VEGETABLE CROPS HOTLINE

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

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IN THIS ISSUE

10 Rules for Fungicide Application - *(Dan Egel)* - Below I have listed 10 rules that will help vegetable growers apply fungicides effectively and safely.

Apply fungicides prior to the development of disease. All fungicides, regardless of mode of action or their ability to move within a plant are more effective if applied before disease starts or at least before things get out of hand. This is because all lesions start with a single fungal spore. It might take a few days to a week for the lesion to become large enough to be seen with the unaided eye. So, a disease will start in a field before even an excellent scouting program can detect it.

Use shorter spray intervals during weather conducive to plant disease. Each plant disease has its own "personality" and thus prefers different weather. However, most plant diseases require leaf wetness. Therefore, during periods of rain and heavy dews, more frequent fungicide applications are a good idea. The normal range of spray applications is every 7 to 14 days. Muskmelon and watermelon growers have the guesswork taken out of this process with a Purdue University program known as ***MELCAST***. Ask the author for more details by calling (812) 886-0198.

Apply fungicides *before* a rain if possible. Water is necessary for most fungal spores to infect a leaf or stem and for the splash dispersal of many spores. Therefore apply fungicides before a rain if it appears that the fungicide will have a chance to dry before the rain. It is not necessary to apply fungicides again after every rain. Most modern fungicides have a good sticker and will persist through rains pretty well. Some fungicide labels will have specific instructions for applying the product before a rain.

Avoid applying fungicides in the heat of the day. It is possible for any foliar applied chemical to cause some plant damage if applied under conditions of heat and direct sunshine. Also remember that if fungicides and insecticides are applied in a tank mix, make the applications so that bees are unharmed.

Timing of fungicide applications is more important than nozzle type and spray pressure. Studies here in southern Indiana as well as by researchers in other areas of the country have found that nozzle type and spray pressure doesn't make as much difference as we once thought. (See the ***Vegetable Crops Hotline*** issue #430 for details.) Nozzles and spray pressure are not as important as application of a fungicide before the disease gets started, before a rain and more frequent applications during wet weather.

Some diseases cannot be managed by foliar sprays. Problems caused by soil borne fungi or nematodes cannot be controlled with foliar fungicides. Examples of these types of problems would be Fusarium wilt of watermelon or root-knot nematodes of tomatoes. Also, be certain that the problem you observe is really a disease. No amount of fungicide will improve a problem caused by soil fertility.

Do not apply foliar fungicides to the soil. Although fungicides may kill or inhibit the growth of fungi which cause plant diseases, the application of those same fungicides to the soil will be wasteful and off label. Foliar fungicides are designed to protect the surfaces of plants.

Make certain the fungicide matches the crop and disease. That is, **READ THE LABEL**. The label is the law. Plus, considerable time and money was spent to test each fungicide with a particular crop and disease. Off label applications also waste your time and money.

Double-check the label for the current rate per acre. Rates may vary widely based on label changes and different formulations. While you are checking the rate, also check to make sure your application method is labeled. (Can this fungicide be applied in the greenhouse?) Did you get the rate from the ***Midwest Vegetable Production Guide for Commercial Growers 2010 (ID-56)*** **<www.btny.purdue.edu/Pubs/ID/ID-56/>**? Check the label anyway.

Play it safe. Always adhere to the Post-Harvest Intervals, Re-Entry Intervals and Worker Protection Standards listed on the label. No one wants an accident or lawsuit. Besides, the label is the law.

Pay particular attention to the last three items. Reading and following the law will keep one safe and legal and help one learn about the fungicide one is applying.

Fungicide Vocabulary - *(Dan Egel)* - Each year vegetable growers encounter loads of information about how fungicides work. This information comes from fungicide labels, promotional materials, sales/technical representatives and extension specialists. Below I have listed some common terms that are often used and an explanation for each one. I hope this will help clear up some confusion.

