

VEGETABLE CROPS HOTLINE

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

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WHY ISN'T MY FUNGICIDE WORKING? - (Dan Egel) -

There are many reasons why a particular disease may be difficult to manage-why the disease seems to be spreading like wildfire even though a regular foliar fungicide spray schedule is followed. Here are some reasons:

- When severe disease pressure exists in a field, it can seem like the fungicide is not working when actually there are so many fungal spores produced that the plants are overwhelmed. Fungicides are designed to lessen the impact of a disease; even the best fungicides will not stop a disease completely. Events that may cause disease pressure that may overcome our efforts to manage the disease include lack of crop rotation, introduction of a disease on seed or transplants and extremely wet weather conducive to the spread of the disease.
- If the rate that is used is the result of improper calibration or the rate used is wrong, the result may be an explosion of disease. Check your calculations for sprayer calibration again. Check

the label for the proper rate. In most cases, I recommend using the highest rate labeled for a fungicide. This helps guard against fungicide resistance.

- One might be applying a fungicide frequently for a disease that appears to be widespread in a field. However, one may be mistaken about what disease is prevalent and therefore applying the wrong product. Or, the problem may not be an infectious problem at all, but rather a nutritional or pH related problem. It may make sense to have the problem officially diagnosed.
- The problem may indeed be fungicide resistance. Read on for more description of the problem and how to manage fungicide resistance. See also article in this issue about fungicide resistance to gummy stem blight.

Fungicides help to manage diseases by interrupting the normal systems of a fungus. These systems might include cell wall development, energy production, protein synthesis etc. This works great unless the fungi that cause a disease mutate to a form that is not sensitive to the fungicide anymore. We call such strains of the fungus resistant to a particular fungicide.

Why is it that some fungicides have been around for years and don't seem to have any problems with fungicide resistance and other fungicides seem to have resistance to them develop in just a few years? The reason has to do with the mode of action of the fungicide. Some fungicides have multiple modes of action whereas others have single modes of action (see Table 1). If a fungicide has multiple modes of action the product might affect all the systems described above and more.

Table 1: A list of representative fungicides that have active ingredients with single or multiple modes of action. The application of products with a single mode of action must be alternated with other fungicides. Products with multiple modes of action do not need to be alternated.

Multiple modes of action fungicides		Single mode of action fungicides	
Active ingredient	Products	Active ingredient	Products
chlorothalonil	Bravo®, Echo®, Equus®	azoxystrobin	Amistar®, Quadris®
mancozeb	Dithane®, Manzate®, Penncozeb®	pyraclostrobin	Cabrio®
maneb	Maneb®, Manex®	boscalid	Endura®
		tebuconazole	Folicur®
		boscalid and pyraclostrobin	Pristine®

A single mutation by the fungus, therefore, would be unlikely to cause the fungus to become resistant. On the other hand a fungicide that has a single mode of action might be involved in one very specific enzyme system. In such a situation, a single mutation by a fungus may cause it to become resistant to a particular fungicide.

Now let's imagine that a single mode of action fungicide is applied repeatedly in the same field. The single spore that mutated to become resistant to the fungicide is now the only spore in the field that is able to grow and reproduce when the fungicide is applied. The result is that the field becomes infected with a strain of the fungus that cannot be controlled with the single mode of action fungicide. If a low rate of the fungicide is applied, the resistance development process is accelerated.

To avoid fungicide resistance, always alternate single mode of action fungicides with others of a different mode of action. Single mode of action fungicides are always designated by a number. The mode of action of fungicides is usually listed on the top of a fungicide label. (Labels also have additional resistant information listed in other places.) If not, Table 25 on page 47 of the *Midwest Vegetable Production Guide for Commercial Growers 2009* <www.btny.purdue.edu/Pubs/ID/ID-56/> has a list of most of the fungicides vegetable growers should be interested in. For example, Quadris® is in mode of action group 11. After applying this fungicide one should not apply another fungicide from group 11 for the next application. Fungicides in group 11 include Amistar®, Cabrio®, Flint®, Pristine® and Tanos®. The latter two have an active ingredient in group 11 as well as a separate active ingredient in a different mode of action group. Nevertheless, they must be alternated as well. Multiple mode of action fungicides such as Bravo®, are designated by an 'M' and can be applied time after time without risk of resistance.

If you think you have fungicide resistance, contact me.



STATUS OF FUNGICIDE RESISTANCE TO GUMMY STEM BLIGHT IN INDIANA - (Dan Egel) - Gummy stem blight is a foliar disease of muskmelon and watermelon. The disease is known as black rot when it affects pumpkin fruit, but pumpkins with black rot are observed infrequently.

In the spring of 2008, growers began to complain that Pristine® did not seem to be controlling the disease. (See article in this issue about fungicide resistance.) I was able to test strains of the gummy stem blight fungus in my culture collection from past years as well as to test some strains I collected during the 2008 season.

