

SOYBEAN RESPONSE TO SELECTED ROW SPACING AND LOW SEEDING RATES

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ABSTRACT: A study was conducted during the 2002 growing season to evaluate soybean varieties (DK 4868RR and Pioneer 95B53), canopy closure, plant branching, yield, kernel weight (gm/1000 seed), and stem diameter response to narrow row (9.5 and 19 inch spacing) and seed rates (55,000, 110,000, and 165,000 seed/ac). The growing conditions were very favorable through July with no rainfall in August. The 55,000 seed/ac seed rate had a larger stem diameter, shorter plant height at maturity, more branches, and lower yield than 110,000 or 165,000 seed/ac. Row spacing had no effect on branches/plant, stem diameter, and plant height at maturity. Row spacing, however, interacted with variety for yield and with seeding rate for canopy closure. DK 4868RR showed no row spacing effect on yield while Pioneer 95B53 showed higher yield for 19-inch than 9.5-inch rows. The narrower 9.5-inch rows with the higher seeding rates of 110,000 or 165,000 seed/ac always showed greater and earlier canopy closure than 19-inch row with no difference 12 weeks after planting. The low seeding rate of 55,000 seed/ac had 10 to 20% less canopy closure up to 12 weeks after planting.

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KEYWORDS: Soybean, row spacing, seeding rate, stem diameter, height

MATERIALS AND METHODS: The study was conducted on a Leeper silty clay loam soil, Verona, Mississippi during the 2002 growing season. The study was conducted as a split-split plot experiment with variety as the main plot factor, row spacing as subplot factor, and seed rate as sub-subplot factor. Plot size was 14.5 ft x 70 ft with 4 replications. Soil test results indicated high levels of P and medium levels of K. Therefore, 250 lb/ac of granular potash (K₂O) was applied surface-broadcast on 10/04/01. The whole study area was disked twice after fertilizer application on 10/04/01. The study area was do-alled (row conditioner) on 11/05/01.

A burndown application of Gramoxone Max (paraquat) at 1.0 lb ai/ac was made to the whole study on 4/17/02. Delta King 4868RR and Pioneer 95B53 were planted no-till in 9.5 and 19 inch rows on 4/25/02 with a vacuum planter. The seeding rates and row spacings ranged from 55,000 to 165,000 seed/ac (Table 1). The soybean seeds were planted with a Monosem® vacuum planter equipped with an electronic seeding rate control system. The entire study received

postemergence applications of Roundup Ultra Max (glyphosate) at 1.0 lb ai/ac on 5/20/02, 6/18/02, and 7/11/02.

Soybean population (3 wk after planting), soybean canopy closure, plant height at maturity, soybean plant stem diameter at maturity, number of branches/plant at maturity, and yield data were recorded. The percent canopy closure was a visual estimate on a scale of 0 (no canopy closure) to 100% canopy closure (complete closure) between soybean rows in the early, mid, and growing season. The number of branches/plant and stem diameter (2 inches above the ground) at maturity were determined for 10 consecutive plants from a randomly selected row and 10 ft from the end of the plot.

The center 3 rows of the 19-inch rows and the 7 center rows of the 9.5-inch 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. A 1000 kernel sample from each plot was weighed to determine kernel weight. 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 conditions during the growing season were highly variable with favorable growing conditions through July followed by no rainfall in August. Seeding rate affected yield, branches/plant, and interacted with variety for plant height at maturity, and row spacing for stem diameter at maturity. Row spacing only had an effect on canopy closure and interacted with variety for yield. The data indicated that the 55,000 seed/ac rate had a yield of 42.0 bu/ac and was lower than 110,000 and 165,000 seed/ac which had yields of 47.6 and 46.7 bu/ac, respectively, (Table 1). DK 4868RR showed no yield difference between 9.5 and 19-inch rows. But in 9.5-inch rows, DK 4868RR yield was higher than Pioneer 95B53. The 19-inch rows showed no yield difference between varieties. However, Pioneer 95B53 produced higher yield in 19-inch rows than 9.5-inch rows.

The branches/plant at maturity data indicated Pioneer 95B53 had 5.1 branches/plant (averaged over row spacing and seeding rate) which was higher than 3.3/plant for DK 4868RR (Table 2). Row spacing had no effect on branching and there was no row spacing by variety, variety by seeding rate or variety by row spacing by seeding rate interaction. As seeding rate increased from 55,000 seed/ac to 165,000 seed/ac, the number of branches declined from 6.5 to 2.5/plant.

