

## Proper Application Techniques are the Key to Controlling Soybean Rust

With the recent identification of Asian Soybean Rust (*Phakopsora pachyrhizi* fungus) in the continental United States, understanding proper application principles is vitally important for successful rust control. This bulletin lays out key application techniques for proper nozzle selection to help you obtain the best protection from soybean rust.

### Key Application Considerations

With Asian Soybean Rust being so aggressive and developing deep within the soybean canopy, proper placement of fungicides will be critical to achieve effective control. Plant growth stage, canopy density, fungicide rates, carrier volume, application speed, operating pressure, and nozzle selection will all be important factors to achieve proper application. The information that follows is designed to help you manage soybean rust effectively. For additional information related to Asian Soybean Rust and the chemicals approved for treatment, consult your local Cooperative Extension Service (CES) advisor or chemical representative and visit [www.TeeJet.com](http://www.TeeJet.com).

### Canopy Density Determines Application Strategy

The growth stage of the soybean plant at the time of infection will greatly determine the number of potential applications needed and the potential yield loss. Canopy density typically correlates with the plant growth stage and planted row spacing. The closer the row spacing is, the quicker a closed canopy will form. As the plant grows, it will continue to branch out and add leaves until it reaches maturity and leaf drop. As crop canopy becomes more dense, spray penetration and coverage on lower leaves becomes more difficult. Examples of three density stages are as follows:

**VE to V6 vegetative stages:** These stages of plant growth will have a light or less dense canopy, with more visible soil surface than vegetative plant surface. Plants are usually below 12 to 14 inches in height.

**R1-R2 flowering stages:** These stages of plant growth will have a medium canopy with some soil surface still visible. Plant height is usually between 15 and 22 inches.

**R3-R8 pod and seed set:** These stages of plant growth will have the heaviest canopy of all with no soil surface visible. Plants will usually be at least 23 inches in height, depending on the soybean variety.



### Difference Between Spraying Fungicides and Herbicides

When applying a crop protection chemical, it is important to understand how the chemical works and what type of spray application is needed. In soybean production, post-emergence herbicide applications are the most common. With the majority of soybean acres being treated with a post application of a non-selective herbicide, drift tends to be the number one concern. To make a post application of a fungicide, leaf surface coverage needs to be the main objective.

#### Larger Droplets Acceptable for Non-Selective Herbicides

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 off-target drift.

#### Smaller Droplets and Greater Surface Coverage Required for Fungicides

The fungicides that are available for treatment of soybean rust need surface coverage to be effective and this is

achieved best by smaller droplets. Of the fungicide chemistries currently available, there are two primary types, contact and locally systemic. The contact fungicides remain on the surface and will only protect the area that is covered. The locally systemic variety is absorbed into the plant tissue. However, this is not the same type of systemic movement normally seen in systemic-based herbicides as mentioned previously. The fungicide will not move throughout the plant, only within a small absorption zone (within a single leaf, for example).

### Important Application Factors:

#### Nozzle Selection

- Most critical factor
- Determines application rate and leaf coverage
- Controls rust fungicide effectiveness
- Higher spray pressures may be needed for canopy penetration

#### Placement of Fungicides

- Critical to achieve effective rust control
- Large number of small droplets needed for maximum surface coverage

#### Canopy Growth Stage and Density

- Time of infection determines treatment and yield loss

#### Application Rate

- Follow label recommended rates carefully
- Directly affects spray coverage

#### Application Speed

- Slower speeds may be needed for better spray coverage
- Faster speeds can reduce surface area coverage

**Selecting the right spray nozzle is the least expensive thing you can do to protect your soybean crop and your investment.**

## Choosing the Best Nozzle for Your Application

Selecting the right spray nozzle is the least expensive thing you can do to protect your soybean crop and your investment.

Nozzle selection, spraying pressures, and application rates may be the most critical factors in determining your ability to effectively control soybean rust. Canopy penetration and plant surface coverage are also essential elements to consider.

When applying fungicides, a large quantity of small droplets is usually needed to obtain the necessary surface coverage for proper control. To ensure that the fungicides will perform at their best, slightly higher pressures may be needed to create smaller droplets. The majority of fungicides available for treatment of soybean rust need maximum surface coverage to allow for effective control. Use of drift control nozzles that are normally used for application of non-selective herbicides would be the wrong approach and could adversely affect rust control. Though it is still important to maintain a level of drift control while applying fungicides, the goal needs to be selection of a nozzle that will give smaller droplets and more thorough coverage.

