Fungicides and Southern Soybean Diseases

Key Points

- Soybean diseases can be caused by many microorganisms, including fungi, bacteria, viruses, and nematodes. These diseases can damage soybean plants, reducing vigor and yield potential.
- Diseases can attack all plant growth stages, from seeds to mature plants.
- Plants under stressed growing conditions—such as drought, excessive moisture, extreme temperatures, chemical injury, or other physical injuries—are often more susceptible to disease.
- Fungicides with a mode of action that provides a protective barrier that is located on the leaf surface and is applied before infection or soon after an infection occurs are classified as “preventative” fungicides.
- Fungicides with a mode of action that are absorbed into the leaf tissue to halt the growth of pathogens early in the infection process are classified as “curative” fungicides
- Disease symptoms vary depending on the pathogen, and symptoms may also be influenced by soybean product, growing conditions, or physical injuries.

Introduction

Fungicides can be an extremely useful tool to help protect soybean yield potential from fungal pathogens. However, determining when an application is warranted can be difficult. The decision should balance the potential risks of infection with the potential effectiveness and return on investment of a fungicide application. The factors discussed in this article should all be considered when deciding whether to apply a fungicide.

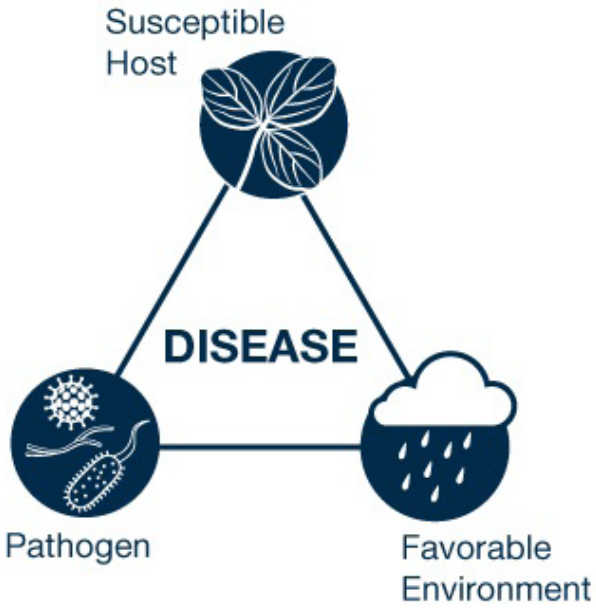

Figure 1. Disease triangle.

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The Disease Triangle

Many conditions affect the risk posed by disease to a soybean crop. The severity of a disease will be influenced by the presence of environmental conditions that favor disease development, the susceptibility of the soybean product, and the pathogens present—the three components of the disease triangle. The disease triangle describes the three factors that are needed for a disease to develop (Figure 1). Disease only occurs when all three components of the triangle are present, and the amount of time spent with favorable conditions determines the severity of disease development. The higher the disease pressure, the more likely there will be an economic response to an effective treatment.

Pathogens

Soybean pathogens can overwinter on soybean residue and be brought into the field on air currents or water movement, by vectors such as insects, on infected seed, or on farm machinery carrying soil or plant matter, or wildlife moving from one field to another. Pathogens that overwinter in soybean residue, as in continuous soybean cropping (especially with no-till practices) can create a conducive environment for disease inoculum to accumulate.[1] When growing continuous soybean, be aware of diseases present in the previous year and manage accordingly. Even when a field is rotated to soybean from another crop, growers should take note of any pathogens on the previous crop that could also infect soybean. The timing of the arrival of these pathogens impacts the recommended timing of a fungicide applications. Depending on the fungicide, it may be best to delay application until a pathogen is likely to arrive rather than making an application several weeks before the pathogen is expected to arrive. It is also important to understand that there are different variants of pathogen (races, biotypes, pathovars), and these variants (along with host resistance) can affect the need, application rate or timing of fungicide applications.

