

**SOYBEAN VARIETY RESPONSE
TO SEEDING RATES IN NARROW ROWS USING VACUUM PLANTER
TECHNOLOGY**

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ABSTRACT: A study initiated in 2004 to evaluate productive Maturity Group MG IV and V soybean varieties' for plant branching, height at maturity, stem diameter and yield response to seeding rates (60,000, 90,000, 110,000, 120,000, and 150,000 seed/ac). The planting seed per pound ranged from 2928 for DP 5634RR to 4286 for DP 4933RR. The pounds of DP 4933RR seed planted on an acre basis ranged from 14 for 60,000 seed/ac to 35 for 150,000/ac. The pounds of DP 5634RR seed planted per acre ranged from 20.5 for 60,000 seed/ac to 50.5 for 150,000 seed/ac. The other varieties' seed per pound and pound of seed per acre were intermediate between DP 4933RR and DP 5634RR. The 2004 growing season was somewhat unfavorable for early season growth and late season pod fill. This was due to cloudy weather and 114 and 153% of normal rainfall for May and June, respectively, followed by little or no rainfall from mid-July through mid-August. However, yields were above average with most varieties. Seeding rate had no effect on yield, while varieties showed yield response differences. DP 5634RR had the highest yield average of 59 bu/ac and was higher than the other varieties. Hornbeck HBK 4623RR and Asgrow AG 4403 yield averages of 54.7 and 51.8 bu/ac, respectively, were not different but were higher than Deltapine DP 4933RR and Deltapine DP 5915RR which had average yields of 41.6, and 25.6 bu/ac. The Delta King DK 5366RR yield average of 48.7 bu/ac was similar to AG 4403.

Generally as seeding rate decreased, stem diameter increased and plants were shorter in height at maturity with all varieties. The determinant Maturity Group V varieties DK 5366RR, DP 5634RR and DP 5915RR had more branches/plant than indeterminant Maturity Group IV varieties AG 4403, HBK 4623RR, and DP 4933RR. These preliminary results indicated that all soybean varieties showed no significant yield response differences to seeding rates from 60,000 to 150,000 seed/ac. However, further study is needed to determine the consistency of this yield response to lower seeding rates.

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KEYWORDS: Soybean, seeding rate, stem diameter, height

MATERIALS AND METHODS: A 3-year study was initiated in 2004 on a Leeper silty clay loam soil, Verona, Mississippi to evaluate six soybean varieties, 3 maturity group (MG) IV and 3

MG V, with respect to yield and growth response to seeding rate. The study was conducted as a split plot experiment with variety as the main plot factor, and seeding rate as the subplot factor. Plot size was 11.25 ft x 40 ft with 4 replications. A fall tillage stale seedbed production system was used in this study. Soil fertility levels were maintained at high levels for maximum yield. Soil test results indicated high P and K levels so no P and K fertilizer were applied. However, 1 gpa of zinc sulfate solution was applied on 10/09/03 to relieve a zinc deficiency.

MG IV varieties (Hornbeck HBK 4623RR, Asgrow AG 4403, Deltapine DP 4933RR), and MG V varieties, (Delta King DK 5366RR, Delta Pine DP 5634RR, and Delta Pine DP 5915RR) were planted no-till on 4/22/04 in 15-inch rows in a fall prepared stale seedbed. The seeding rates were in 30,000 seed/ac increments from 60,000 to 150,000 seed/ac (Table 1). The soybean seeds were planted with a Monosem® vacuum planter equipped with an electronic seeding rate control system. A burndown application of Roundup WEATHERMAX® (glyphosate) + Clarity (dicamba) at 0.96 + 0.25 lb ai/ac was applied 3/25/04. Postemergence applications of Roundup WEATHERMAX at 0.94 lb ai/ac were made for weed control on 5/12/04 and 6/11/04.

Soybean population (36 days after planting), plant height at maturity, soybean plant stem diameter at maturity, number of branches/plant at maturity, and yield data were recorded. The number of branches/plant and stem diameter (2 inches above the ground) at maturity was determined for 12 consecutive plants from 2 randomly selected rows. Reproductive (R) stages for all varieties were recorded weekly starting when the first variety begins to bloom through maturity.

The center 4 rows of each plot were harvested with a plot combine for grain yield within a week after maturity. After cleaning the seed with a 3-sieve seed cleaner, the seed was weighed and seed moisture was determined with a Dickey John® 2000 grain analysis computer. The cleaned soybean seed weight and seed moisture were used to calculate soybean grain yield at 13% moisture. The data were subjected to SAS Mixed procedure analysis and means were separated using Fisher's Protected LSD calculated at the 5% significance level.

