SPRAYER TRAFFIC EFFECTS ON REPRODUCTIVE-STAGE SOYBEAN PLANTED AT THREE ROW SPACINGS

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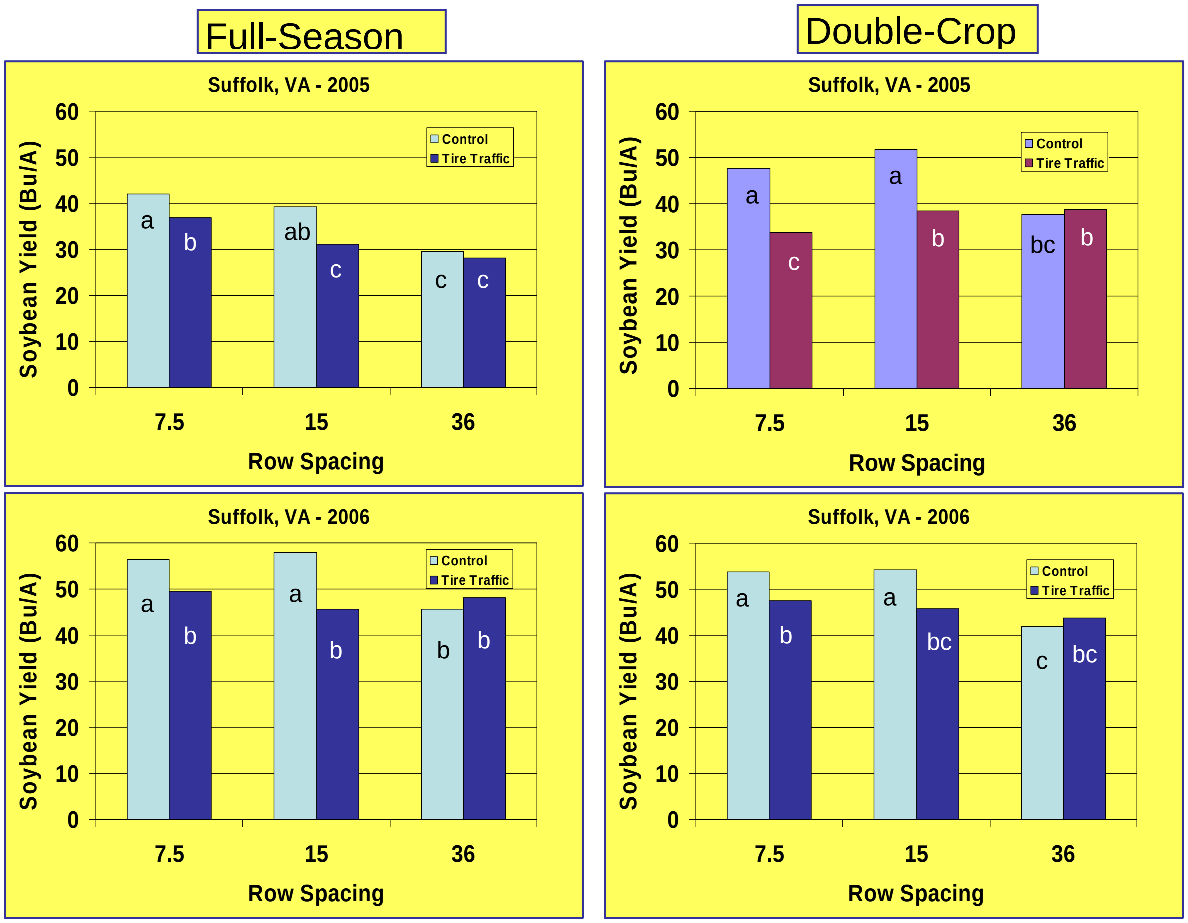
Soil Type: Dragston fine sandy loam
Planting Dates: Full-Season: May 26, 2005 & May 22, 2006
Double-Crop: June 28, 2005 & June 29, 2006
Variety: Asgrow AG5603 (2005 FS only) and Vigoro V55N5RR
Tillage: No-till in 7.5, 15, and 36 inch rows
Treatment Dates: Full-Season: Aug. 22, 2005 & Aug. 17, 2006
Double-Crop: Sept. 12, 2005 & Sept. 12, 2006
Soybean Stage at time of treatments: R4 (late pod development)
Fungicide: Quadris at 6.2 oz/A + NIS 0.25% applied to half of plots
Crop Protection: Roundup Ultra Max post-emergence
Warrior for corn earworm (2006)
Harvest Dates: Full-Season: Nov. 19, 2005 & Nov. 18, 2006
Double-Crop: Dec. 8, 2005 & Nov. 18, 2006

Background: Control of Asian soybean rust will require a fungicide application during the reproductive stages. Most soybeans in the Mid-Atlantic region are planted in narrow row spacing. Therefore, unless tram lines are established, one or two soybean rows will be damaged by the sprayer tires. The impact of sprayer traffic on reproductive-stage soybean yield has not been fully investigated. Furthermore, planting date, row spacing, and environment may influence the extent of yield loss. The objective of this research was to determine the yield loss caused by sprayer traffic to R4- (late pod) to R5- (early seed) stage soybean planted in three row widths and two planting dates.