Reducing your droplet size in half will yield eight times the number of droplets for the same volume of material. That roughly doubles your surface area coverage. Higher tip pressure is also important to help achieve canopy penetration. It is important to note that as spraying pressure increases, droplet size will decrease significantly and it is possible to create a droplet that is too small and has difficulty reaching the target. The key will be to select the tip that will give a good balance between pressure and droplet size for the application range needed. The following nozzle selection guide for Asian Soybean Rust should help you make the right selection. Remember, the last thing the fungicide touches before it reaches its intended target is the spray nozzle. Making the right spray nozzle selection will ensure the fungicide has the best chance of controlling the disease.

## Application Rate Guidelines

Consult the chemical label for recommendations related to the volume of active ingredient and carrier needed for a specific application. Most of the labels call

for 10 to 20 gallons per acre for ground applications. Carrier volume rates will directly affect the spray coverage on the soybeans. Higher volume rates are needed to achieve maximum surface coverage. (See nozzle selection guide for differences in spray coverage). Working within this range will increase the number of droplets available for plant coverage and also increase the amount of product for canopy penetration. Make sure you talk with both your chemical representative and your custom applicator about the appropriate carrier volume needed.

## Application Speed is an Important Factor

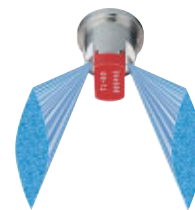
Today's larger machines make it possible to cover a lot of ground in a short amount of time. These high speeds require careful consideration to maximize the efficacy and efficiency of your operation. Speeds appropriate for other applications may not be appropriate for fungicide applications. The biggest effect that ground speed may have is a reduction in the thoroughness of chemical deposition on the target. Furthermore, higher speeds dictate the use of larger spray nozzles that result in an increase in droplet size when compared to smaller nozzles of the same type. High application speeds and critical application timing make proper nozzle selection even more important. Droplet size, total volume per acre to be applied, speed and available spraying pressure must all be given careful consideration when selecting the best nozzle for this application.

## Droplet Size

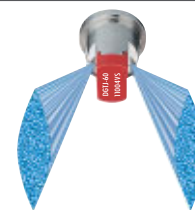
Droplet size is critical in determining the effectiveness of the fungicide being applied. Droplet sizes in the Very Fine, Fine, Medium, and Coarse droplet categories will be ideal for soybean rust applications. Keep in mind that as spray nozzle pressure changes, droplet size changes as well. The chart on the back of this bulletin outlines how spray pressure affects droplet size with a given spray nozzle.

With yield loss anywhere from 10-90% possible, it is important to stay informed and aware of potential soybean rust. Fungicide applications are expected to cost \$10 to \$30 per acre, with as many as three applications needed in a single season. Early detection, the use of approved fungicides, and proper applications can result in the effective management of soybean rust. Don't fall into the mind set that every nozzle performs the same and will perform at an equal level. Each spray nozzle has its strengths for specific applications. Make sure you are selecting the nozzle that is going to give you the strongest spraying performance for the task at hand.

## NOZZLES FOR SOYBEAN RUST



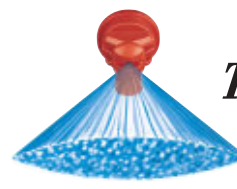
**TwinJet<sup>®</sup>**  
(TJ60)  
110° Spray Angle



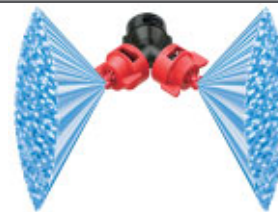
**DG TwinJet<sup>®</sup>**  
(DGTJ60)  
110° Spray Angle



**XR TeeJet<sup>®</sup>**  
**XRC TeeJet<sup>®</sup>**  
(XR/XRC)  
80° and 110°  
Spray Angles



**Turbo TeeJet<sup>®</sup>**  
(TT)  
110° Spray Angle



110° Spray Angle  
**Turbo TeeJet<sup>®</sup> Duo** (QJ90-2X)



**AirJet<sup>®</sup>**  
(49880A)



**Row Applicator Kit**  
(23770)



**Hose Drops with Swivels**

Droplet Size Categories:

**TeeJet<sup>®</sup>** Spray Products

www.TeeJet.com

Surface Area Spray Coverage (using water sensitive paper)