RESULTS AND DISCUSSION: Environmental growing conditions in 2004 were favorable through mid-May followed by 114 to 153% of rainfall in May and June with no rainfall from mid-July to mid-August. Yield results indicated seeding rate had no effect on yield and there was no variety by seeding rate interaction (Table 1). However, there were yield differences among varieties. Averaged over seeding rates, DP 5634RR had the highest yield of 59.0 bu/ac and was higher than the other varieties. HBK 4623RR and AG4403 showed similar yields of 54.7 and 51.8 bu/ac, respectively. DK 5366RR had yield equal to AG 4403. DP5915BR produced 25.6 bu/ac and was lower than all of the other varieties in the study. The lower yield is partially due to a dry period (7/19 to 8/20) during late pod fill period with excessive rainfall and warm temperatures after maturity. This delayed harvest and resulted in seed rot and yield losses. The number of branches per plant showed differences in seeding rates and varieties with no variety by seeding rate interaction (Table 2). The 60,000 seed/ac averaged over varieties had 7.9 branches/plant and was higher than all other seeding rates. There were branches/plant differences between 60,000, 90,000, 120,000, and 150,000 seed/ac with 7.9, 6.9, 6.2 and 5.8 branches/plant, respectively. Varieties also showed differences with the determinant MG V varieties (DK 5366RR, DP 5634RR, DP 5915RR) having more branches per plant than the

indeterminant MG IV varieties (HBK 4623RR, AG4403, DP 4933RR). There were some branch differences among varieties within a maturity group. DP 5915RR, DK 5366RR and DP 5634RR had the most branches/plant which ranged from 8.3 to 9.7. However, DP 5915RR had a greater number of branches than DK 5366RR and DP 5634RR. HBK 4623RR, AG 4403, and DP 4933RR had no differences in branches/plant.

Stem diameter generally increased as seeding rate decreased (Table 3). However, there was a seeding rate by variety interaction. With all varieties, there were stem diameter differences between 60,000 and 90,000 seed/ac. However, HBK 4623RR and AG4403 showed differences in stem diameter between 60,000, 90,000, 120,000, and 150,000 seed/ac. DK 5366RR, DP 5915RR and DP 4933RR showed no differences in stem diameter between 120,000 and 150,000 seed/ac.

Plant populations 36 days after planting indicated no differences between varieties with no variety by seeding rate interaction (Table 4). The average population across varieties indicated 58,900, 88,600, 114,300, and 139,000 plants/ac for 60,000, 90,000, 120,000, and 150,000 seed/ac, respectively. The difference in population is a result of the differences in seeding rate.

Plant height at maturity indicated differences among varieties and seeding rates with no variety by seeding rate interaction (Table 5). Varieties with a height of 33 inches were HBK 4623RR, AG4403, and DP 5634RR. DP 4933RR was the tallest variety with a height of 39 inches. DK 5366RR was the shortest variety with a height of 27 inches followed by DP 5915RR with a height of 30 inches. Seeding rates of 60,000, 90,000, 120,000 and 150,000 seed/ac had heights of 29, 32, 34, and 35 inches, respectively. The 120,000 and 150,000 seed/ac were not different in height but were taller than 60,000 and 90,000 seed/ac. The 60,000 and 90,000 seed/ac were different with the lowest height of 29 inches for the 60,000 seed/ac.

Reproductive stages during the growing season indicated differences among varieties (Table 6). The MG IV varieties had a shorter reproductive period than MG V varieties. HBK 4623RR and AG 4403 began blooming 6/03/04, 42 days after planting. These varieties matured the latter days of August. DP 4933RR began flowering 6/10/04, 49 days after planting, and matured 9/10/04. DK 5366RR began flowering 6/14/04, 53 days after planting, and matured 10/01/04. DP 5634RR began blooming 6/16/04, 55 days after planting and matured 10/01/04. DP 5915RR began blooming 6/16/04, 55 days after planting and matured 10/15/04.

The planting seed per pound ranged from 2928 for DP 5634RR to 4286 for DP 4933RR (Table 7). The pounds of planted seed/ac ranged from 14 for DP 4933RR at 60,000 seed/ac to 35 at 150,000 seed/ac. The pounds of DP 5634RR planted per acre ranged from 20.5 for 60,000 seed/ac to 50.5 for 150,000 seed/ac. The other varieties' pounds of planted seed/ac ranged between those for DP 4933RR and DP 5634RR.