Contact fungicide-This is a term I like to use to describe fungicides that are designed to inhibit spore germination and kill fungal strands when the fungicide is in contact with the fungus on the surface of the plant. **Contact fungicides** do not enter into plants. Most **contact fungicides** have **multiple sites of action** (sometimes incorrectly termed multiple modes of action). Compare **contact fungicide** with **systemic fungicide**. (See Figure 1)

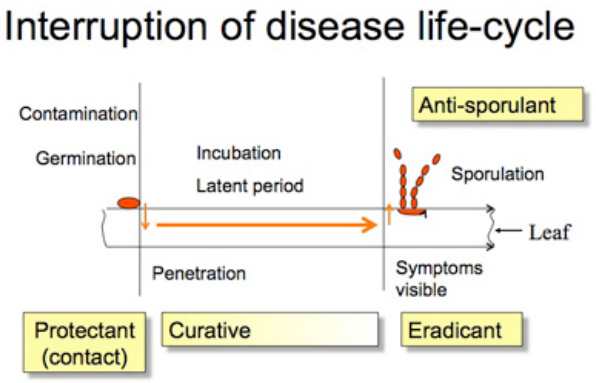

Figure 1: The diagram above illustrates at what point in the fungal life cycle fungicides may act. For more explanation, see the accompanying article. *(Figure courtesy Dow AgroSciences)*

Protective or protectant fungicide-These terms may be used interchangeably with the term **contact fungicide** above to describe how a fungicide works. That is, **protective or protectant fungicides** are those products that act on a plant surface to kill fungi. Some manufacturers use the term protective or protectant to describe the action of their products that have systemic activity *in addition* to protective activity. Therefore, I don't like to use this term to describe product activity. In addition, these terms are also used to describe *how to use* a fungicide. **Protective or protectant fungicides** protect the plant or prevent disease-it is unwise to use these materials after a disease has started and expect the product to clear up the disease. In this sense, all fungicides should be used in a preventive or protectant manner, regardless of how the fungicide works, systemic or contact. Therefore, I like to differentiate between contact fungicides and systemic fungicides rather than preventative and systemic fungicides.

Systemic fungicide-These fungicides are absorbed into the plant and move within the plant. Systemic fungicides may move from one surface of the leaf to another or from the spot of application toward the tip of the leaf or plant, but usually less than an inch and usually not from the spot of application back toward the roots. The distance a systemic fungicide moves varies widely depending on the product. Systemic fungicides have a single **mode of action**. This is important in resistance management.

Multiple sites of action-This term refers to how a fungicide works to kill a fungus. Fungicides with multiple sites of action target several biochemical pathways instead of just one (see **single mode of action**). Fungicides of this type are very unlikely to result in the development of resistance in fungi. Most **contact fungicides** have **multiple sites of action.**

Single mode of action-Fungicides that work in this way target only a single biochemical pathway and are therefore more likely than fungicides with **multiple sites of action** to develop **fungicide resistance**. **Systemic fungicides** each have a **single mode of action** indicated by the **FRAC code** on the label that is specific for each active ingredient.

Fungicide resistance-Fungi that no longer are killed by a fungicide with a particular mode of action are said to have developed fungicide resistance. Fungicide resistance can be avoided by alternating fungicide applications between products with different FRAC codes.

FRAC or MOA code-The FRAC (Fungicide Resistance Action Committee) code refers to the mode of action (MOA) of each fungicide. Most fungicide labels have the FRAC code listed on the label so that users will be able to alternate between fungicides with different MOA codes to avoid fungicide resistance. Table 25 on page 47 of the ***Midwest Vegetable Production Guide for Commercial Growers 2010 (ID-56)*** lists many of the fungicides used in Indiana along with their MOA (FRAC) codes.

Penetrant-A fungicide that is able to enter into (penetrate) a leaf. Also known as translaminar activity. Even if a fungicide lacks systemic activity once in a leaf, rain fastness may be increased by the ability to penetrate a leaf.