The experimental design was a split-strip-plot with three row spacings as the main plot, with or without traffic as the vertical treatment, and with or without fungicide as the horizontal treatment. At Suffolk, individual plots were 24 feet long and consisted of nineteen 7.5-inch rows, ten 15-inch rows, or four 36-inch rows. Wheel traffic damaged 4, 2, and 0 rows in the 7.5-, 15-, and 36-inch plots, respectively (25% of the rows). This left a 30-inch gap between undamaged 15-inch rows and 22.5-inch gap between 7.5-inch rows.



Cropping System	Year	Row Spacing	Plot*	Sprayer Boom Width 45	60	90	120
		(inches)	---------------------(% Yield Loss)---------------------				
Full Season	2005	7.5	12.6	2.8	2.1	1.4	1.1
		15	20.9	5.6	4.6	2.8	2.3
		36	---	---	---	---	---
	2006	7.5	12.1	2.6	2.0	1.3	1.0
		15	21.2	4.8	3.5	2.4	1.8
		36	---	---	---	---	---
Double Crop	2005	7.5	29.0	6.4	4.8	3.2	2.4
		15	25.5	5.6	4.3	2.8	2.1
		36	---	---	---	---	---
	2006	7.5	11.5	2.6	1.9	1.3	1.0
		15	15.5	3.4	2.6	1.7	1.3
		36	---	---	---	---	---

*Wide rows suffered no significant yield loss with wheel traffic. Row spacing of 7.5- and 15-inches is significantly different at all locations, except the 2005 Suffolk double-crop experiment.

Discussion: Wheel traffic reduced soybean yields when planted in 7.5- or 15-inch rows regardless of location, cropping system, or fungicide. Fungicide did not affect soybean response to wheel traffic nor did it interact with other factors, so yield was averaged over fungicide treatment. Fungicide only increased yield by 3.3 bushel per acre at the 2006 Suffolk full-season site, but not in the other locations. Wheel traffic did not reduce yields in 30- or 36-inch row spacing, but soybean planted in wide rows yielded less than narrow row spacing without traffic in all Suffolk experiments. Moreover, wide-row soybean yielded equal to or less than trafficked soybean planted in narrow row spacing at those sites.

Yield loss from wheel traffic applied to R4-stage soybean planted in 7.5 or 15 inch rows ranged from 12 to 29%. This translates into a 1 to 6% loss in yield depending on sprayer boom width. The greatest yield loss was at the 2005 double-crop site. At that site, an 18-day period of high temperatures and no rainfall preceded the wheel traffic treatment and rainfall was not received until 4 days after the wheel traffic treatment. This 3-week period of hot and dry conditions was likely responsible for the greater yield reduction and lack of compensation from neighboring rows.

Even if the non-compensating experiment is ignored, percent yield reduction was still quite variable (12 to 21%). This indicates that the ability of neighboring rows to compensate for damaged ones may be dependent on several factors. Yield loss in the 7.5-inch row spacing was less at 3 of 4 sites. At those three sites, traffic reduced yield by an average of 12.1 and 19.2% in the 7.5- and 15-inch row spacing, respectively. At the 2005 Suffolk double-crop experiment, row spacing did not affect the amount of yield loss occurring at the site that experienced hot and dry conditions. These indicate that drilled soybean will tolerate wheel traffic better than soybean planted in 15-inch rows, unless drought stress prevents compensation from neighboring rows.

Summary: Widening row spacing to avoid yield loss does not appear to be a solution to reproductive-stage pesticide applications since doing so resulted in yields as low as or lower than narrow row spacing with traffic treatments. Recent experiments in Indiana showed similar results. When taking into account typical spray boom widths, widening rows to avoid wheel traffic damage cannot usually be justified. Drilled soybean tended to compensate better than 15-inch soybean, but the effect of cropping system was not consistent. Theoretically, 7.5-inch rows should compensate since the resulting gap between rows would be less than 15-inch rows. But, our research shows that this may only be the case when environmental conditions are conducive for compensation. Water stress appeared to be the over-riding factor associated with the crops ability to compensate for damaged rows.

In summary, yield loss from running over narrow-row R4-stage soybean with a sprayer needs to be accounted for when determining the cost of managing reproductive-stage pests. Otherwise, the cost and benefit of such pest management practices cannot be fully determined. Alternatives to driving over rows with a ground sprayer include aerial application or the installation of tram lines at planting. Another option may be to run the sprayer perpendicular or at an angle to the rows. With this strategy, damage would be limited to the width of the tire (versus the 22.5- or 30-inch gaps between rows in our study), and may allow more compensation from neighboring plants. These data provide information that can be used to further refine pest management decisions.