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Asian Soybean Rust – Frequently Asked Questions VI: Sprayer and Nozzle Technology

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Do I need a new sprayer?

Growers should assess their situation to ensure that Asian soybean rust (ASR) can be controlled with their current equipment. When recommended, fungicides must be applied to all soybean acreage quickly because ASR can move and develop very rapidly. In addition, relatively higher spray volumes (15 to 20 gallons per acre (GPA)) will be needed. This may require slower speeds and more tank refills.

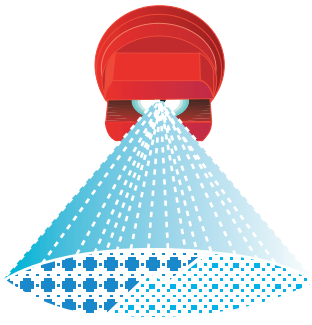
Which types of nozzles are recommended for canopy penetration and/or effective application?

Flat-fan or double flat-fan nozzles are recommended. Nozzles that can apply 15 to 20 GPA and produce medium droplet size (200 to 300 microns) are required to penetrate the canopy and adequately cover the leaf surface. Fine to very fine droplets, like those produced with hollow cone nozzles, will not penetrate the canopy and are prone to drift. Large droplets will not give adequate coverage of the leaf, may bounce off leaves, and are more likely to miss the target and land on the ground.

It must be emphasized that many nozzles used for herbicide applications are not appropriate for rust control. For more details on nozzle selection, see the Virginia Soybean Update, Volume 8, No. 2, March 2005, *http://www.vaes.vt.edu/tidewater/soybean/soybean-up/0503/0503.html,* or the Asian Soybean Rust website at Virginia Tech.

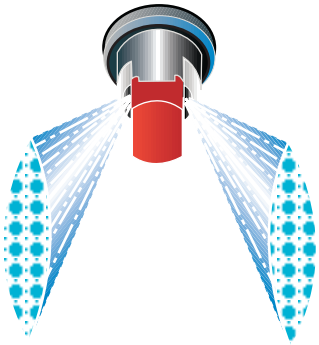
Which is more important: spray volume, pressure, or droplet size?

Spray volume is most important. At least 15 gallons, and preferably 20 gallons, per acre of spray volume are needed for ground applications. At least 5 gallons per acre are needed for aerial applications. This volume will be needed to penetrate and thoroughly cover all leaf surfaces in the soybean canopy.



At 15 PSI/1 bar Pressure

At 30 PSI/4 bar Pressure



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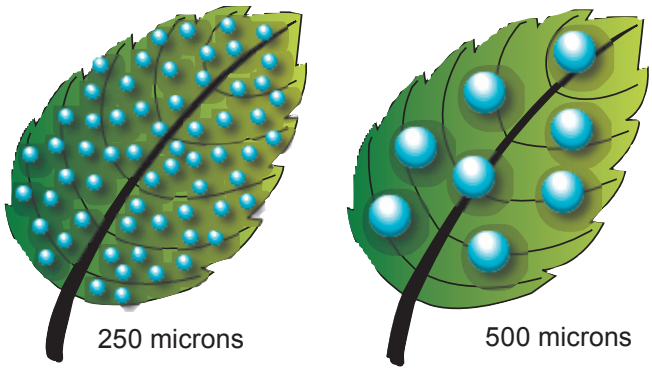
Next in order of importance is the droplet size. A medium droplet size (200 to 300 microns) is required to penetrate the canopy and adequately cover the leaf surfaces. Fine to very fine droplets, like those produced from hollow cone nozzles, will not penetrate the canopy and are prone to drift. Large droplets will not give adequate coverage, may bounce off leaves, and because the total number of droplets is less, are more likely to miss the target and land on the ground.



