

## SOYBEAN RESPONSE TO SELECTED ROW SPACING AND SEEDING RATES WITH UNIFORM AND NON-UNIFORM SEED SPACING

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**ABSTRACT:** A study was conducted during the 2000 and 2001 growing seasons to evaluate the influence soybean row spacing and seed rates with non-uniform (air-assist planter) and uniform seed spacing (vacuum planter) have on soybean yield and sicklepod control using single or sequential applications of Roundup Ultra (glyphosate). The two-year results indicated that with two or three Roundup applications and the 9.5 or 19 inch row (vacuum planter method), the  $\frac{3}{4}$  recommended seeding rate (105,000 seed/ac) produced yield equal to the air-assist planter with 7.5 or 15 inch row with the recommended seeding rate (140,000 seed/ac). The 28.5 inch row (vacuum planter) with 140,000 seed/ac had lower yield and late season sicklepod control than 19 inch or narrower rows. Two applications of Roundup had 95% sicklepod control compared to 67% for one Roundup application in 2001, and 95% control for three applications compared to 84% for two applications in 2000. Except for the 28.5 inch row, all treatments with two applications of Roundup in 2001 or three applications in 2000, showed no difference in control and provided greater than 90% late season sicklepod control. However, with one Roundup application in 2001 and two applications in 2000, narrower rows (9.5 and 7.5 inch) with increased seeding rates to 1.5 the recommended rate, showed greater late season sicklepod control. The vacuum planter method compared with the air-assist planter did not increase late season sicklepod control. But the vacuum planter in 9.5 or 19 inch rows at  $\frac{3}{4}$  recommended seed rate had yield equal to 7.5 or 15 inch rows at the recommended seed rate using the air-assist planter.

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**KEY WORDS:** Soybean, row spacing, seeding rate, uniform seed spacing, non-uniform seed spacing.

**MATERIALS AND METHODS:** The study was conducted on a Catalpa silty clay soil infested with high levels of sicklepod in 2000 and 2001. The study was conducted as a split plot with Roundup (glyphosate) applications as main plot and row spacing, seed rate, seed spacing combinations as subplots. Plot size was 10 ft x 40 ft long with 4 replications.

Soil test results indicated high levels of P and medium levels of K. Therefore, only 200 lb/ac of granular potash (K<sub>2</sub>O) was applied surface-broadcast on 10/30/00. The whole study area was subsoiled 11/22/00 and disked 12/11/00. The study area was doaled 3/27/01 and field cultivated 5/15/01. A burndown application of Glyphos (glyphosate) at 1.2 lb ai/ac was made to the whole study on 4/20/01 and repeated at 0.5 lb ai/ac on 5/08/01. Gramoxone (paraquat) + surfactant at 0.9 lb ai/ac + 0.5 pt/ac was applied as a burndown after soybean planting. Delta Pineland "DP5915RR" a late maturity group V variety was planted on 5/17/01. The seeding rates and row spacings as listed in Table 1 ranged from 105,000 seed/ac to 240,000 seed per acre and row spacing ranged from 7.5 to 28.5 inches. The 7.5 and 15-inch row treatments were planted with a John Deere® 750 drill equipped with an air-assist seeder (model 2848DP, Gandy Company Manufacturers, 528 Gandrud Road, Owatonna, MN 55060) and electronic seed rate control system. The 9.5, 19, and 28.5-inch rows were planted with a Monosem® vacuum planter equipped with an electronic seeding rate control system.

The entire study received postemergence applications of Roundup Ultra (glyphosate) at 1.0 lb ai/ac on 5/30/01. A second application of Roundup at 1.0 lb ai/ac was only applied to one of the subplot treatments in each replication on 6/26/01. Gramoxone (paraquat) at 0.3 lb ai/ac was applied as a desiccant to kill sicklepod in the whole study on 10/18/01. Soybeans were harvested 10/26/01.

Soybean population, soybean canopy closure, sicklepod control, and yield data were recorded. The center 5 ft of each plot was harvested with a plot combine for grain yield. The seed was weighed before and after cleaning with a 3-sieve seed cleaner. The difference in cleaned and uncleaned seed weight was considered foreign matter. The cleaned soybean seed weight was used to calculate soybean grain yield at 13% moisture. The data was subjected to SAS mixed procedure analysis and means were separated using Fisher's Protected LSD at the 5% probability level.