Curative-When a fungicide application interrupts the development of an established infection that is not showing visible disease symptoms on the plant. Note that such a fungicide has some degree of movement once in the plant (systemic). Curative fungicides do not have the ability to 'cure' a disease from a field of vegetables. All fungicides should be used in a preventative manner-before disease becomes severe.

Eradicant-When a fungicide application interrupts the further development of an established infection that is showing visible disease symptoms on the plant.

Antisporulant- A material preventing or decreasing spore production without stopping the vegetative growth of a fungus.

Vapor-A phase entered into by some fungicides after application to a leaf. Some fungicides may be redistributed while in a vapor phase to other plant surfaces. Some contact fungicides have a vapor phase.

Monitoring Soil Moisture - *(Liz Maynard)* - Managing irrigation to provide an even supply of water is important for good yields of high quality vegetables. Avoiding over-application of water is also important for crop quality and to reduce nutrient leaching and waste of water and other resources. A key practice in managing irrigation is monitoring soil moisture.

Tensiometers are one tool commonly used to measure soil moisture. As the name implies, they measure the soil water tension (the opposite of pressure), or how tightly the water is held in the soil. The units of soil water tension are centibars (cb), or kiloPascals (kP). A tensiometer consists of a tube of varying length with a porous ceramic tip at the bottom and a tension gauge and fluid reservoir at the other (Figure 1). The tube is filled with water, sealed, and placed in the soil with the ceramic tip at the depth where soil moisture will be measured. In a wet soil the tension gauge reads 0. As the soil dries water will slowly move from the ceramic tip into the soil. This creates tension in the sealed tube and the gauge needle will move from zero to a negative value. The drier the soil, the farther the needle will move. When the water in the tube is at equilibrium with the water in the soil, the gauge reading will indicate the soil water tension. After irrigation or rain wets the soil, water will move back into the tube and the gauge needle will move closer to 0, indicating less soil water tension.

Figure 1: A tensiometer ready to be installed. The instrument is filled with water to which a green dye has been added. The ceramic tip at the bottom is covered with a plastic bag to prevent it from drying out. The plastic will be removed before installation. *(Photo by Liz Maynard)*

When used for scheduling irrigation, tensiometers are typically placed in pairs at two depths: one near the upper part of the main root zone, and one near the deeper part of the root zone. For a tomato crop, this might be 6 in. and 18 in. (Figure 2). When the shallower instrument reaches a predetermined threshold irrigation is started. The threshold varies depending on crop, soil, and production system, but is typically between 10 and 50 centibars. When water reaches the deeper instrument, irrigation is stopped. Some operations use just one tensiometer to determine when to start irrigating, and stop irrigation based on the volume of water applied. Solenoid valves may be connected to tensiometers so that irrigation can be turned on and off automatically.

Figure 2: Tensiometers installed in a research plot of tomatoes. (Typically just one or two would be installed at one spot, not four as shown here.) *(Photo by Liz Maynard)*

Tensiometers require periodic maintenance once placed in the field: water may need to be added, or they may need to be de-aired. These are not complicated operations, but if not done the instrument will not provide accurate readings.

Tensiometers help us to 'see' the soil conditions below the soil surface or under plastic mulch, providing information that will help keep the crop optimally watered. By taking some of the guesswork out of irrigation management they help us efficiently provide the crop what it needs.

Other instruments and methods of measuring soil moisture are available. Monitoring soil moisture is just one tool in the box of an irrigation manager. Watch this newsletter for discussion of other methods and tools, and refer to the Irrigation Section on pp. 14 to 16 of the ***2010 Midwest Vegetable Production Guide for Commercial Growers (ID-56)*** for more information.

