Why Fungicides Fail

When applied correctly, fungicides can mean the difference between economic loss or gain.

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Fungicides are an essential part of many vegetable disease management programs. These crop protectants, however, are not “magic bullets” and their use should not be looked upon as the sole disease management tactic for any vegetable crop.

Using fungicides as part of an integrated disease management program, along with varietal resistance and cultural practices that favor plant growth and development, will give the best results. Several factors must be considered when deciding which fungicide to use and when to use it.

Fungicide Type

There are two broad categories of fungicides: protectant and curative. The most common are protectant fungicides that must be applied before the plant is infected. These fungicides are effective only where they are applied, so good coverage is essential. Commonly used protectant fungicides for vegetables are Bravo (chiorothalonil, Syngenta) and mancozeb.

Curative fungicides can stop a disease even after it has begun, although there is usually a window of several days after infection when a disease can be cured. These fungicides stop pathogens from growing in the plant tissues, and/or inhibit the pathogen from reproducing.

Most curative fungicides are systemic, meaning they can move through the plant from the point they are applied. Ridomil Gold (mefenoxam, Syngenta) is an example of a curative fungicide. Some of the newer fungicides, such as the strobilurins, e.g. Flint (trifloxystrobin, Bayer) and Quadris (azoxystrobin, Syngenta), are protectants but also have local systemic activity.

Timing Of Application

When to apply fungicides depends on the biology of the pathogen, the weather, the rate of growth of the crop, and the manufacturer’s suggested application interval. For example, late blight of tomatoes can expand from a small number of plants to a full-blown epidemic in a few days if weather conditions are right (cool and wet). Other diseases, such as early blight, progress more slowly, allowing a little less vigilance in fungicide application. Most pathogens have distinct temperature and moisture optima, so knowing what these are will help with the timing of applications.

Weather-based disease forecasting systems are available, and can help the grower decide when to spray. For tomatoes, Tomcast predicts the appearance of early blight and anthracnose. Blightcast predicts late blight outbreaks. For more data on these systems, go to ohioline.osu.edu/~vegnet/tomcats/basics.htm#topbs.

Fungicide Failure

A common cause of fungicide failure is using the wrong one. No fungicide is effective against all plant pathogens. None work on viruses and phytoplasmas, and only a few inhibit bacterial diseases.

For example, Ridomil Gold is active against diseases caused by Pythium and Phytophthora, and against white rust and the downy mildews, but is ineffective against fungi in other genera such as Rhizoctonia and Scierotinia. Protectant fungicides generally have broader activity than curative systemic fungicides, which usually have a more specific mode of action.

Diseases caused by bacteria are problematic and, to date, only copper compounds and the plant activatorActigard (Syngenta) have shown the ability to reduce the severity of bacterial diseases.

Application Methods And Rates

When applying fungicides, the objective is to maximize coverage and minimize drift. There are many nozzles and sprayers available, and nozzle pressure, tractor speed, and spray volume can all be adjusted for each formulation and crop. Fungicides may fail if they are washed off the leaves, therefore many manufacturers recommend the use of spreader/stickers to increase both coverage and rainfastness. Dosage also is critical for disease control.

Overuse or improper use can lead to fungicide failure and resistance to pathogens. For example, Ridomil no longer controls late blight of tomatoes because resistance to the product has developed worldwide over the past decade.

Resistance tends to develop faster in pathogens that reproduce and spread quickly, such as bacteria and airborne spore-forming fungi including those causing rust and powdery mildew. Resistance also is more likely to develop with fungicides that have avery targeted mode of action. The strobilurin fungicides, including Quadris and Flint, are in this category and resistance management strategies are included on the labels to assure that the fungicides are used properly. These strategies primarily consist of limits on the total number of applications that can be made, and alternation with fungicides with a different mode of action

When fungicides are used properly, they are valuable disease management tools. However, proper use requires a good understanding not only of the positive characteristics of particular fungicides, but also of their limitations.

When Fungicides Don't Do The Job	
Action	**Solution**
Applied the wrong product	Get an accurate disease diagnosis.
Applied fungicide at the wrong time	Check the label. Is the fungicide a curative or protectant? What is the recommended spray interval? Try a weather-based disease forecasting system.
Applied too little or too	Calibrate your sprayer. Adjust pressure, volume, much fungicide or tractor speed. Change nozzles or consider a different type of sprayer. Use a spreadersticker to improve coverage and rainfastness.
Did all the right things but the fungicide still wasn't effective	The pathogen may be resistant to the fungicide. Resistance can only be prevented by using an appropriate resistance-management program.

Product and company names are necessary to reportfactually on available data; however, USDA and The Ohio State University (OSU) neither guarantee nor warrant the standard of the product, and the use of the name by the USDA and OSU implies no approval of the product to the exclusion of others that may also be suitable. *Miller (miller. 769@osu.edu) andRiedel (riedel.1@osu.edu) are in the Plant Pathology Department at The Ohio State University. Derksen is with the USDA -ARSApplication Technology Research Unit stationed at the OARDC in Wooster, OH.*