsin have the same mode of action. Nova has yet a different mode of action. Be certain to read the label carefully. More information is also listed in the **Midwest Vegetable Production Guide for Commercial Growers 2001**.

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