

Foliar Fungicide Applications and Soybean Rust

The management of soybean foliar diseases with fungicides is now a common consideration. The introduction of Asian soybean rust led to more effective fungicide treatments, and higher commodity prices allow greater use of yield enhancing or protecting inputs. Growers can be better prepared to manage soybean rust by being familiar with such factors as fungicide class and activity, fungicide treatment timing, and application considerations.

Fungicides and Diseases. Many fungicide programs are effective against Asian rust (Figure 1) and other late-season fungal diseases. Soybean diseases that look similar to rust are bacterial blight, bacterial pustule, downy mildew, cercospora blight, brown spot, and Frogeye leaf spot. Fungicide selection to control these diseases will partly depend on the timing of infection.

There are two classifications of foliar fungicides (Table 1):

1. **Protective** - function only pre-infection; prevent fungi from successfully infecting the host tissue; also referred to as preventative.
2. **Curative** - function early post-infection; have the ability to inhibit further infection.

Chlorothalonil is an example of a contact fungicide with protective activity. It is broad-spectrum with a multi-site mode of action and it can be effective against a range of fungal diseases including Asian soybean rust. Because it remains on the leaf surface and is not taken up by the plant, it may need to be applied more frequently depending on environmental and disease conditions. It generally provides about 7 to 14 days of disease protection.

The strobilurin chemicals are examples of systemic fungicides with protective activity. They move into the plant and are considered locally systemic, meaning that movement is limited and may not extend beyond the point of uptake. All strobilurins have the same mode of action (inhibit fungal cell respiration) and are broad-spectrum fungicides. They are generally excellent for managing late-season soybean diseases, but may not be the most effective for managing rust.

The triazole chemicals are examples of systemic fungicides with curative activity. They tend to move into the plant quickly with more upward movement to new developing leaves than the strobilurins. It is this curative activity (post-infection) that makes triazoles the fungicide of choice if soybean rust is established at low levels. However, triazoles do not have unlimited curative activity, and become less effective once soybean rust has become established at even moderate levels in the field. All triazoles have the same mode of action (inhibit the biosynthesis of sterols) and like the strobilurins, generally provide about 14 to 28 days of disease protection at labeled rates.

The general trend is to apply a mixture or premix of a strobilurin and a triazole fungicide for protection against both soybean rust and other late-season diseases. However, acceptable control of late-season diseases with these mixtures may still be difficult under certain circumstances.

Application Considerations. Fungicide applications in soybeans are generally not needed in the early vegetative growth stages (VE through V6). Spraying in the flowering stages (R1 through R2) may be necessary if rust is present or if the risk is high. Under these circumstances, a fungicide treatment may reduce the amount of rust present and lessen the disease severity later in the season.

Table 1. Examples of fungicides and general activity provided.

Chemical Class	Examples	Activity
Chlorothalonil	Bravo®, Echo®, etc.	Contact, Protective
Strobilurins	Azoxystrobin (Quadris®) Pyraclostrobin (Headline®)	Systemic, Protective
Triazoles	Cyproconazole (Alto®) Fluzilazole (Punch®) Flutriafol (TopGuard®) Metconazole (Caramba®) Myclobutanil (Laredo®) Propiconazole (Tilt®, etc.) Tebuconazole (Folicur®, etc.) Tetraconazole (Domark®)	Systemic, Curative

to pg. 2 

▶ from previous page

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Prior to soybean rust, fungicide applications in soybeans were generally made between R3 and R5 (pod development stages) targeting late-season diseases. Pod set through seed fill stages (R3 through R6) are the most critical period for seed yield. Leaf loss can reduce yield if rust or other diseases attack during early seed filling. Spraying fungicides after plants reach R6 is generally no longer necessary and not recommended.

Fungicide applications to manage rust made earlier than the R3 stage in soybeans may be too early to control late-season diseases. Therefore, multiple fungicide applications to manage foliar diseases other than rust may be necessary under these conditions.

Spraying fungicides is different than applying herbicides and insecticides. Fungicide spray needs to be placed as deep into the canopy as possible. Soybean diseases usually start in the lower canopy and move into the middle, then upper canopy as the crop matures. Sprayer reconfiguration may be necessary to obtain good coverage and canopy penetration. Using a spray volume of no less than 15 GPA is important to provide good coverage. Spray volumes at 10 GPA may give acceptable coverage early in the season with less canopy density, but greater spray volumes are needed as the season progresses because the canopy is deeper and denser.

Nozzle type, spray pressure, application volume and speed will determine the uniformity of spray deposition and

penetration into the canopy. Flat-fan pattern nozzles are generally the best choice, provided the spray from these nozzles is characterized as high-fine to mid-medium (200-300 micron droplets in diameter). Proper nozzle orientation and overlap is also critical to achieve good spray deposition.

Managing Fungicide Resistance. Fungicide resistance can occur when a selection pressure is placed on the fungal pathogen population. Both the fungicide and the pathogen play a role in the magnitude of the selection pressure and the risk of resistance. Managing selection pressure is the key to reducing the risk of fungicide resistance. The best resistance management program utilizes all available practices to prolong the effectiveness and the life of the fungicides.

- Scout and monitor fields for disease development and apply fungicides as necessary.
- Scout and monitor fields for fungicide efficacy and signs of any fungicide failure.
- Apply mixtures of fungicides with different modes of action.
- If more than one fungicide application during the season is required, use fungicides with different modes of action.

Please contact your local agronomist for more information on soybean fungicides and soybean rust management.

Source: A. Dorrance, M. Draper, and D. Hershman. *Using Foliar Fungicides to Manage Soybean Rust*. Plant Health Initiative. NCERA publication SR-2008.



Figure 1. Soybean leaves infected with soybean rust. Courtesy: USDA ARS, online location: <http://www.ars.usda.gov> (Photo by Christine Stone)



◀ **Asian soybean rust pustules on underside of leaf.**

Close-up of rust pustule. ▶



Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible. **ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS.** **Tank mixtures:** The applicable labeling for each product must be in the possession of the user at the time of application. Follow applicable use instructions, including application rates, precautions and restrictions of each product used in the tank mixture. Monsanto has not tested all tank mix product formulations for compatibility or performance other than specifically listed by brand name. Always predetermine the compatibility of tank mixtures by mixing small proportional quantities in advance. Technology Development by Monsanto and Design(SM) is a servicemark of Monsanto Technology LLC. Headline® is a registered trademark of BASF Corporation. All other trademarks are the property of their respective owners. ©2010 Monsanto Company. 07082010ABT