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In This Issue

Putting the spin on fungicide rotations

(Janna Beckerman, jbeckerm@purdue.edu)

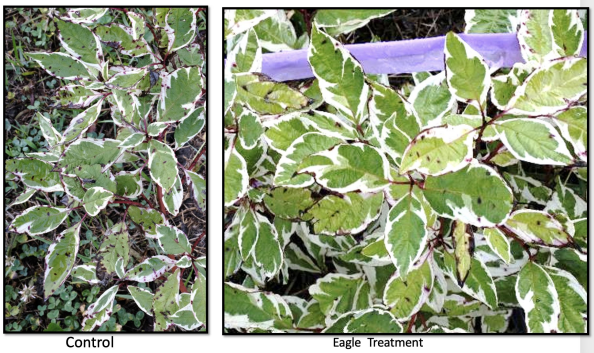

Figure 1. Eagle fungicide effectively controlled Septoria leaf spot during this dogwood trial.

Fungicides are important tools for managing ornamental plant diseases (Fig. 1). There are many different fungicides and numerous methods of classifying them. One way to classify fungicides is by their **chemical structures** or **modes of action** — the specific ways the fungicides kill a fungus. Fungicides that share a common mode of action belong to the same fungicide class (sometimes referred to as a fungicide family). Unfortunately, if a fungus is resistant to a specific fungicide, it is usually resistant to all the fungicides within that fungicide class.

Fungicides are also characterized by their specificity. **Site-specific fungicides** react with one very specific, very important biochemical process, called the **target site**. For example, a fungicide target site could be the specific proteins involved in cell wall biosynthesis, RNA biosynthesis, or cell division. Sites specific fungicides target these specific processes, which prevents the fungus from growing and ultimately causes its death.

Multi-site fungicides have multiple modes of action, so they affect multiple target sites, and simultaneously interfere with numerous metabolic processes of the fungus. Fungicide resistance occurs when a fungus develops a genetic mutation at the target site that reduces its sensitivity to a specific fungicide.

Because they affect multiple target sites, multi-site fungicides have a very low risk of causing fungicide resistance because it is highly unlikely for a fungus to simultaneously develop all of the mutations necessary for resistance.

Site-specific fungicides, however, have a much higher risk of causing resistance because a single genetic mutation at the target site can change a fungus' biochemical process so that it can still perform the needed biological function (cell division, membrane biosynthesis, respiration). The result is a fungus strain that is less susceptible or no longer susceptible to the site-specific fungicide.

If a single fungicide continues to be used, the fungicide-sensitive portion of the population is suppressed over time, and only the fungicide-resistant portion of the population remains, which goes on to reproduce and make up the majority of the population. Eventually, the fungicide is ineffective because this majority of the fungal population is no longer susceptible to it.

Minimizing Resistance

To minimize the possibility of fungicide resistance from occurring, implement a comprehensive management strategy before resistance develops. Some key tactics to include in your management strategy include:

1. **Follow good plant practices**. Using disease-resistant cultivars, following proper planting and fertilization techniques, and sanitizing equipment reduce the reliance on fungicides, thereby reducing the risk of their over-use and the development of resistant populations.
2. Use the **recommended doses** as stated on fungicide labels. Many fungicides have been extensively tested to identify the optimal rate. Cutting the rate results in a sublethal dose that is not only ineffective for disease management, but increases the risk of resistance.
3. Minimize the number of fungicide treatments per season, and **apply only when necessary**. Excessive use of site-specific fungicides increases the likelihood of resistance. By reducing the number of site-specific fungicide applications, you reduce the likelihood of resistance development.
4. **Do not rely solely on one fungicide with a site-specific mode of action**.

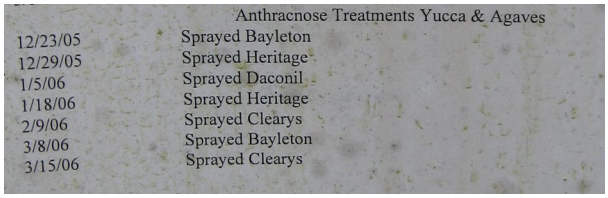

Figure 2. An inexpensive and ineffective fungicide rotation to manage canna rust.

Use a diversity of fungicides with different modes of action that provide broad-spectrum disease control. There is no single, best fungicide. There are, however, multiple fungicides with different efficacies for different diseases (Fig. 2). Many single-site fungicides are highly effective by themselves, but you should tank-mix them with another fungicide from a different family, or rotate or alternate multiple fungicides to reduce the risk of resistance. The important thing to remember is that you should avoid consecutive applications of site-specific fungicides.

