PURDUE UNIVERSITY
PURDUE EXTENSION
SPS-103-W

SOYBEAN PRODUCTION SYSTEMS

Managing Fungicide Applications in Soybean

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Why Apply Fungicides?

Asian soybean rust has the potential to be the most destructive soybean disease in the United States (Miles et al., 2003; Figure 1). Not only can the pathogen lower grain yields, the increased expense of fungicides to combat it can increase production costs (Sconyers and Kemerait, 2006). According to one estimate, the costs of a severe rust outbreak could reach $2 billion a year (Alexander et al., 2005).

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Figure 1. *Soybean leaf infected with Asian soybean rust.*

Because there are no commercially available soybean cultivars resistant to rust, the best strategy for managing the pathogen is through fungicide applications (Dorrance et al., 2004). But because current fungicides are only locally systemic, they do not move from the upper leaves of the crop canopy to the lower leaves. That means fungicide applications must penetrate and cover leaves throughout the canopy for effective disease control (Derksen et al., 2001).

Prior to 2005, fungicide use in Indiana soybean was rare and little was known about proper application. This publication summarizes a two-year Purdue Extension study that examined optimal fungicide application methods.

We examined the effects of three factors on fungicide spray coverage and yield loss in soybean:

- Crop row spacing
- Application timing
- Spray volume

The studies were conducted with large equipment, on large plots (60 feet x 300 feet), and at three Indiana locations (Columbia City, Farmland, and Butlerville).

Is Row Spacing a Factor?

Many growers have contemplated switching from 7.5-inch rows to 30-inch rows to increase fungicide coverage in the lower canopy. However, our studies showed no difference in spray penetration or total coverage between soybean planted in 7.5-, 15-, or 30-inch rows across locations and years.

From our results, we recommend that growers base their soybean row spacing decisions on other factors, such as yield potential, equipment availability, or weed control.

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Figure 2. *A sprayer rig applying fungicide to soybean.*

What Spray Volume Is Best?

To maximize spray rig efficiency, growers and applicators want to apply the lowest spray volume that provides sufficient spray coverage (Figure 2). Our experiment tested four spray volumes: 10, 15, 20, and 25 gallons per acre (GPA).

The 15, 20, and 25 GPA spray volumes penetrated and covered the soybean canopy equally well, and better than the 10 GPA volume.

Therefore, our research suggests that 15 GPA is the optimum spray volume for fungicide applications.

Do Wheel Tracks Affect Yield?

Sprayer wheel traffic from first flower (growth stage R1) through harvest can damage soybean plants and reduce yield (Figure 3).

Our research suggests that an adequate soybean stand (more than 100,000 plants per acre) planted in late April though mid-May can compensate for wheel tracks made when a field is sprayed at R1. Yield loss can occur, however, when wheel tracks are made at R1 or later in thin soybean stands (less than 100,000 plants per acre) or late planted soybeans.

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Figure 3. *Sprayer wheel track damage in soybean.*

Regardless of stand, plants could not compensate for wheel tracks made at R3 (early pod development) or R5 (early seed development).

Soybean planted in narrow rows (15 inches or less) always had yield loss from wheel track damage, whereas soybean planted in wide rows (30 inches) had yield loss from wheel tracks in only half of all research trials. Although 30-inch rows should be wide enough to allow the sprayer's wheels to pass between rows without damaging the standing crop, some damage does occur because it is difficult to keep the wheels from hitting some plants while operating at 10-15 MPH. The percentage of yield loss was the same regardless of row spacing (Table 1).

Multiple trips along the same wheel tracks in any row spacing did not increase yield loss over the first trip.

How Does Sprayer Boom Width Affect Yield?

Yield loss from wheel track damage decreased as spray boom width increased (Table 1). That's because longer spray booms mean fewer passes through the field, which results in correspondingly less damage from the wheels. Additional sprayer trips that used existing wheel tracks caused no additional yield loss at any location.

Table 1. *Estimated impact of boom width on grain yield loss per acre from wheel-track damage in soybean at Farmland, Columbia City, and Butlerville, Indiana.*

	Boom Width (feet)			
	30	60	90	120
	Yield Loss Per Acre (%)			
Farmland 2005	5.5	2.8	2.1	1.4
Farmland 2006	6.7	3.4	2.6	1.7
Columbia City 2006	4.3	2.1	1.6	1.1
Butlerville 2005	3.2	1.6	1.2	0.8
Average	**4.9**	**2.5**	**1.9**	**1.3**

Yield losses were the same at all three row widths (7.5, 15, and 30 inches).

Conclusions

Based on our studies, we have reached the following conclusions:

- Row spacing has no effect on fungicide penetration or leaf coverage.
- Ground applications of fungicides should be no less than 15 GPA.
- Yield loss due to sprayer wheel tracks depends on the soybean growth stage when wheel tracks are made, crop row spacing, boom width, and soybean stand (see Table 1).
- Multiple trips using the same sprayer wheel tracks will not increase yield loss over the first trip.

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The authors would like to thank the farm mangers and crew at the Northeast, Davis, and Southeast Purdue Agricultural Centers for their invaluable assistance with this project.

INDIANA SOYBEAN ALLIANCE

Financial support for the research presented in this material was provided by the Indiana Soybean Alliance.

NEW 6/07