



Tips for Ground Application of Fungicide for Asian Rust Control

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Asian soybean rust, a pest first identified in the United States during the late fall of 2004, has the potential to cause severe damage to the soybean crop across a wide area of the United States. In areas where the pathogen has been present, losses have been near 80 percent without treatment. Because of the size of the U.S. soybean crop, a large rippling affect through the industry may result. Soybean rust can appear and spread quickly over a large area from the plant's early vegetative stages through its later stages. If the disease goes untreated, the plant may become entirely defoliated in 10 to 14 days.

The challenging aspect of combating this disease is the lack of practical experience in making fungicide applications to a soybean crop during the growth stages when this disease may strike. The most critical stages for the disease to affect the yield and quality of the soybean plant are from the start of flowering, R1, through pod formation, R4, and fill, R5. During these stages the canopy density is increasing, making it difficult to achieve adequate placement of the fungicide. Many questions remain regarding specific application techniques. Some questions that applicators will need to ask are:

- What fungicide or combination of fungicides should be used?
- At what stage of the disease should the application(s) occur?
- Will multiple applications be necessary?
- What application volume (GPA) will be needed?
- What spray nozzle type, orifice size, and pressure will be necessary for good coverage?
- Will a specific droplet size be necessary?
- Can fungicide applications be combined

with herbicides or insecticides as a tank-mix application?

- Would the addition of tank mix deposition aids benefit canopy penetration?
- What application system would work best – aerial, ground or chemigation?
- Are there any spray system technologies that may be better than using conventional systems?
- What other application time conditions should be considered – environmental, time of day, field conditions, or others?

Critical information regarding the answers to many of these questions is available through several sources. Strict attention to the label directions for the product(s) of choice will be essential. Any spray system (aerial or ground) should be able to make efficient and efficacious applications for rust control. This publication addresses ground applications only. Several general application practices would be appropriate, including selecting the proper fungicide or combination, applying it at the proper time, and setting the application parameters to give ample coverage deep into the soybean canopy.

Experience with disease control in heavy canopies indicates that getting the spray droplets to penetrate into the canopy would be beneficial to achieve the best coverage and improved efficacy. Experience would also tell us that when using conventional spray systems, it can be very difficult to achieve adequate coverage into the lower parts of heavy crop canopies, which is necessary for maximizing product performance. A key to successful prevention or control of soybean rust is in knowing what amount of actual fungicide will be needed in the lower parts of the canopy and then getting it there.

The following is a set of guidelines that can be

used to help select the proper application parameters for making fungicide applications with conventional boom sprayers.

- Application timing will be critical and multiple applications may be needed to fully minimize the impact from a disease outbreak.
- All applications must be made uniformly over the crop.
- Regardless of the mode of action of the fungicide of choice, an application providing excellent coverage throughout the canopy is essential. Achieving good coverage is influenced by growth stage at the time of application.
- Selecting the proper application volume is a good starting point. Currently many labels are suggesting a minimum of 10 and preferably 15 to 20 gallons per acre (GPA). Data supports improved droplet penetration into the canopy as application volumes increase. Calibrating the sprayer to achieve the selected GPA using the intended operating speed and pressure is essential.
- Base application speed depends on several factors including field conditions, nozzle type, and orifice size selected, as well as operating pressure requirements. Travel speed considerations are important for maximizing efficacy of fungicide applications. Relatively high speeds common to herbicide applications may not be appropriate. Higher speeds may result in less penetration into the canopy.
- The nozzle type, orifice size, and operating pressure selected are influenced by the need to achieve the optimum spray droplet size for maximum coverage in the canopy. Research indicates droplet size requirements in the upper fine to lower medium range (200 to 300 microns — Volume Median Diameter — VMD) based on current standards (ASAE S-572). Nozzle manufacturer charts will guide you through this determination. Manufacturer Web site addresses are provided at the end of this publication for your reference. With a specific droplet size in mind, selecting the nozzle type best suited for the job is influenced by speed of travel, pressure, and orifice size needed to deliver the desired GPA. Again, proper calibration is essential; field operations must adhere to these selected parameters.
- There are several options available for selecting a nozzle type to use. There are

also some limitations to consider. The main concern is to select a nozzle type that will deliver the desired droplet spectra for fungicide applications.