For this an additional information in this newly updated brief, see https://www.extension.purdue.edu/extmedia/BP/BP-71-W.pdf

Make your plants healthier by improving the timing of your pest management

(Cliff Sadof, csadof@purdue.edu)

It happens almost every year. The bright pink flowers on my saucer magnolia that are lured out by the warm weather turn ugly brown after the April freeze. Not all plants and animals are harmed by these wild swings. Plants that had yet to flower, leaf out, or germinate are just fine. Same goes for the spores of plant diseases or insects in their overwintering stages.

Plants and animals use a range of environmental cues to let them know wake them from winter dormancy. Photo receptors are often one of many signals that plants can use to know when spring is coming and it is time become responsive to warming temperatures. The predictable sequence in which of plants and pests become active is called a phenology. Learning the phenology in your area can help you time pest management activities to coincide with the most susceptible stages of pests and plants.

The phenology of many plants and pests can be predicted by tracking the amount of time that the temperature is above the level of warmth needed to initiate growth. The amount of heat accumulation necessary for insects to hatch from eggs or flowers to break bud is often expressed as degree-days. In a previous issue we discussed how tables of degree days, and insect and plant phenology can be used to time your management activities. We also provided links to a number of apps that help you determine degree days in your area. One of the more notable efforts in this area is a turf pest map to help you time applications of herbicides, fungicides and insecticides.

National Phenology Network

The National Phenology Network (NPN) is a national effort of scientists and citizen scientist volunteers to collect the data on a broad range of plants, pests, and weather to make them available to the general public. Currently they include maps that predict the emergence of a number of common landscape pests include, bagworm, eastern tent caterpillar, pine needle scale and lilac borer. They are looking to expand this list and need your help.

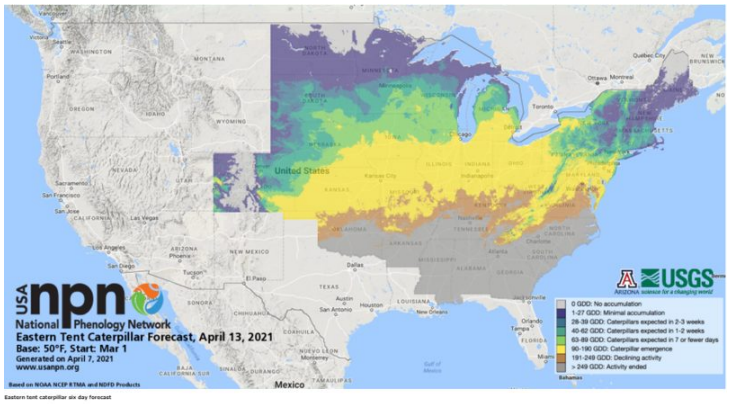

Figure 1. The NPN Eastern tent caterpillar 6 day forecast predicts caterpillars will be present in much of Indiana on April 13.

How to help the National Phenology Network collect more information?

The NPN could use your help to validate the models and maps the provide to the public. Their Nature's Notebook program provides specific opportunities to collect data on plant development, flowers used for bats, nectar sources, insect pests, invasive plants, and lilacs and dogwoods. Links on the nature notebook page provide details on how you can join a project, set up an account and start observing. Remember, you do not need to be an expert to participate. Instructions and photos provided for each of these programs make it is to report the correct information.

WHY is Professional Soil Testing So Essential ??? – PART 1

(Chris Carlson, Associate Professor, Kent State University, crcarlso@kent.edu)

PART 1 – The Importance of "Physical" Soil Testing

In my 40 years of teaching and consulting, one of the biggest and most frustrating problems I continually encounter is when so called "landscape professionals" and homeowners continue to apply annual soil fertilizers, lime, and other soil amendments without ever conducting a professional soils test.

Before planting long-lived trees, shrubs, flowering perennials and lawns, it is absolutely essential to have your soil tested for its physical, chemical, and biological properties. To have a beautiful landscape, an awesome lawn, or a very productive vegetable garden, we need to do soil tests because the health and vigor of everything we grow is directly dependent on the soil we are growing our plant's roots in.

I always ask my clients, "When was the last time you did a professional soils test"? and their usual answer is "What"??? It's all about the soil environment that we are trying to grow the roots

in. Without knowing physical soil compaction, soil drainage, organic matter percentages, soil acidity (pH) and chemical nutrient deficiencies and/or toxicities, our roots may suffer. Continually applying fertilizers, lime, or any amendments without confirming whether there is a proven "need" is considered malpractice by many professionals.