Variety and row spacing had no effect on stem diameter at maturity and there was no variety by row spacing or variety by row spacing by seeding rate interaction (Table 3). However, there was a variety by seeding rate interaction for stem diameter. DK 4868RR showed differences in stem diameter between each seeding rate with 55,000 seed/ac having the largest diameter of 0.533 inches. This was in contrast to Pioneer 95B53, which only showed that the 55,000 seed/ac stem diameter of 0.472 inches was greater than 110,000 or 165,000 seed/ac with no difference between 110,000 and 165,000 seed/ac. However, at 110,000 or 165,000 seed/ac, there was no difference between DK 4868RR and Pioneer 95B53. The DK 4868RR stem diameter of 0.533

inches for 55,000 seed/ac was greater than the 0.472 inches for Pioneer 95B53 with 55,000 seed/ac.

DK 4868RR at maturity had a mean height of 35.6 inches compared to 26.7 inches for Pioneer 95B53 (Table 4). There were no variety, row spacing, row spacing by seeding rate, variety by row spacing, or variety by seeding rate by row spacing interaction for height. However, there was a variety by seeding rate interaction. The low seed rate of 55,000/ac for both varieties was shorter in height than 110,000 or 165,000 seed/ac. There was no height difference between 110,000 and 165,000 seed/ac for DK 4868RR. However, Pioneer 95B53 showed a difference in height between each seeding rates.

Variety had no influence on canopy closure and there were no variety by row spacing, variety by seeding rate, or variety by row spacing by seeding rate interaction for canopy closure across all dates (Table 5). There was a row spacing by seeding rate interaction for canopy closure across all dates and there was a variety by row spacing interaction for canopy closure on 7/19/02. At the 55,000 seed/ac (averaged over variety), both 19 and 9.5-inch rows showed similar and lower canopy closure than 110,000 or 165,000 seed/ac across all dates.

Early in the growing season (6/24/02) with 165,000 seed/ac, averaged over variety, the 9.5-inch row had 91% canopy closure compared to 77% for 19-inch row. However, in early July (7/09/02) and mid July (7/19/02) at the 165,000 seed/ac, the 19-inch row canopy closure (averaged over varieties) of 87 and 94%, respectively, was equal to 9.5-inch rows on both dates. However, on 7/09/02, the 110,000 seed/ac in 9.5-inch row had 91% canopy closure which was higher than 55,000 seed/ac (74%). This treatment was equal to both 9.5-inch rows and 19-inch rows at 165,000 seed/ac. On 7/19/03, the 9.5-inch and 19-inch rows at 110,000 seed/ac showed no difference in canopy closure of 92 to 96%. These treatments showed canopy closure equivalent to 165,000 seed/ac, and were higher than the 55,000 seed/ac.

COOPERATORS: None

PUBLICATIONS: None

Table 1. Soybean variety yield response to row spacing and seeding rate in 2002, Verona, MS.

Row spacing	Seeding rate	-----Soybean yield-----		
		-----Varieties-----		Mean
		DK 4868RR	P95B53	
Inch	Seed/ac x 1000	----- Bu/ac -----		
9.5	55	42.4	37.2	39.8
9.5	110	49.1	44.0	46.6
9.5	165	<u>47.9</u>	<u>43.1</u>	<u>45.5</u>
Mean		46.5	41.1	44.0
19	55	41.6	46.9	44.2
19	110	49.1	48.3	48.7
19	165	<u>50.6</u>	<u>45.3</u>	<u>48.0</u>
Mean		47.1	46.8	47.0
Var LSD (0.05):	NS		Seed/ac	Mean ⁴
WI variety LSD (0.05):	3.6 ²		55	42.0
WI row space LSD (0.05):	3.3 ³		110	47.6
Seed rate LSD (0.05):	2.8 ¹		165	46.7
RS x seed rate LSD (0.05):	NS			
Var x RS x seed rate LSD (0.05)	NS			

¹ LSD (0.05) for comparing seeding rates (averaged over variety and row spacing).

² LSD (0.05) for comparing row spacing (averaged over seeding rate) within variety.

³ LSD (0.05) for comparing varieties within row spacing (averaged over seeding rate).

⁴ Yield averaged over variety and row spacing.

Table 2. Soybean variety branching response to row spacing and seeding rate in 2002, Verona, MS.