The seed cost per acre planted, based on the number of seed per pound and seed cost of \$28/50 lb bag for each variety, ranged from \$7.84 for DP 4933RR at 60,000 seed/ac to \$28.70 for DP 5634RR at 150,000 seed/ac (Table 8). Since seeding rates from 60,000/ac to 150,000/ac had no effect on yield for all varieties, these preliminary results indicated that using lower seeding rates could reduce planting seed costs as much as 40%. These preliminary results indicated soybean

varieties response to seeding rates were similar with no yield response differences between 60,000 seed/ac up to 150,000 seed/ac.

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Table 1. Roundup Ready soybean variety yield response seed rate in 2004, Verona, MS.

Variety	Brand	Maturity Group	-----Seed/ac x 1000-----				Mean
			60	90	120	150	
			-----bu/ac-----				
HBK 4623RR	Hornbeck	E IV	51.5	54.6	56.7	56	54.7
AG 4403	Asgrow	E IV	51.8	52.2	50.7	52.4	51.8
DP 4933RR	Deltapine	L IV	40	42.7	41.9	41.9	41.6
DK 5366RR	Delta King	E V	48.7	47.6	49.2	49.6	48.7
DP 5634RR	Deltapine	M V	60.1	58.2	59.8	58.1	59.0
DP 5915RR	Deltapine	L V	<u>25.7</u>	<u>26.1</u>	<u>22.4</u>	<u>28.2</u>	25.6
			46.3	46.9	46.8	47.7	
		Var LSD (0.05)	4.1				
		Seed rate LSD (0.05)	NS				

Table 2. Roundup Ready soybean variety branching response to seeding rate in 2004, Verona, MS.

Variety	Brand	MG	-----Seed/ac x 1000-----				Mean
			60	90	120	150	
			-----Branches/plant-----				
HBK 4623RR	Hornbeck	E IV	5.9	4.5	3.8	3.5	4.4
AG 4403	Asgrow	E IV	5.3	4.6	3.9	4.3	4.5
DP 4933RR	Deltapine	L IV	6.7	5.1	4.2	3.6	4.9
DK 5366RR	Delta King	E V	9.2	8.8	8.3	7.0	8.3
DP 5634RR	Deltapine	M V	10.0	8.9	7.8	7.5	8.5
DP 5915RR	Deltapine	L V	<u>10.6</u>	<u>9.8</u>	<u>9.3</u>	<u>9.1</u>	<u>9.7</u>
		Mean	7.9	6.9	6.2	5.8	
		Var LSD (0.05)	0.9				
		Seed rate LSD (0.05)	0.3				

Table 3. Roundup Ready soybean variety stem diameter response to seeding rate in 2004, Verona, MS.

Variety	Brand	MG	-----Seed /ac x 1000-----			
			60	90	120	150
			-----inches-----			
HBK 4623RR	Hornbeck	E IV	0.424	0.366	0.322	0.279
AG 4403	Asgrow	E IV	0.446	0.359	0.294	0.363
DP 4933RR	Deltapine	L IV	0.468	0.381	0.327	0.303
DK 5366RR	Delta King	E V	0.389	0.336	0.289	0.286
DP 5634RR	Deltapine	M V	0.399	0.341	0.317	0.314
DP 5915RR	Deltapine	L V	0.462	0.402	0.338	0.357
	WI Variety VAR LSD (0.05) ¹		0.030			
	WI seed rate LSD (0.05) ²		0.034			

¹LSD (0.05) for comparing seeding rates within a variety.

²LSD (0.05) for comparing varieties within seeding rate.

Table 4. Roundup Ready soybean variety plant population response seed rate 36 days after planting in 2004, Verona, MS.

Variety	Brand	MG	-----Seed/ac x1000-----				Mean
			60	90	120	150	
			-----plants/ac x 1000-----				
HBK 4623RR	Hornbeck	E IV	55.9	86.4	108.9	135.0	96.6
AG 4403	Asgrow	E IV	60.9	90.8	117.6	145.2	103.6
DP 4933RR	Deltapine	L IV	59.5	94.4	102.4	140.1	99.1
DK 5366RR	Delta King	E V	58.0	84.9	115.4	139.4	99.4
DP 5634RR	Deltapine	M V	58.1	91.5	122.7	146.6	104.7
DP 5915RR	Deltapine	L V	<u>61.0</u>	<u>83.5</u>	<u>119.1</u>	<u>127.8</u>	<u>97.9</u>
	Mean		58.9	88.6	114.3	139.0	
	Var LSD (0.05)		NS				
	Seed rate LSD (0.05)		5.4				

Table 5. Roundup Ready soybean variety height at maturity response to seeding rate in 2004, Verona, MS.