FEATURES	BENEFITS	10 GALLONS PER ACRE	20 GALLONS PER ACRE
<ul style="list-style-type: none"> <li>■ Dual orifice flat spray tip creates two identical spray patterns with a 60-degree included angle between them.</li> <li>■ Generates relatively fine droplets.</li> <li>■ Provides better distribution than similarly sized hollow cone spray tips.</li> <li>■ Recommended operating pressure range: 30–60 psi.</li> <li>■ Droplet size range: ●●●●</li> </ul>	<ul style="list-style-type: none"> <li>■ Small droplet size provides thorough leaf coverage for optimal control.</li> <li>■ Double spray pattern allows for excellent coverage of plant surface.</li> <li>■ Dual 60-degree angled spray pattern helps with better canopy penetration.</li> <li>■ Best suited for light, medium, and heavy canopy densities.</li> </ul>		
<ul style="list-style-type: none"> <li>■ Pre-orifice design produces larger droplets with fewer drift prone droplets.</li> <li>■ Dual orifice flat spray tip creates two identical spray patterns with an included 60-degree angle between them.</li> <li>■ Recommended operating pressure range: 30–60 psi.</li> <li>■ Droplet size range: ●●●●</li> </ul>	<ul style="list-style-type: none"> <li>■ Larger droplets than the standard TwinJet nozzle for better crop penetration.</li> <li>■ Double spray pattern allows for excellent coverage of plant surface.</li> <li>■ Dual 60-degree angled spray pattern provides better canopy penetration.</li> <li>■ Best suited for light, medium, and heavy canopy densities.</li> </ul>		
<ul style="list-style-type: none"> <li>■ Extended range flat spray tip.</li> <li>■ Generates relatively fine droplets at higher pressures.</li> <li>■ Recommended operating pressure range: 15–60 psi.</li> <li>■ Droplet size range: ●●●●●●</li> </ul>	<ul style="list-style-type: none"> <li>■ Relatively fine droplet size at higher pressures provides very good penetration and plant coverage.</li> <li>■ Extended pressure range for improved performance with automatic rate controls.</li> <li>■ Ideal tip for use with row applicator kits or hose drops.</li> <li>■ Best suited for light and medium canopy densities.</li> </ul>		
<ul style="list-style-type: none"> <li>■ Flat spray tip with excellent pattern quality.</li> <li>■ Spray pattern is offset 15-degrees from vertical.</li> <li>■ Recommended operating pressure range: 15–90 psi.</li> <li>■ Droplet size range: ●●●●●○</li> </ul>	<ul style="list-style-type: none"> <li>■ Provides good plant coverage and penetration.</li> <li>■ Wide operating pressure range makes tip ideal for use with automatic rate controls and varying ground speed conditions.</li> <li>■ Coarser droplet size provides better drift control than TwinJet or XR tip of the same size.</li> <li>■ Best suited for light and medium canopy densities.</li> </ul>		
<ul style="list-style-type: none"> <li>■ Duo cap adapter can be fitted with any standard TeeJet tip.</li> <li>■ Features a 90-degree included angle between outlets.</li> <li>■ Use with Turbo TeeJet tips allows user to create 60-, 90- or 120-degree included angle between spray patterns.</li> <li>■ Recommended operating pressure range: 15–90 psi.</li> <li>■ Droplet size range: ●●●●●○</li> </ul>	<ul style="list-style-type: none"> <li>■ Dual flat spray pattern allows for better canopy penetration and coverage.</li> <li>■ Use of TT tips provides larger droplets than equivalent TwinJet for improved drift control.</li> <li>■ Ability to select different capacities and styles of tips offers applicator the ultimate in flexibility and adaptability.</li> <li>■ Also ideal for use with automatic rate controls.</li> <li>■ Best suited for light, medium, and heavy canopy densities.</li> </ul>		
<ul style="list-style-type: none"> <li>■ Liquid plus air nozzle uses both liquid and air inputs to control application rate and droplet size independent of each other.</li> <li>■ Features wide turndown ratio and choice of several orifice inserts for a large range of application rates.</li> <li>■ Droplet size range: ●●●●●○</li> </ul>	<ul style="list-style-type: none"> <li>■ Ability to “dial in” droplet size on the go allows operator to select the most appropriate droplet size for the application, regardless of applied volume.</li> <li>■ Allows operator to quickly and easily move from applying highly drift sensitive herbicides like glyphosate to fungicide treatments requiring much finer droplets.</li> <li>■ Combined use of air and liquid may provide better canopy penetration.</li> <li>■ Best suited for light, medium, and heavy canopy densities.</li> </ul>		
<ul style="list-style-type: none"> <li>■ Utilizes up to three spray tips.</li> <li>■ Arms can be adjusted and positioned as needed.</li> <li>■ Typically used with flat spray tips such as XR or XRC or hollow cone spray tips such as TX.</li> </ul>	<ul style="list-style-type: none"> <li>■ Multiple tips provide thorough coverage of entire plant.</li> <li>■ Adjustability allows the unit to be easily matched to plant size and conditions.</li> <li>■ Best for rowed beans in early to middle growth stages.</li> </ul>		
<ul style="list-style-type: none"> <li>■ Drops offered in 15" and 24" lengths.</li> <li>■ Swivels offered in single and double outlet configurations with Quick TeeJet® lugs.</li> <li>■ Strong, flexible construction.</li> </ul>	<ul style="list-style-type: none"> <li>■ When used with flat spray tips, such as XR or XRC, provides good coverage of middle to lower plant surfaces.</li> <li>■ Best for rowed beans in early to middle growth stages.</li> <li>■ Offers improved coverage and canopy penetration over typical broadcast spraying.</li> </ul>		

● VERY FINE ● FINE ● MEDIUM ● COARSE ● VERY COARSE ○ EXTREMELY COARSE

(Droplet size categories may vary with nozzle capacity, spray angle and spray pressure)

## Important Management Steps


Here are six important steps to be better prepared to manage soybean rust.