**RESULTS AND DISCUSSION:** Environmental conditions during the growing season were highly variable and unfavorable (no rainfall) especially during mid-July through early August with 26 days with no rainfall. Timely rainfall in June and mid-August through early September, however, resulted in average soybean yield of 26 bu/ac for the study.

The results of this study indicated that soybean production in a sicklepod infested field, has management trade-off between seeding rate, row spacing, planting method, and number of herbicide applications. The study indicated that narrowing rows from 28.5 to 7.5 inch and increasing seeding rate to 210,000 seed/ac improved late season sicklepod control with one Roundup application late season. However, with two Roundup applications, all rows narrower than 28.5 inches (19, 9.5, 15, and 7.5 inch rows) had similar control of 91% or more which was greater than 28.5 inch rows. At 140,000 seed/ac, the vacuum planter method in 19 inch rows (averaged across Roundup applications) produced yield equal to 210,000 seed/ac and was higher in yield than the 7.5 and 15 inch rows planted with the air assist planter. However, increasing the seed rate in the 7.5 inch row to 210,000 seed/ac produced yield equal to 9.5 or 19 inch row with 140,000 seed/ac recommended seeding rate. Compared to the air-assist planting method, the preliminary results indicate that uniform seed placement in the row (vacuum planter) in 19 inch or 9.5 inch at the recommended seeding rate may increase yield at least 10%. With excellent sicklepod control, seeding rate may be reduced to 0.75 recommended rate with the vacuum planter in 19 or 9.5 inch rows.

**Table 1.** Soybean row spacing/seed rate/planter method yield response to Roundup weed management systems in 2001, Verona, MS

Row spacing Inch	Planter seed delivery method	Seeding rate Seed/ac x 1000	-----Soybean yield----- -----Roundup applications-----		
			One	Two	Mean
7.5	air-assist <sup>1</sup>	140	20.3	23.7	22.0
7.5	air-assist	210	24.7	29.1	26.9
9.5	vacuum <sup>2</sup>	105	20.9	30.1	25.5
9.5	vacuum	140	23.7	31.9	27.8
9.5	vacuum	210	26.3	32.4	29.6
15	air-assist	140	20.0	30.1	25.0
15	air-assist	210	22.7	28.0	25.4
19	vacuum	105	19.6	33.0	26.0
19	vacuum	140	24.7	34.2	29.4
19	vacuum	210	25.8	33.1	29.4
28.5	vacuum	140	14.4	24.2	19.3
Mean			22.0	30.0	26.0
Application LSD (0.05): NS					
Row/seedrate LSD(0.05): 3.3					
Application x seedrate LSD(0.05): NS					

<sup>1</sup> The air-assist planter seed delivery system was an air-assist seeder (model 2848DP), Gandy Company Manufacturers, 528 Gandrud Road, Owatonna, MN 55060. mounted on a John Deere® 750 no-till drill.

<sup>2</sup> The vacuum planter seed delivery system was a Monosem Vacuum Planter distributed by ATI Inc. – Monosem, 17135 West 116<sup>th</sup> Street, Lenexa, KS 66219.

**Table 2.** Sicklepod (*Senna obtusifolia*) control at soybean maturity as influenced by soybean row spacing/ seeding rate/planter method in combination with Roundup applications in 2001, Verona, MS.

Row Spacing	Planter seed delivery method	Seeding rate	Sicklepod control at maturity	
			-----Roundup applications-----	
			One	Two
Inch		Seed/ac x 1000	----- % -----	
7.5	air-assist <sup>1</sup>	140	71	97
7.5	air-assist	210	78	97
9.5	vacuum <sup>2</sup>	105	65	97
9.5	vacuum	140	70	98
9.5	vacuum	210	80	99
15	air-assist	140	65	97
15	air-assist	210	73	98
19	vacuum	105	53	91
19	vacuum	140	65	95
19	vacuum	210	64	95
28.5	Vacuum	140	50	84
Mean			67	95
Row space/seed rate LSD (0.05) <sup>3</sup>			12	
Planter method x RUP application LSD (0.05) <sup>4</sup>			7	

<sup>1</sup> The air-assist planter seed delivery system was either an air-assist seeder (model 2848DP), Gandy Company Manufacturers, 528 Gandrud Road, Owatonna, MN 55060, mounted on a John Deere 750 no-till drill.