- A limitation with wide-angle flat spray nozzle types is not to use them at excessively high pressures, creating a droplet spectrum in the low end of the fine to the very fine category — below 200 microns. These smaller droplets are highly drift prone and lack sufficient velocity to get adequate canopy penetration. They also may move off target, creating undesirable environmental concerns.



Figure 1. Total Range, Extended Range (left), Turbo TeeJet flat-fan (center), TwinJet (right)

- When considering high pressure limitations for some spray systems, wide-angle Extended Range (XR)[®] or Total Range (TR)[®] (figure 1), Turbo TeeJet[®] flat-fan (figure 1), and certain venturi design nozzles may provide the best options for achieving the droplet spectra needs. The Spraying Systems TwinJet[®] nozzle is also a possibility (figure 1).
- The use of some venturi or air induction type nozzles with excellent drift reducing tendencies have severe limitations based on flow rate and pressure requirements to obtain 200 to 300 micron droplets. Achieving a proper droplet size can be accomplished but may require pressures of 125 PSI or higher. Higher pressure requirements may be more than your spray equipment is capable of delivering. However, the AirMix[®] from Greenleaf (figure 2) and the Air BubbleJet[®] from Billericay Farms (figure 2) have the ability to produce the desired droplet spectra at somewhat lower pressures. A close review of the manufacturer's droplet selection charts may resolve this issue.

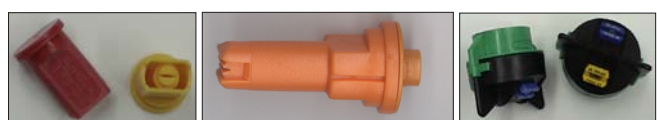


Figure 2. Greenleaf Air Mix (left), Billericay Air Bubble Jet (center), Hypro Twin-cap with Lurmark adapter utilizing two extended range flat-fan nozzles.

- Hollow-cone nozzles also have been suggested but often are used at high pressures (by design) resulting in the creation of fine droplets that have higher potential for drift and have very low trajectory speeds, making canopy penetration difficult. Hollow-cone nozzles may be an excellent choice when used with two- and three-nozzle clusters for directed applications — especially prior to full canopy closure.
- The Wilger COMBO-JET® - COMBO-RATE® nozzle system also has possibilities for improved crop canopy coverage (figure 3). This system allows applicators the flexibility to meet higher flow rate requirements by combining multiple nozzles at one location (nozzle bank) while maintaining the correct droplet size, rather than using a single larger orifice resulting in a droplet spectra too big for adequate crop canopy coverage.



Figure 3. Wilger combination nozzle bank (left) and Twin Cap adapter with MR nozzles.

- Another option with promise is a special nozzle design that incorporates a double flat-fan spray set up. Double cap or twin cap nozzle holders are available from manufacturers to adapt standard nozzle bodies. This design has two cap openings or two independent caps allowing for two flat-fan nozzles to be mounted on the typical nozzle body (figure 2). One nozzle is oriented forward and one backward from the direction of travel, ranging from 60 to 120 degrees between. This arrangement should not be confused with twin-orifice nozzles. A double cap setup could accommodate either extended range or turbo flat-fan designs (figure 4) or a combination as long as flow rate and droplet size needs were fulfilled. It is also possible to use this ‘TwinFan’ arrangement in combination with the Greenleaf AirMix® and TurboDrop® Venturi (TDTF) (figure 4). Greenleaf is recommending a smaller orifice with wider angle to produce smaller droplets

for coverage in the upper part of the crop canopy on the forward nozzle and a narrow angle with larger orifice on the rearward nozzle producing larger droplets to penetrate deeper into the crop canopy. Doing this in combination with a venturi system allows for higher pressures (80 to 150 PSI) to achieve the fine to medium droplet, thus the potential for increased droplet velocity into the crop canopy.

- Other nozzle designs may be appropriate for fungicide applications as well. Again, this is only true if you properly match the application parameters to provide the desired droplet spectra.
- It is also possible to consider lower boom settings for fungicide applications. This is only advised when using the wider angle (110+ degree fan) spray patterns. Nozzle set-up charts indicate 14 to 15 inches above the target on 20-inch spacing to provide adequate overlap to avoid streaking with wider angled spray nozzles.
- It is best to use different travel directions when more than one application is necessary. This may not be as important when nozzles with multiple spray or canopy entry angles are used — such as the twin fans.