The advantage of high pressure is mainly due to the smaller droplets that high pressure produces. If low-drift, coarse-droplet nozzles (e.g. herbicide nozzles) are used; higher pressure might reduce droplet size into the medium size range. However, this is not guaranteed; please consult the nozzle manufacturer for droplet spectrum data. On the other hand, higher pressure could change medium-size droplets into fine or very fine droplets, resulting in less penetration of the canopy, more drift, and less control.

Obtaining 15 to 20 GPA of volume and medium sized droplets is a challenge. Certain combinations of sprayer speed, nozzle spacing, and/or nozzle flow rate will not allow 15 to 20 GPA. The easiest way to obtain this combination is to either reduce the sprayer speed or use double or twin nozzles. An Excel spreadsheet that can help determine the right combination of nozzles and speeds to give 15 to 20 gallons per acre and medium spray droplets can be found at the Asian Soybean Rust website, *www.ppws.vt.edu/ipm/soybeanrust/index.htm*, under Fungicide Equipment, Nozzle Selector Guide.

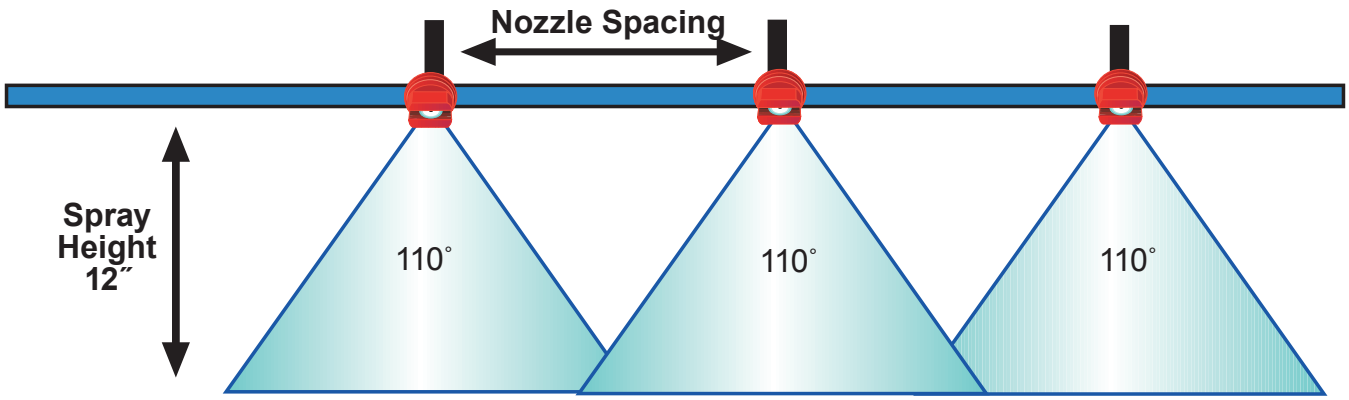
What are some general application recommendations to consider?

Here are some specific recommendations to help achieve the best coverage and control when spraying for soybean rust.

- Keep spray volume above 15 GPA for best results. With the soybean canopies taller than 24 inches 20 GPA is recommended.
- Choose the appropriate size and type of nozzles and operate them at a pressure that will allow them to produce medium-size droplets (200 to 300 microns).
- Nozzles that produce a flat-fan pattern seem to provide better coverage than nozzles that produce a cone pattern when there is a full canopy.
- Choose "low-drift" nozzles, which allow a grower to increase the pressure without increasing the number of small, drift-prone droplets (those at 100 microns or smaller). Operate these nozzles at slightly higher pressures (60 to 70 PSI) than usual. Higher spray pressures usually help the droplets penetrate the canopy better.
- Use directed spraying, if applicable, to improve coverage.
- Use twin-nozzle/pattern technology. Research has shown that two spray patterns, one angled forward and one angled backward, perform better than single nozzles spraying in one direction.
- If economically feasible, use air-assisted spraying. Research has shown that air-assisted spraying, which uses air to help droplets (100 microns or smaller) reach the interior of the plant canopy and the underside of leaves, consistently provides the best coverage and droplet penetration, especially when beans are at, or near, their full-growth stage. One should match air flow to canopy density when using air-assisted sprayers.