Row spacing	Seeding rate	-----Soybean varieties-----		
		DK 4868RR	P95B53	Mean
Inch	Seed/ac x 1000	----- Branches/plant -----		
9.5	55	6.1	7.2	6.7
9.5	110	2.7	4.9	3.8
9.5	165	<u>2.0</u>	<u>3.6</u>	<u>2.8</u>
Mean		3.6	5.2	4.4
19	55	4.8	7.5	6.2
19	110	2.6	4.8	3.7
19	165	<u>1.6</u>	<u>2.8</u>	<u>2.2</u>
Mean		3.0	5.0	4.0
Overall mean		3.3	5.1	4.2
Variety LSD (0.05):	1.4		<u>Seed/ac</u>	<u>Mean</u> ¹
Row space LSD (0.05):	NS		55	6.5
RS x seed rate LSD (0.05):	NS		110	3.8
Seed rate LSD (0.05):	0.6		165	2.5
Var x R.S. LDS (0.05):	NS			
Variety x seed rate LSD (0.05):	NS			
Var x R.S. x seed rate LSD (0.05):	NS			

¹ Averaged over variety and row spacing.

Table 3. Soybean variety stem diameter at maturity as influenced by row spacing and seeding rate in 2002, Verona, MS.

Seeding rate	-----Stem diameter at maturity-----	
	-----Varieties-----	
Seed/ac x 1000	DK 4868RR	P95B53
	----- Inches -----	
55	0.533	0.472
110	0.371	0.355
165	0.279	0.313
Variety LSD (0.05): NS		
Var x RS LSD (0.05): NS		
Row space LSD (0.05): NS		
RS x seed rate LSD (0.05): NS		
WI variety LSD (0.05): 0.044 ¹		
WI seed rate LSD (0.05): 0.044 ²		
Var x RS x seed rate LSD (0.05) NS		

¹ LSD (0.05) for comparison within variety.

² LSD (0.05) for comparison within seeding rate.

Table 4. Soybean plant height at maturity as influenced by variety, row spacing, and seeding rate in 2002, Verona, MS.

Seeding rate	-----Plant ht at maturity-----	
	-----Varieties-----	
Seed/ac x 1000	DK 4868RR	P95B53
	----- inches -----	
55	30.9	23.8
110	37.9	26.3
165	<u>38.0</u>	<u>30.1</u>
Mean	35.6	26.7
Var LSD (0.05): NS		
Row space LSD (0.05): NS		
Var x RS LSD (0.05): NS		
RS x seed rate LSD (0.05): NS		
Var x RS x seed rate LSD (0.05): NS		
WI variety LSD (0.05): 2.0 ¹		
WI seedrate LSD (0.05): 1.8 ²		

¹ LSD (0.05) for comparison within variety.

² LSD (0.05) for comparison within seeding rate.

Table 5. Canopy closure response to soybean variety row spacing and seeding rate in 2002, Verona, MS.

Row spacing	Seeding rate	----% Soybean canopy closure----			----% Soybean canopy closure----			----% Soybean canopy closure----		
		-----Varieties-----			-----Varieties-----			-----Varieties-----		
		DK4868RR	P95B53	Mean	DK4868RR	P95B53	Mean	DK4868RR	P95B53	Mean
Inch	Seed/ac x 1000	-----6/24/02-----			-----7/09/02-----			-----7/19/02-----		
9.5	55	43	42	43	75	73	74	88	83	86
9.5	110	90	64	77	93	89	91	97	95	96
9.5	165	<u>89</u>	<u>93</u>	<u>91</u>	<u>91</u>	<u>96</u>	<u>94</u>	<u>97</u>	<u>98</u>	<u>98</u>
	Mean	74	66	70	86	86	86	94	92	93
19	55	45	43	44	71	76	74	86	90	88
19	110	70	60	65	78	83	81	92	91	92
19	165	<u>76</u>	<u>78</u>	<u>77</u>	<u>84</u>	<u>90</u>	<u>87</u>	<u>93</u>	<u>95</u>	<u>94</u>
	Mean	64	60	62	78	83	81	90	92	91
	Overall Mean	69	63		82	85		92	92	
Var. LSD (0.05):		NS			NS			NS		
WI Var LSD (0.05) ¹ :		7			NS			3		
WI row space LSD (0.05) ² :		7			NS			2		
WI row space LSD (0.05) ² :		7			5			3		
WI seedrate LSD (0.05) ³ :		7			9			3		
Var.x seed rate LSD 0.05:		NS			NS			NS		
Var x RS x S.rate LSD (0.05):		NS			NS			NS		
Var x RS LSD (0.05):		NS			NS			NS		

¹ LSD (0.05) for comparison of row spacing within variety.

² LSD (0.05) for comparison of seeding rate within row spacing.

³ LSD (0.05) for comparison of row spacing within seeding rate.