Spray equipment considerations for foliar fungicide application on soybeans

Mark Hanna
Iowa State University, hmhanna@iastate.edu

Palle Pedersen
Iowa State University

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Spray equipment considerations for foliar fungicide application on soybeans

Abstract
The potential for rapid appearance of Asian soybean rust has many growers re-evaluating sprayers. Because fungicide application requirements differ from those of commonly used systemic herbicides (e.g., glyphosate), in most cases nozzles will need to be changed and the adequacy of pumps, booms, and other plumbing system components will need to be checked. Due to lack of Midwestern experience in foliar fungicide application into the soybean canopy, current recommendations are based on other fungicide application work or experience in South America.

Disciplines
Agriculture | Agronomy and Crop Sciences | Bioresource and Agricultural Engineering
The potential for rapid appearance of Asian soybean rust has many growers re-evaluating sprayers. Because fungicide application requirements differ from those of commonly used systemic herbicides (e.g., glyphosate), in most cases nozzles will need to be changed and the adequacy of pumps, booms, and other plumbing system components will need to be checked. Due to lack of Midwestern experience in foliar fungicide application into the soybean canopy, current recommendations are based on other fungicide application work or experience in South America.

Application technology when using fungicides is extremely important because fungicides are the primary tool used to control Asian soybean rust (ASR). Technologies are available to manage this pathogen very efficiently. However, just applying fungicides will not be enough. Overall, it is all about coverage. Coverage is critical to any successful fungicide application that is achieved through a combination of spray volume, nozzle selection, and pressure. Soybean is most sensitive to ASR from flowering (R1) to end of the seed filling period (R6) with the rust pustule first showing up underneath the lowest leaves in the canopy. Effective management of soybean rust with fungicides will depend on placing the fungicides as deeply into the canopy as possible. The disease usually starts in the lower canopy and moves into the middle then upper leaves as the plant matures. With ASR being so aggressive and developing deep in the soybean canopy, effective control of ASR with a fungicide requires good canopy penetration and coverage. Thus, fungicide application for ASR control often requires smaller droplets, which are produced by using nozzles with smaller orifices and/or higher pressures than are used for herbicides.

Following label instructions will be a key. Most herbicides used today are systemic, meaning the chemical can move throughout the whole weed. Total plant coverage isn’t necessary to eradicate a weed; get enough spray on the plant and the plant will translocate the active ingredient throughout. This allows the applicator to use a nozzle that produces large droplets, which helps decrease the chance of drift.

Fungicides, however, are mostly contact or locally systemic. The contact fungicides remain on the surface and will only protect the area that is covered. The local systemic is absorbed into the plant tissue and will only move locally and nothing like the systemic-based herbicides as mentioned above. Until Midwestern
research becomes available to increase odds of successful application, fungicide application principles indicate use of medium-to-fine droplet sizes and application rates of 15 to 20 gal/acre or more.

**Nozzle selection**

*Matching droplet size to calibrated application rate will dictate selection of an appropriate nozzle.*

Many herbicide sprayers have been set up with newer tip styles (e.g., air induction), lower operating pressures, or larger tips to produce coarse droplets in the 350–450 micron range. Although this remains appropriate and desirable for systemic herbicide spraying to avoid drift, research indicates leaf coverage with foliar fungicide is best when using smaller droplets in the 200–300 micron range. Droplets below 200 microns in size are prone to drift.

Check spray tip specifications from the manufacturer for tips that produce droplets in the small–medium to large–fine range according to American Society of Agricultural Engineers standard S-572. Use of two nozzle tips or orifices at each boom outlet may be helpful for several reasons. Dividing a given flow in two at each boom outlet requires smaller tip/orifice sizes, which produce smaller droplets. Smaller orifices require higher operating pressure to release a specific flow, which also reduces droplet size. Finally, spraying at different angles with tips into the canopy permits leaves to receive spray from different directions.

To select an appropriate nozzle, evaluate droplet size classification for nozzle tips and select a size and operating pressure that will deliver the required gal/acre application rate at the desired speed and an appropriate pressure. For most sprayers, standard flat fan or twin-type nozzles of the appropriate size can generate the desired volumes, pressure, and droplet sizes. Extended range flat fan nozzles should be suitable within the ideal pressure range, but a drop in pressure may result in creation of undesirably larger droplets.

Check to make sure the pressure and nozzle size you will be using produce droplets in the medium–fine range. Although higher than normal pressure ranges are suggested (and may be used), droplet size is a key. The appropriate pressure is that which delivers a small–medium to large–fine droplet at the required application rate. Higher pressure by itself will not simply “drive” small droplets into the canopy because small droplets slow considerably the closer to the nozzle they get, due to air drag. Droplets less than 200 microns tend to drift in a cloud above the canopy. Keep in mind that warm weather conditions during application will evaporate water from these small droplets causing them to move away from the application site.

**Pump and boom**

In many cases sprayers that successfully operate at 20 to 30 psi, will require operating pressure of 30 to 50 psi or more. Use of abrasive material (e.g., ammonium sulfate) over time may have worn pump components. Check the sprayer and pump well before application in case refurbishing or replacement is needed for the pump or other components to operate at higher pressures.

Boom height may be more critical than for herbicide spraying. The boom should be high enough so that nozzle patterns achieve proper overlap (30–50% for flat fan) at the target height. The boom should be not much higher than this, however, to minimize the travel distance of smaller spray droplets into the plant canopy. Target height on a closed crop canopy for full overlapping coverage on the upper leaves is the upper canopy surface (considerably higher than near or at the soil surface for herbicide application to smaller weeds).

Check manufacturer catalogs for proper height. Note the use of 110° tips on 20-in. spacing allows lower boom height (16–18 in.). In earlier growth stages, before the canopy is very developed, it may be desirable to consider multiple directed nozzles mounted between rows.

**Summary**

Fungicides must be applied correctly to have the greatest chance in controlling soybean rust. Because soybean rust tends to initially develop in the lower and mid-canopy, thorough coverage of foliage, including penetration of spray into the canopy, is essential to achieve a successful soybean rust spray program. Fungicides are best applied at higher gallons per acre, and typically with smaller, different nozzles operated at higher pressures than for herbicides. Besides label information, limited research indicates nozzles should be selected to produce medium–fine droplets at 15–20+ gal/acre application rate. Components, including the pump, should be checked at desired operating pressure. The bottom line for soybean rust control is coverage, coverage, and more coverage!

Mark Hanna is an extension agricultural engineer in ag and biosystems engineering with responsibilities in field machinery. Palle Pedersen is an assistant professor of agronomy with research and extension responsibilities in soybean production.