Susceptible Hosts

Soybean products can vary in their responses to diseases like Septoria brown spot, Cercospora leaf blight, and frogeye leaf spot. Resistant soybean products should be selected, when possible, especially in fields with a history of these diseases. Selecting resistant products reduces the likelihood that a susceptible host will be available for a pathogen.

Favorable Environmental Conditions

Early planting can expose a soybean crop to environmental conditions favorable to disease development.[1] Generally speaking, humid and wet conditions are favorable for the development of most diseases. A soybean plant is more vulnerable to certain disease anytime its leaves are wet over an extended period, so overhead irrigation or heavy dew can also increase the risk of disease. Additionally, a dense crop canopy with little air circulation (which often results from narrow row width) can encourage disease development.[1]

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Diseases Managed by Fungicides

Before using a foliar fungicide, it is important to scout to determine which diseases are present, as only fungal pathogens can be managed by a fungicide. Bacterial diseases and viral diseases are not managed by fungicides. Additionally, even if a disease is fungal, a fungicide that is effective against one fungal disease may not be effective against another fungal disease.

Many soybean growing areas utilize a fungicide program to anticipate fugal problems that are expected most years. By looking at forecasted weather condition that create a favorable environment, a fungicide application can be made prior to observing a problem to maximize the timing to minimize potential problems. With many fungicides now including multiple chemical groups, and often with both a preventive and curative mode of action, these programs used to anticipate a problem often minimize crop damage while maximizing the yield potential. Both curative and preventive fungicide types benefiting from early applications.

Foliar fungicides may help manage diseases such as aerial blight, southern rust, pod and stem blight, anthracnose, Septoria brown spot, Cercospora leaf blight, and frogeye leaf spot, as well as others.[2] However, several fungal diseases are not well controlled by foliar fungicides, either because of the location of the infection or because of the precise timing of the application needed for treatment to be effective. For example, charcoal rot and sudden death syndrome can cause severe yield losses, but foliar fungicides are not effective against them because these infections occur in soybean roots. For additional information about soybean diseases in the South go to A Guide to Common Soybean Diseases in The South.

Other Considerations

It is important to also consider yield potential, soybean growth stage, the potential for additional disease development, fungicide and application costs, and the commodity price of soybean when deciding if a fungicide should be applied. Fungicides are just another tool in the toolbox to use as needed, and overuse of fungicides, particularly ones with the same mode of action, can lead to the development of fungicide resistance in pathogen populations.

How to Manage Fungicide Resistance

Fungicide resistance prevention should also be considered in treatment decisions. The FRAC code 11 fungicides (referred to as (QoI or strobilurin fungicides) are very effective at managing many diseases. However, this fungicide class has a high risk of fungicide resistance development in pathogens, while FRAC code 3 and 7 fungicides are considered to have a medium-to-high risk for resistance development by fungal species.[3] FRAC code 11 resistance has already been discovered in the frogeye leaf spot pathogen and documented in fungal species infecting other crops as well. Widespread, indiscriminate use of fungicides increases the selection pressure on fungal pathogens, which can accelerate the development of fungicide resistance. Other disease management practices, such as crop rotation and planting resistant soybean products, should be used along with alternating or combining applications of fungicides with different modes of action for effective fungicide resistance management. Fungicide labels should always be followed and may include recommendations or use restrictions to help manage the development of fungicide resistance.

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Ideal Soybean Fungicide Application Timing

The ideal application window for applying a foliar fungicide is between the R2 and R4 growth stages (Figure 2), and foliar fungicide applications are generally not needed or recommended in the early vegetative growth stages (VE through V6) or after R6. Fungicide applications for late-season diseases are generally made between R2 and R4 (pod development stages).

Current and forecasted weather conditions, and the effective protective time of foliar fungicides (generally 14 to 21 days) are also important considerations when determining if a fungicide application is needed to protect a soybean crop. If disease-favoring environmental conditions are anticipated at the R3 growth stage, treatment with a fungicide may be warranted because the time from pod-set through the seed-fill stages (R3 through R6) is critical to a soybean crop's yield. Leaf loss can significantly reduce yield if diseases attack during early seed filling. More than one fungicide application may be needed in environments with high disease pressure.