Figure1: A soil probe can be useful for soil testing and checking for moisture in the soil.

Figure 2: It is important to recognize the amount of sand, silt and clay in your landscape soils.

As an analogy, when you go to a family doctor or physician, why will they usually require a professional blood test from you? They want to "show you the numbers" of your cholesterol, HDL, LDL, triglycerides, sodium, potassium, and a whole array of other very important blood tests. Again, if they prescribe you to take medications, but they are not helping and can actually hinder your health, lawsuits can definitely occur. I tell my students, before anything is applied on a client's property, "show me the numbers"!

Although many intelligent homeowners and landscapers may have initially done a chemical soil test, many have never done a soil texture, soil compaction, and/or soil drainage test on their property or their clients. Why do we need to do these "physical" soil tests? Think about it. For root growth, its not just about nutrient deficiencies, toxicities, or soil acidity problems, its about life giving oxygen in the root zone. Without oxygen, the entire ecosystem below ground will suffer. This is why I recommend you to determine your soil texture, (sand, silt, and clay %'s). Professional soils labs can determine your soil's texture and that is very important, not only for knowing how much and when to water, but to determine what kind of fertilizers will work best for your soil. Many sandy soils are nutrient deficient because they have little negatively charged organic matter or clay to hold onto the positively charged nutrient fertilizers (cations). Excess rain and watering will leach many of the quick-release fertilizers, especially nitrate and potassium out of the root zone. This is why I recommend slow-release fertilizers on most soils so your plant's roots will have available nutrients for a much longer time.

Figure 3: Compacted soils are damaging to not just the roots but overall plant health.

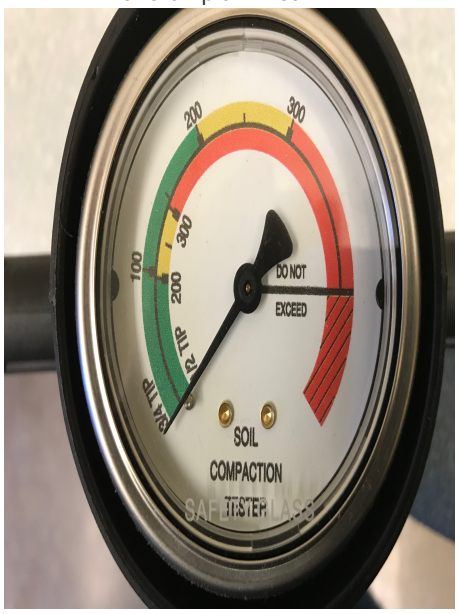

Figure 4: Special tools can be used to determine the level of compac+on.

Soil compaction is another problem I encounter, especially in newly developed, urban sites. If you have a loam or clay soil and it is compacted, you will lose macro-porosity (large air pores) in your soil which is critical for good oxygen supply to your roots. Severely compacted soils (>145-200 psi) have lower oxygen levels and lower moisture retention during droughts and that can severely affect your root system. When it comes to root health, I

always ask my clients, “How long can you hold your breath under water”? Roots are the same as humans and we both need oxygen. It’s the power of earthworms that create the oxygen tunnels that allow life-giving oxygen to enter the soil and toxic carbon dioxide and other toxic gases to leave the soil. Charles Darwin’s research has shown that ideally, you should have between 12-15 earthworms per cubic foot of your soil. Soils that are poorly drained, compacted and/or have low organic matter percentages usually are sadly deficient of earthworms and they truly can make a difference.

The beneficial soil bacteria and fungi which are also extremely important to our plants, also need oxygen to function and break down the organic matter into usable nutrients. Hence, if you have poor soil drainage or compaction problems, we need to install drain tiles, grade the surface of the soil to a minimum 1-2% slope, use raised beds, and/or plow, rototill or core aerate the soils before you plant your plants. I’ve seen compaction and drainage issues kill lots of plants because the homeowners or landscapers NEVER did percolation or compaction testing nor did they match the species moisture requirements with the site. Most xeric (dry requiring) and mesic (moist requiring) plants will need a percolation rate of 2-3 inches of water drop per hour. If your perc rate is less than 1 inch of water drop per hour, you better improve the soil drainage and/or compaction and use hydric, wetland or swamp species that have adapted through evolution to survive in wetter soils. Even hydric plants need oxygen, however!

Look for PART 2 in issue 21-07 on 5/11/21

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