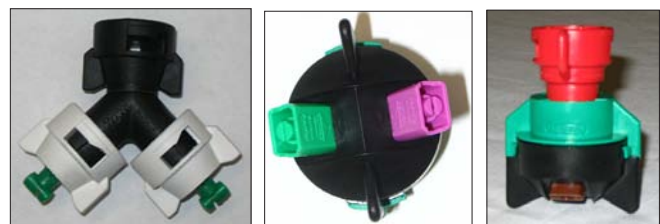


Figure 4. Double nozzle body adapter TeeJet Duo (left), Greenleaf TwinFan AirMix (center), and Greenleaf TurboDrop Venturi TwinFan (right). Twin fan uses the Hypro Twin-cap.

- In canopy applications, increasing nozzle overlap from the typical 50 to 60 percent to 80 to 85 percent may improve deposition potential. This can be achieved by raising the boom height above target to 21 to 23 inches or tilting the boom approximately 15 degrees rearward, an angle that already exists with the turbo flat-fan. Raising the boom for applications requiring canopy penetration, however, is not advised due to losses in droplet trajectory speeds and increased drift potential.

- Higher temperatures and lower humidity may cause evaporation, deterring good penetration of water from the droplets, thus decreasing their size. Heat energy absorbed into the canopy also may make it difficult to move the smaller droplets through the strong micro-inversion layer in the top of the crop.
- The use of adjuvants and surfactants may be beneficial as spreaders and stickers. Research supports improved canopy penetration with the addition of spray deposition aids. Take care to avoid major droplet spectra changes, particularly increases in the overall droplet spectrum, when these products are added to the tank. Remember to always check the fungicide label for adjuvant compatibility issues.
- The combination of a tank mix of herbicide (Glyphosate) and fungicide is not recommended. The main reason is because of the different droplet spectra requirements for each pesticide. Herbicide applications are commonly made with lower application volumes (5 to 12 GPA) and with a droplet spectra recommendation for higher medium to coarse to low very coarse classification (300 to 500 microns). This is not recommended for fungicides in the soybean rust scenario. When using the lower droplet spectrum with herbicides the drift potential increases.
- Using air-assist, air shroud, spray technology may provide an advantage for increasing droplet penetration in the soybean canopy. There is evidence that air-assist may improve coverage on the under side of the plant leaves. However, spray systems with air-assist technology are considerably more costly. More information about air-assist technology is available by doing a Web search with the key words “air-assist sprayers.”
- Research does not support the use of electrostatic spray systems to increase

canopy penetration in heavy crop canopies such as soybeans. To learn more about the electrostatic spray process do a Web search using the key words “electrostatic sprayers.”

Fungicide recommendations for controlling Asian soybean rust are based on observations and experiences in other countries where conditions, rates, and other parameters may differ. Research will continue and recommendations are likely to adjust as our understanding of Asian soybean rust improves. One thing that is known for sure is it is essential to select the application parameters to achieve thorough canopy coverage while minimizing drift. It cannot be stressed enough to make sure the application system chosen for the job is properly calibrated to deliver the proper amount of fungicide in a uniform manner over the soybean crop. Follow label directions and be alert for any new strategies that may be forthcoming.

For more information on specific management strategies for controlling Asian soybean rust refer to the following Web sites or others that you may be aware of.

- www.aphis.usda.gov/lpa/issues/sbr/sbr.html
- www.apsnet.org/online/feature/rustadvice
- www.apsnet.org/online/feature/rust
- www.aphis.usda.gov/ppq/ep/soybean_rust/
- www.gpdn.org

A general search with “Asian soybean rust” as the keyword will also provide a large amount of information.

Manufacturer Web sites

- Spraying Systems – TeeJet
<http://www.teejet.com/ms/teejet/>
- Greenleaf Technologies
<http://www.turbodrop.com/>
- Hypro Pumps
<http://www.hypropumps.com/>
- Billericay Farm Services
<http://www.bfs.uk.com/bubblejet.htm>
- Wilger Industries
<http://www.wilger.net/products.html>

Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned.

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