

Fungicide spray coverage as affected by spray volume and nozzle type in wide- and narrow-row soybean

Trey H. Koger, USDA-ARS, CGPRU, Stoneville, MS; Eric R. Walker, USDA-ARS, CGPRU, Jackson, TN; and Dan H. Poston, DREC, Mississippi State University, Stoneville, MS

INTRODUCTION

Spray volume and nozzle type affect overall pesticide performance. However, very little information exists on the impacts of fungicide spray coverage on disease severity in soybean, particularly within the crop canopy. Soybean rust typically affects the middle to lower portion of the plant canopy more severely than other parts of the plant. Thus, information is needed on the impacts of spray volume and nozzle type on overall spray coverage in narrow- and wide-row soybean.

OBJECTIVES

Investigate impacts of spray volume and nozzle type on intra- and inter-row spray coverage, fungicide efficacy, and soybean yield in narrow- and wide-row soybean.

MATERIALS AND METHODS

- An irrigated field experiment was conducted on a Sharkey clay soil at the USDA-ARS / Mississippi State University Delta Research and Extension Center in 2005.
- Soybean variety 'Dekalb 46-51RR' was planted in early April in 40- and 102-cm-wide rows at 320,000 seed/ha.
- Water sensitive cards (2.5- by 7.6-cm) were placed within the row drill (intra-row) and centered between rows (inter-row) half-way up the plant (equal distance from ground to plant apex) in each plot at the R3 soybean growth stage.
- A one liter/ha application of Quilt fungicide was applied at 84 or 168 liters spray solution/ha with flat-fan (FF), air-induction (AI), twin-jet (TJ), or turbo duo-jet (TD) spray nozzles using a tractor-driven CO₂ pressurized spray system at 276 kPa. An untreated check for each soybean row spacing was included.
- Overall spray coverage of individual spray cards was evaluated with SigmaScan Pro 5.0 software. Severity of frogeye (*Cercospora sojina*) and late-season cercospora (*Cercospora kikuchii*) was rated on a scale of 0 to 9 (0 = no disease presence and 9 = disease infestation) 4 weeks after fungicide application. Soybean yields were estimated by harvesting the middle four (narrow rows) or two (wide rows) rows per plot and adjusting to 13% moisture.

RESULTS AND DISCUSSION

- Optimal spray coverage in the absence of interference from soybean plants (inter-row in 102-cm-wide row plots) was more affected by spray volume (Figure 1) than nozzle type.
- Overall spray coverage was 20, 21, 27, and 27%, respectively, for TD, TJ, AI, and FF nozzles in the absence of interference from soybean plants (data not shown).
- Intra-row spray coverage ranged from 2.5 to 6% regardless of soybean row spacing, spray volume, or nozzle type (Table 1).
- Interference caused by canopy closure reduced spray coverage within the plant canopy of 40-cm-wide row system across both spray volumes and all nozzle types when compared to 102-cm-wide row system (Table 1).
- FF nozzles provided the best spray coverage within the plant canopy across row spacing and spray volume factors (Table 1).
- Frogeye and cercospora severity was similar across row spacing, spray volume, and nozzle type; but was reduced when compared to untreated soybean. Frogeye and cercospora severity was 1.4 and 2.6, respectively when treated with fungicide vs. 3.0 and 3.3, respectively, when not treated (data not shown).
- Soybean yields were similar across spray volume and nozzle type, but were 270 kg/ha higher when a fungicide was applied vs. when left untreated (Figure 2).
- Soybean yields were 810 kg/ha higher in 40-cm rows (5580 kg/ha) vs. 102-cm rows (4770 kg/ha) across spray volume and nozzle type (data not shown).

Figure 1. Spray coverage in the absence of interference from soybean plants as affected by spray volume. Averaged across nozzle type.

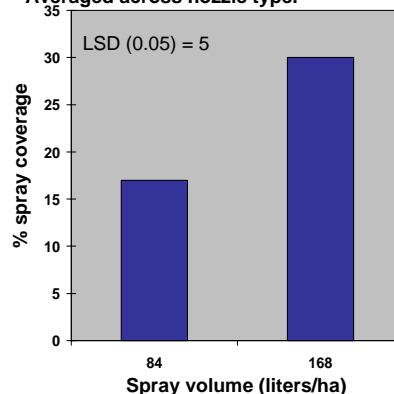


Figure 2. Soybean yield for fungicide treated and nontreated soybean. Fungicide treated averaged across row spacing, spray volume, and nozzle type.

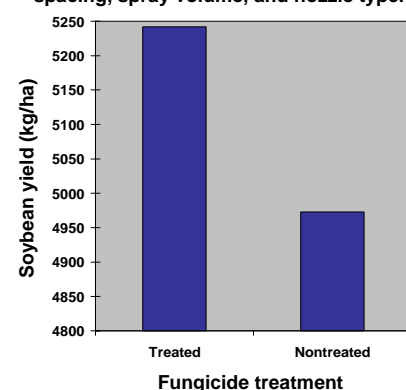


Table 1. Spray coverage as affected by spray placement, soybean row spacing, spray volume, and nozzle type.

Spray placement	Soybean row spacing	Spray volume	Spray nozzle type				Average
			Flat fan	Air induction	Twinjet	Turbo Duojet	
Row drill	40	84	6	2	3	2	3
	102	84	4	3	2	1	2.5
	40	168	11	4	4	3	6
	102	168	3	6	8	3	5
Row middle	40	84	3	4	4	3	4
	102	84	20	21	15	13	17
	40	168	13	3	10	5	8
	102	168	35	33	27	27	30
Average			12	9	9	7	
Nozzle type LSD (0.05)					2.5		
Spray placement*row spacing*spray volume LSD (0.05)					3.5		
Placement*row spacing*spray volume*nozzle type LSD (0.05)					7		

CONCLUSIONS

- Applying a fungicide vs. not applying a fungicide had more impact on disease severity and subsequent soybean yield than degree of spray coverage across spray volume and nozzle type. Even though soybean row spacing affected spray coverage, row spacing did not affect disease severity. Higher soybean yields in narrow rows can be attributed to higher degree of sunlight interception and less inter-row plant competition.