Variety	Brand	MG	-----Seed/ac x 1000-----				Mean
			60	90	120	150	
			-----inches-----				
HBK 4623RR	Hornbeck	E IV	29	33	34	36	33
AG 4403	Asgrow	E IV	30	32	33	36	33
DP 4933RR	Deltapine	L IV	37	38	41	41	39
DK 5366RR	Delta King	E V	23	26	29	29	27
DP 5634RR	Deltapine	M V	30	31	34	36	33
DP 5915RR	Deltapine	L V	<u>29</u>	<u>29</u>	<u>31</u>	<u>32</u>	30
	Mean		29	32	34	35	
	Var LSD (0.05)	1					
	Seed rate LSD (0.05)	1					
	Var x SR LSD (0.05)	NS					

Table 6. E29 Table. Reproductive (R) stages for soybean varieties during the growing in 2004 at Verona, MS.¹

DATE	HBK 4623RR	AG 4403	DP 4933RR	DK 5366RR	DP 5634RR	DP 5915RR
6/03/04	R1	R1	----	----	----	----
6/10/04	----	----	R1	----	----	----
6/14/04	----	----	----	R1	----	----
6/16/04	R3	R3	R2	R2	R1	R1
6/21/04	R3	R3	R3	R2	R2	R1
6/29/04	R4	R4	R3	R2	R2	R2
7/06/04	R4	R4	R4	R3	R2	R2
7/12/04	R5	R5	R5	R4	R2	R3
7/19/04	R5	R5	R5	R5	R3	R4
7/26/04	R6	R6	R6	R5	R4	R5
8/02/04	R6	R6	R6	R6	R5	R5
8/09/04	R6	R6	R6	R6	R5	R5
8/17/04	R7a	R7a	R7a	R6	R6	R6
8/20/04	R7b	R7b	R7a	R6	R6	R6
8/23/04	R7c	R7c	R7b	R6	R6	R6
8/26/04	R7c	R8	R7c	R6	R6	R6
8/30/04	R8	----	R7c	R7a	R6	R6
9/02/04	----	----	R7c	R7a	R6	R6
9/07/04	----	----	R7c	R7a	R6	R6
9/10/04	----	----	R8	R7b	R6	R6
9/13/04	----	----	----	R7b	R6	R6
9/20/04	----	----	----	R7c	R7c	R7a
9/24/04	----	----	----	R7c	R7c	R7b
9/27/04	----	----	----	R7c	R7c	R7b
10/01/04	----	----	----	R8	R8	R7b
10/04/04	----	----	----	----	----	R7c
10/15/04	----	----	----	----	----	R8

¹Observations indicated no differences among seeding rates.

Table 7. Roundup Ready soybean variety seed per pound and pounds of seed per acre based on the

respective seeding rates in 2004, Verona, MS.

Variety	Brand	Maturity Group	Seed/lb	Seed/ac x 1000			
				60	90	120	150
HBK 4623RR	Hornbeck	E IV	3550	16.9	25.4	33.8	42.3
AG 4403	Asgrow	E IV	3421	17.5	26.3	35.0	43.8
DP 4933RR	Deltapine	L IV	4286	14.0	21.0	28.0	35.0
DK 5366RR	Delta King	E V	3657	16.4	24.6	32.8	41.0
DP 5634RR	Deltapine	M V	2928	20.5	30.7	41.0	50.5
DP 5915RR	Deltapine	L V	3274	18.3	27.5	36.6	45.8

Table 8. Roundup Ready soybean variety seed per pound and seed cost per acre based on \$28 per fifty pound of planting seed in 2004, Verona, MS.

Variety	Brand	Maturity Group	Seed/lb	Seed/ac x 1000			
				60	90	120	150
HBK 4623RR	Hornbeck	E IV	3550	9.46	14.19	18.92	23.65
AG 4403	Asgrow	E IV	3421	9.80	14.70	19.60	24.50
DP 4933RR	Deltapine	L IV	4286	7.84	11.76	15.68	19.60
DK 5366RR	Delta King	E V	3657	9.18	13.77	18.36	22.95
DP 5634RR	Deltapine	M V	2928	11.48	17.22	22.96	28.70
DP 5915RR	Deltapine	L V	3274	10.25	15.38	20.50	25.62