Fruitveg at Purdue - *(Liz Maynard)* - Have you ever wanted to send a question out to other vegetable farmers in Indiana, see if anyone is interested in bulk purchases, or get feedback on an idea you are trying? The fruitveg email list was set up for that and other communications among fruit and vegetable producers in Indiana. Extension sometimes uses it to get important information out that might not be suitable for a Hotline Bulletin. If you'd like to join, go to <**www.hort.purdue.edu/fruitveg**>, and click on the link to 'mail lists' on the left, then follow links to the fruitveg mail list. Or, send a note to **emaynard@purdue.edu**, and we'll get you signed up.

Maneb Cancelled - *(Kent L. Smith, Ph.D., Plant Pathologist, USDA, ARS, AO, Office of Pest Management Policy, Washington, DC)* - Maneb is due to be fully cancelled in about a month. Existing stocks of maneb can be used until exhausted. So if users can find some existing stocks of maneb, simply follow the label directions. In the future, EPA will be revoking all maneb tolerances but that is in the distant future. They expect to publish a Federal Register notice sometime this year that will propose a date of tolerance revocation but this notice will be open to comments.

A decision on new mancozeb registrations that will cover cancelled maneb uses that had no mancozeb registrations is due this month. We are still expecting some decision soon but have not heard anything. Watch this newsletter for more information.

Effective Crop Rotation Webinar - *(Chuck Mohler, University of Maine)* - April 6 at 2PM Eastern Time (1PM CT, 12PM MT, 11AM PT). Reserve your Webinar Seat Now at: <**https://www1.gotomeeting.com/register/900173144**>.

Implementing a good crop rotation on a farm growing a diversity of crops is remarkably difficult. Great variation in acreage among crops, multiple cropping, variation in field conditions and other factors makes a simple repeating sequence of crops impractical. Moreover, unforeseeable changes in weather, market conditions, labor supply and other factors generally derail highly specific long-term rotation plans. The Northeast Organic Network (NEON) crop rotation initiative used intensive consultation with experienced growers and extensive literature review to develop a collection of tools to help growers manage crop rotations. These are now available in a book "Crop Rotation on Organic Farms: A Planning Manual", Charles L. Mohler and Sue Ellen Johnson, eds. NRAES: Ithaca, NY. Together, the rotation planning tools provide the means for sound rotation planning while coping with complexity and allowing the flexibility to meet unforeseen challenges. The webinar will highlight key findings from the crop rotation planning initiative, and summarize important considerations for rotation planning.

Farmers Market Boot Camp - *(Announcement)* - For some of us, March Madness means we're pulling on those boots and gearing up for a great 2010 Farm Market season! The sessions listed below will include moderated discussions between Market Masters/Vendors and the area's County Health Inspectors.

You will hear:

- Some of the common issues inspectors are running into and how to avoid them.
- The most common issues facing Market Masters and what is and is not working.
- Our final session in Early May will send you into the 2010 season with workshops on Marketing, Merchandising and Selling!

Dates and Cities near you:

- Tuesday, April 13, Indiana Farm Bureau Office, 225 S. East Street, Indianapolis, IN **(Register by Friday, April 9th)**
- Friday, April 16, Jasper Inn, 951 Wernsing Road, Jasper, IN **(Register by Tuesday, April 13th)**
- Tuesday, April 20, Strongbow Inn, 2405 Morthland Drive, Valparaiso, IN **(Register by Friday, April 16th)**
- Wednesday, April 21, Whitley County Farm Bureau Office, 607 N. Opportunity Drive, Columbia City, IN, **(Register by Monday, April 19th)**
- Friday, April 23, Holiday Inn Express, 249 N. Sandy Creek Drive, Seymour, IN **(Register by Tueday, April 20th)**
- **Date in early May - TO BE ANNOUNCED, INDIANAPOLIS**

Don't let March Madness make you crazy, call and register today!

Time:	10:00am-1:00pm
Cost:	Free
Registration:	Required, lunch is included
Contact:	Debbie Trocha, (317) 692-7707 or **dtrocha@icdc.coop**

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