1. Check your sprayer condition and performance before spring. Have your sprayer fitted with the appropriate TeeJet nozzles prior to the heavy spraying season.
2. This winter, learn as much about soybean rust as you can. There is a lot of information available from your local extension agents, state universities, local chemical dealers, the Internet and Spraying Systems Co. Check our website at [www.teejet.com](http://www.teejet.com) for more information regarding soybean rust.
3. Scout your fields. If you haven't been doing so, learn to do it this year. It is important to detect the infection early. This is an aggressive and rapidly progressing disease. Decisions to apply fungicides need to be made early and quickly.


4. Make a correct identification. Soybean rust can easily be mistaken for other known diseases such as bacterial pustules, downy mildew, septoria brown spot, and bacterial leafspot in early stages. Each one of these diseases will have a different effect on yield and a different economic threshold for spraying.
5. Plant early plots within your fields or in the area about three weeks prior to when the majority of your soybean crop goes in. This can allow for early detection and enable you to make preventative fungicide treatments.
6. Find out what fungicide options you have for your state. Also, know what rates are needed and the proper way to apply a fungicide. Know the difference between preventative and curative programs.

**TeeJet** *There's No Better Way to Spray*


### Turbo TeeJet® (TT)

	PSI										
	15	20	25	30	35	40	50	60	70	80	90
TT11001	C	M	M	M	M	M	F	F	F	F	F
TT110015	C	C	M	M	M	M	M	M	F	F	F
TT11002	C	C	C	M	M	M	M	M	M	M	F
TT11003	VC	VC	C	C	C	C	M	M	M	M	M
TT11004	XC	VC	VC	C	C	C	C	C	M	M	M
TT11005	XC	VC	VC	VC	VC	C	C	C	C	M	M
TT11006	XC	XC	VC	VC	VC	C	C	C	C	C	M
TT11008	XC	XC	VC	VC	VC	VC	C	C	C	C	M


### XR TeeJet® (XR) and XRC TeeJet® (XRC)

	PSI						
	15	20	25	30	40	50	60
XR8001	M	F	F	F	F	F	F
XR80015	M	M	M	F	F	F	F
XR8002	M	M	M	M	F	F	F
XR8003	M	M	M	M	M	M	F
XR8004	C	C	M	M	M	M	M
XR8005	C	C	C	C	M	M	M
XR8006	C	C	C	C	C	C	C
XR8008	VC	VC	VC	C	C	C	C
XR11001	F	F	F	F	F	VF	VF
XR110015	F	F	F	F	F	F	F
XR11002	M	F	F	F	F	F	F
XR11003	M	M	M	F	F	F	F
XR11004	M	M	M	M	M	F	F
XR11005	M	M	M	M	M	M	F
XR11006	C	C	M	M	M	M	M
XR11008	C	C	C	C	C	M	M

### TwinJet®

	PSI				
	30	35	40	50	60
TJ60-11002	F	F	F	F	F
TJ60-11003	F	F	F	F	F
TJ60-11004	M	F	F	F	F
TJ60-11006	M	M	M	M	M
TJ60-11008	C	M	M	M	M
TJ60-11010	C	C	C	M	M

### DG TwinJet®

	PSI				
	30	35	40	50	60
DGTJ60-110015	F	F	F	F	F
DGTJ60-11002	M	M	M	F	F
DGTJ60-11003	C	M	M	M	M
DGTJ60-11004	C	C	C	C	M
DGTJ60-11006	C	C	C	C	C
DGTJ60-11008	C	C	C	C	C

Droplet size classifications are based on BCPC specifications and in accordance with ASAE Standard S-572 at the date of printing. Classifications are subject to change.

<b>VF</b>	<b>F</b>	<b>M</b>	<b>C</b>	<b>VC</b>	<b>XC</b>
Very Fine	Fine	Medium	Coarse	Very Coarse	Extremely Coarse

Note: Very Fine, Fine, Medium, and Coarse droplets are best suited for applying fungicides to control soybean rust. Make sure the capacity and pressures used fall within the correct droplet size category.

**TeeJet**®  
Spray Products