<sup>2</sup> The vacuum planter seed delivery system was a Monosem Vacuum Planter distributed by ATI Inc. – Monosem, 17135 West 116<sup>th</sup> Street, Lenexa, KS 66219.

<sup>3</sup> LSD (.05) for comparing treatments within Roundup applications.

<sup>4</sup> LSD (.05) for comparing a row spacing/seed rate/planter method treatment across Roundup application treatments.

**Table 3.** Soybean row spacing and seed rate response to Roundup weed management systems in 2000, Verona, MS

Row spacing	Planter seed delivery method	Seeding rate	Soybean yield		
			----Roundup applications----		Mean
Inch		Seed/ac x 1000	Two	Three	
7.5	air-assist <sup>1</sup>	140	26.2	34.3	30.2
7.5	air-assist	210	29.8	33.7	31.7
9.5	vacuum	105	27.5	35.2	31.5
9.5	vacuum	140	31.4	37.3	34.4
9.5	vacuum	210	34.2	34.8	34.5
15	air-assist	140	23.1	31.0	27.1
15	air-assist	210	29.8	28.3	29.0
19	vacuum	105	22.5	31.7	27.1
19	vacuum	140	28.0	32.2	30.1
19	vacuum	210	31.7	32.5	32.1
28.5	vacuum	140	20.6	28.6	24.6
Mean			27.7	32.7	
Grand Mean			29.2		
Application x seedrate LSD(0.05) <sup>3</sup>			4.8 <sup>3</sup>		
Application x seedrate LSD (0.05) <sup>4</sup>			6.4 <sup>4</sup>		

<sup>1</sup> The air-assist planter seed delivery system was either an air-assist seeder (model 2848DP), Gandy Company Manufacturers, 528 Gandrud Road, Owatonna, MN 55060, mounted on a John Deere 750 no-till drill.

<sup>2</sup> The vacuum planter seed delivery system was a Monosem Vacuum Planter distributed by ATI Inc. – Monosem, 17135 West 116<sup>th</sup> Street, Lenexa, KS 66219.

<sup>3</sup> This LSD is used for comparisons of yield within a Roundup Ultra application.

<sup>4</sup> This LSD is used for comparison of one row space/seed rate/planter method across Roundup applications.

**Table 4.** Sicklepod (*Senna obtusifolia*) control at soybean maturity as influenced by soybean row spacing – seeding rate combination with two or three Roundup applications in 2000, Verona, MS.

Row spacing Inch	Planter seed delivery method	Seeding rate Seed/ac x 1000	Sicklepod control		
			----Roundup applications-----		Mean
			Two	Three	
			----- % -----		
7.5	air-assist <sup>1</sup>	140	81	93	87
7.5	air-assist	210	88	99	93
9.5	vacuum	105	81	98	90
9.5	vacuum	140	91	96	93
9.5	vacuum	210	94	97	96
15	air-assist	140	78	92	85
15	air-assist	210	84	96	90
19	vacuum	105	72	94	83
19	vacuum	140	88	96	92
19	vacuum	210	91	98	94
28.5	air-assist	140	78	87	82
Mean			84	95	
Grand Mean			90		
Application LSD (0.05) <sup>3</sup>			7		
Row/seedrate LSD(0.05) <sup>4</sup>			6		
Application x row seedrate LSD(0.05)			NS		

<sup>1</sup> The air-assist planter seed delivery system was either an air-assist seeder (model 2848DP), Gandy Company Manufacturers, 528 Gandrud Road, Owatonna, MN 55060, mounted on a John Deere 750 no-till drill.

<sup>2</sup> The vacuum planter seed delivery system was a Monosem Vacuum Planter distributed by ATI Inc. – Monosem, 17135 West 116<sup>th</sup> Street, Lenexa, KS 66219.

<sup>3</sup> This LSD is used to compare the means of the two and three Roundup applications (averaged over row / space/seed rate/planter method).

<sup>4</sup> This LSD is used to compare row space/seed rate/planter method (averaged over Roundup applications).