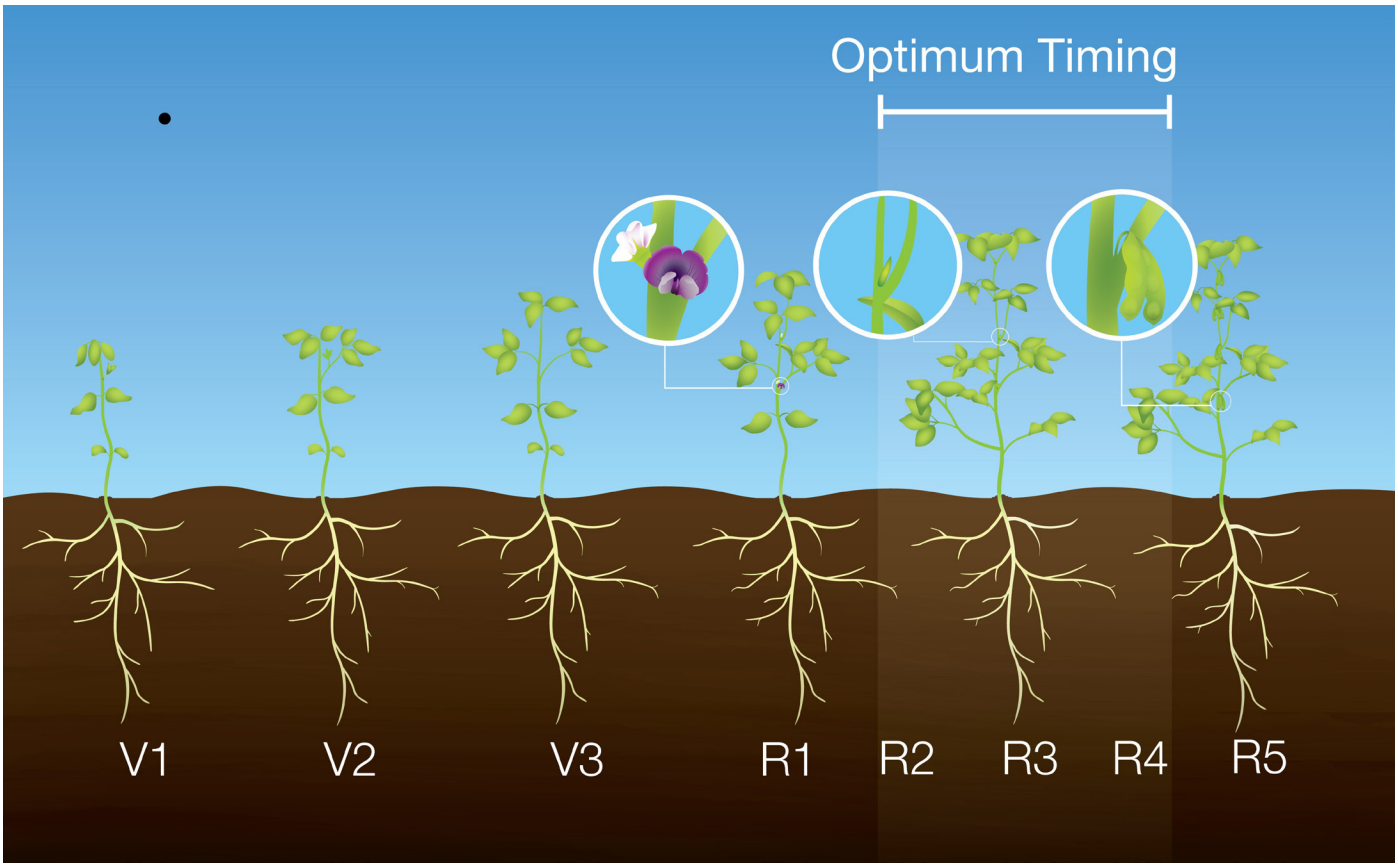

Figure 2. Soybean foliar fungicide application timing.