Several strains from Knox County were found to be resistant to boscalid, which is an ingredient in Pristine® as well as other fungicides (Table 2). Boscalid is in the mode of action group 7. In addition, BASF™ (maker of Pristine®) offered to test strains of the gummy stem blight fungus for resistance to group 11 fungicides (often referred to as the strobilurin fungicides, mode of action group 11). My thanks to BASF™ for their help and support. The results can be seen in Table 2.

All of the strains that have been determined to have resistance so far are from Knox County. So far, all strains that are resistant to group 7 are also resistant to group 11.

What does this mean for gummy stem blight control for muskmelon and watermelon growers? If you grow these crops in Knox County and if you feel that Pristine® has not worked for you, you may want to avoid the use of this product in 2009 unless the product is mixed with a contact fungicide. If, on the other hand, you live outside of Knox County or you feel that Pristine has worked for you, there is no reason to avoid Pristine® in 2009. I hope to collect strains of gummy stem blight to test for resistance statewide this year.

Alternatives to Pristine® and the group 11 fungicides include the contact fungicides (see multiple mode action fungicides in Table 1, previous article). Some watermelon growers may want to avoid chlorothalonil products during harvest due to possible damage to the rinds of fruit. Folicur®3.6F is now labeled for gummy stem blight of cucurbits. I believe Folicur®3.6F will provide adequate control of gummy stem blight. *(Continued on page 3)*

Table 2: List of fungicide resistant strains of the gummy stem blight fungus observed in Indiana. Group 7 fungicides include the active ingredient boscalid, which is one of the ingredients in Pristine. Group 11 fungicides include Pristine®, Amistar®, Quadris®, Cabrio®, Flint® and others

County	Number of strains	Group 7 resistance	Group 11 resistance	Host
Knox	1	Yes	Yes	Muskmelon
Knox	6	Yes	Yes	Watermelon
Knox	1	Yes	ND	Watermelon
Knox	1	Yes	Yes	Cucumber
Owen	1	No	No	Watermelon

^zMedia analysis conducted by Dan Egel's laboratory at the SW Purdue Agricultural Center.

^yPCR analysis conducted by BASF™ laboratory in Germany.

ND=Not Done

Be certain to alternate its use with another product with a different mode of action. Folicur®3.6F is in group 3. **(Folicur®3.6F is labeled for gummy stem blight of cucurbits at 8 oz per acre. The rate listed in the ID-56 is wrong.)**

There have not been any emergency exemptions provided for any product for control of gummy stem blight in Indiana to date. If this situation changes an announcement will be made in these pages.

One other word. Please do not panic. If you have questions or concerns, call me. If you think you may have resistance, call me. If you are not sure what disease you are battling, call me. Last year, many people thought that gummy stem blight was a very severe problem. However, on examination, the problems in their fields were not due to this disease (gummy stem blight pressure was light in the southwestern portion of the state last year). I will do what I can to help in the year to come. Give me a call at (812) 886-0198 or email me at egel@purdue.edu.



VEGETABLE CROP NEEDS FOR PHOSPHORUS AND POTASSIUM FERTILIZERS - (*Liz Maynard*) - Soil tests for the plant nutrients phosphorus (P) and potassium (K) help us determine how much fertilizer to apply. If a nutrient is in the 'medium' range, the recommended amount to apply is equal to the amount that will be removed by the harvested portion of the crop. The goal is to replace the nutrients taken up by the crop and not returned to the soil in crop residues. Over time, the nutrient level in the soil should stay fairly constant. If a nutrient is in the 'high' range, the recommended amount to apply is less than that removed by the harvested crop. At very high levels no application is recommended. Over time, the nutrient levels will decline to the medium range. If a nutrient is in the 'low' range, the recommended amount to apply is more than the amount that will be removed by the harvested crop. Over time, the nutrients in the soil will build up to the 'medium' level. The 'low', 'medium', and 'high' ranges depend on the crop, region, and soil.

For vegetables in Indiana, guidelines published by Michigan State University are a good reference. "Nutrient Recommendations for Vegetable Crops in Michigan," E2934, is available online at <web2.msue.msu.edu/bulletins/Bulletin/PDF/E2934.pdf>. One type of information provided by this publication is the 'critical level' of soil P and K for various vegetable crops. The 'critical level' is the dividing line between the 'low' range and the 'medium' range. If the soil test is below this level, crop yield is likely to increase if the nutrient is added to the soil; above this level, no yield increase is likely. For most vegetables, the critical level of soil P (measured using the Bray P1 method) in a mineral soil is 30 to 45 ppm. For K, the critical level in a mineral soil depends on the soil cation exchange capacity (CEC). For a soil with a CEC of 5, the critical level is 87 ppm K, while for a soil with a CEC of 15 the critical level is 112 ppm K.