How should the boom be oriented to the crop canopy?

The boom height should assure good coverage over the canopy. Match boom height to nozzle spacing to provide good coverage and avoid skips in the top canopy. A combination that works well is a nozzle spacing of 20 inches and a boom height of 12 to 18 inches above the canopy for wide-angle (110-degree) nozzles. Adjust the boom height as necessary to improve coverage and penetration. Some of the twin-nozzle configurations help with canopy penetration.



Is aerial application effective for ASR?

Yes, aerial applications are effective for ASR control, if 5 gallons per acre of spray volume is used. Agricultural aircraft have a speed advantage and the ability to spray when field conditions are too wet for a ground sprayer. Thus, aircraft may have significant advantages in timeliness over ground sprayers.

Will row spacing affect spray penetration?

Although one would think that wider row spacing would allow better spray penetration, research has found no difference in spray penetration with row spacing if 15 to 20 GPA spray volume is used and a small to medium droplet size is obtained.

Will the addition of spray additives (i.e., surfactants, crop oil concentrates, drift retardants, etc.) affect spray coverage and penetration?

Surfactants decrease the surface tension between the spray solution and the leaf surface and allow droplets to spread more evenly over the leaf. Therefore, coverage of individual leaflets that intercept droplets may increase. However, the addition of a spray additive does not necessarily result in increased coverage of the entire plant. Only by using 15 to 20 GPA spray volume and maintaining small- to medium-size droplets is coverage maximized.

Spray additives may affect penetration via changing the spray droplet size. However, because of specific properties of individual fungicides and individual additives, the effect on droplet size cannot be generalized. The crop protection industry and universities are conducting research to clarify these chemical interactions. Consult individual product labels for compatibility issues and other factors that might alter fungicide efficacy.

Why calibrate applicators?

Calibration is the best way to ensure you are delivering the desired rate. The window of opportunity to spray for ASR is narrower than for most pests. You may not have the time to calibrate after ASR has arrived. The early spring months are the best time to thoroughly check the sprayer, select nozzle packages, and calibrate the sprayer properly. Do this before the arrival of ASR and calibrate frequently!

Timely spraying is also a key to reducing potential ASR damage. Do maintenance checks on spray equipment so it will be ready when needed. Calibrate frequently! Sprayers should be calibrated several times a year. Changes in operating conditions and the type of chemical used may require a new calibration. Be prepared to spray for ASR before it arrives and have your sprayer calibrated. Use the "Ounce" calibration methods as described in *Fine Tuning a Sprayer with "Ounce" Calibration Method*, Virginia Cooperative Extension publication 442-453, *http://pubs.ext.vt.edu/442-453/*

Other ASR Resources

Asian Soybean Rust website at Virginia Tech – *http://www.ppws.vt.edu/ipm/soybeanrust/index.htm*

USDA Soybean Rust Tracking site – *http://www.sbrusa.net/*

North American Plant Disease Forecast Center– *http://www.ces.ncsu.edu/depts/pp/soybeanrust/*

The Southern Plant Diagnostic Network – *http://spdn.ifas.ufl.edu/soybean_rust.htm*

Related Publications

Asian Soybean Rust – Frequently Asked Questions I: Background and General Information, Virginia Cooperative Extension publication 450-301

Asian Soybean Rust – Frequently Asked Questions II: Identification, Biology, and Ecology, Virginia Cooperative Extension publication 450-302

Asian Soybean Rust – Frequently Asked Questions III: Control with Fungicides, Virginia Cooperative Extension publication 450-303

Asian Soybean Rust – Frequently Asked Questions IV: Cropping Systems and Cultural Practices, Virginia Cooperative Extension publication 450-304

Asian Soybean Rust – Frequently Asked Questions V: Monitoring, Tracking, and Scouting, Virginia Cooperative Extension publication 450-305

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