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Types of Soybean Fungicides

Three main fungicide chemical groups used in soybean:

- Demethylation inhibitor (DMI) fungicides (which includes fungicides known as triazoles), FRAC code 3
- Succinate dehydrogenase inhibitor (SDHI) fungicides, FRAC code 7
- Quinone outside inhibitor (QoI) fungicides, FRAC code 11

Some of these fungicides are classified as preventative fungicides, which should be applied before infection to prevent diseases from developing, and some of these fungicides are classified as curative fungicides, which should be applied before infection or early after infection to treat or cure a disease.

Demethylation inhibitor fungicides have curative and preventive properties; they are absorbed into the leaf tissue of infected plants early in the infection process. This fungicide group stops sterol production in fungi, preventing fungi from forming cell membranes and eventually killing them.

Succinate dehydrogenase inhibitor and quinone outside inhibitor fungicides are mostly preventative. To be effective, they should be applied prior to infection or very early after infection occurs. The SDHI and QoI fungicide groups stop energy production in fungi by inhibiting respiration, which kills the fungi.[4]

There are additional FRAC code fungicides labeled for crop use, but the FRAC code 3, 7, and 11 products mentioned above are most often used to control foliar fungal diseases in soybean.[3] Always consult product labels and follow application instructions and restrictions. Fungicide applications are more effective when applied before and infection occurs.

Should Insecticides be Applied with Fungicides?

Although tank mixing permissible products is efficient from an application standpoint, precise timing is usually required for optimum effectiveness of one or both spray components. The application (spray) parameters, spray pressure (PSI), and volume (gallons per acre) for fungicides may also be different from those used for insecticide applications. Finally, disease and insect pressure vary by year and location, so decisions on insecticide applications may need to be made separately from decisions on fungicide applications.

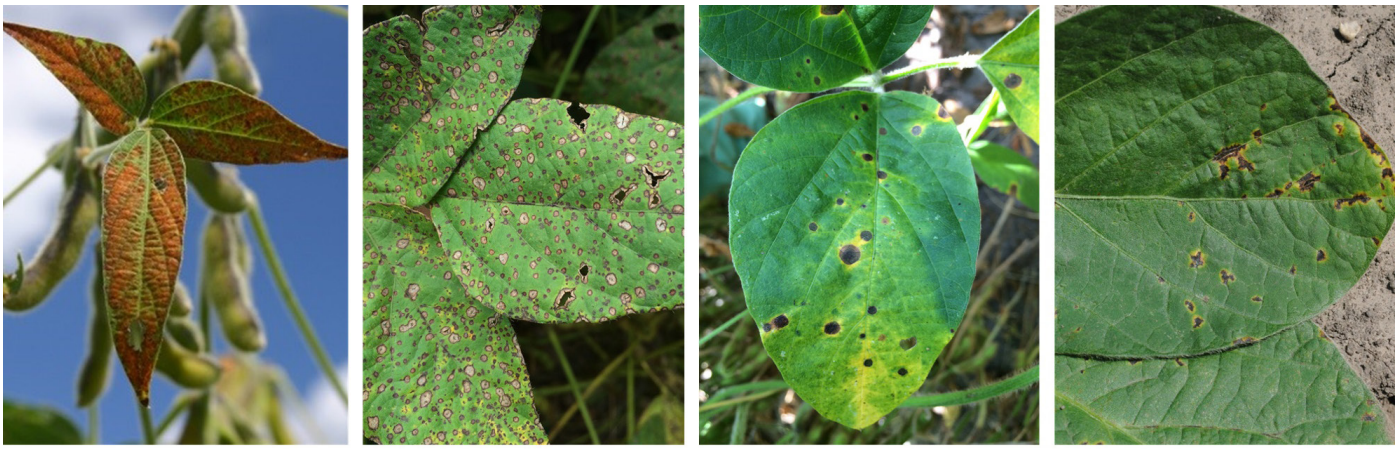

Figure 3. Soybean foliar disease symptoms of Cercospora leaf blight, frogeye leaf spot, target spot, and Septoria brown spot.

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Sources

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