Knowing whether a field is above or below the 'critical level' for P or K will help you evaluate the benefit of applying those nutrients. If it is below, increased yield this season is likely. If it is above, increased yield this season is unlikely, but applying enough P or K to replace those removed in the harvest will maintain the nutrient level in the soil. The amount of P removed in the harvest ranges from 0.8 lb. P₂O₅ per ton of yield (for tomatoes and radishes) to 4.0 lb. P₂O₅ per ton of yield (for asparagus). The amount of K removed in the harvest ranges from 2.4 lb. K₂O per ton of yield (for watermelon) to 12.7 lb. K₂O per ton of yield (for sweet potato). These large differences between crops means it makes sense to tailor fertilizer applications to the specific crop where possible. The publication provides crop-specific recommendations for how much P and K is needed based on soil test levels.



MANEB® REGISTRATIONS CANCELLED - (*Margaret Tuttle McGrath, Cornell University*) - Due primarily to the cost of re-registering maneb and the existence of mancozeb, United Phosphorus, Inc.™, (UPI) has submitted to EPA a request to voluntarily cancel all Maneb® registrations. DuPont Crop Protection Co.™, Inc., will do likewise. The products affected include Manex®, Maneb 75DF® and Maneb 80WP®. There are several fungicides that will continue to be registered containing mancozeb, a similar active ingredient as maneb in the same chemical class. These include Penncozeb®, Dithane®, and Manzate®. For managing diseases in most vegetable crops there will be no impact of losing maneb because the mancozeb fungicides are labeled for the same diseases on these crops. However, mancozeb is not labeled for use on a few crops, notably cabbage and other cruciferous crops, carrot, eggplant, lettuce and other leaf greens, pepper, pumpkin, snap bean, and winter squash. Revenue from sales of maneb for these crops is miniscule compared to the cost of re-registering maneb. There is a petition pending at EPA to add several crops to the mancozeb label that were only on the maneb label. The current due date for a decision from EPA is July 31, 2009. This date could change if another 6-month extension is granted. Conducting a risk assessment for mancozeb is difficult because this fungicide continues to release the metabolite ethylenethiourea (ETU). Thus ETU residues change. UPI continued to produce maneb until the end of 2008. It is anticipated that there will be a good supply through 2009. UPI can sell maneb through the end of 2009. Since this is a voluntary cancellation, growers can continue to use maneb beyond that date. If EPA were to decide not to expand the mancozeb label, pepper, eggplant and leaf greens are the crops that would be affected the most because chlorothalonil, another broad-spectrum protectant fungicide, is also not labeled for use on these crops. Protectant fungicides play an important role generally in controlling disease and are also important used

with single-site mode-of-action fungicides for managing fungicide resistance. Most fungicides registered now and in development are at risk for resistance developing.



DISASTER AND FLOOD ASSISTANCE GRANT FUNDS STILL AVAILABLE FOR ELIGIBLE INDIANA FAMILY FARMERS - (*Announcement*) - Hoosier Organic Marketing Education (HOME), an Indiana-based non-profit organization, has received authorization from Farm Aid and OpUSA to extend the deadline for Indiana Family Farmers to submit applications for emergency flood relief grant money to April 2009.

While the funds may not be used for farm repairs or investments surrounding the farm and its business related transactions, *they must be used for immediate household necessities in order to provide direct emergency assistance for those who have faced losses during Indiana's recent floods.* Family Farmers who are in need of emergency funds for food, clothing, utilities or health care related to this emergency should contact HOME immediately.

A short list of eligibility criteria can be viewed and downloaded along with an application from OUR <www.indianacertifiedorganic.com/farmassistance>.



IRRIGATION MANAGEMENT PROGRAMS TO BE HELD - (*Announcement*) - Purdue University Cooperative Extension Service is hosting a program, *Irrigation Management: The Next Level*, at two locations in northern Indiana during March to assist farmers with managing their existing irrigation systems.

The first session will be held Wednesday, March 4, from 1:00 until 4:00 p.m. CST at the Centre of La Crosse located at 100 S. Washington Street. There will be a \$5 registration fee payable at the door for this meeting to cover room rental, materials and refreshments. To register, folks who plan to attend this session should call the Purdue Extension-La Porte County office at (219) 324-9407 by Monday, March 2.

The second session will be held on Tuesday, March 17, from 9:30 a.m. until 1:30 p.m. EDT in the Community Center on the Elkhart County Fairgrounds located at 17746 County Road 34 in Goshen, IN. There will be a \$15 registration fee for this meeting for materials and refreshments, and lunch will be provided by Dal-Mar Catering of Nappanee at the end of the session. To register, folks who plan to attend this session should complete a registration form and mail it to the Purdue Extension-Elkhart County office at by Friday, March 13. They may also call the office at (574) 533-0554.

These sessions are intended for farmers who currently operate irrigation systems on their farms, as well as farm managers and others who assist farmers who irrigate. The information and discussions will focus on "fine-tuning" the irrigation process to be more efficient and to save energy and money.

If auxiliary aids and services due to disabilities are required, please contact the respective County Extension office at least three days prior to the event. A registration flyer for either event can be downloaded from the Purdue Extension-La Porte County office website at <www.extension.purdue.edu/laporte>; click on "Ag & Natural Resources" and look under "Events & Educational Opportunities."

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