10-1985

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Todd W. Pfeiffer
University of Kentucky, tpfeiffe@uky.edu

Morris J. Bitzer
University of Kentucky

James H. Herbek
University of Kentucky, james.herbek@uky.edu

Jereme Orf
University of Kentucky, jereme.orf@uky.edu

D. Pilcher
University of Kentucky

See next page for additional authors

Authors
Todd W. Pfeiffer, Morris J. Bitzer, James H. Herbek, Jereme Orf, D. Pilcher, Charles Tutt, and L. Zen

UNIVERSITY OF KENTUCKY
COLLEGE OF AGRICULTURE
Lexington, Kentucky 40546

COOPERATIVE EXTENSION SERVICE

AGRONOMY NOTES

Vol. 18 No. 4, October 1985

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T. W. Pfeiffer, M. J. Bitzer, J. Herbek, J. Orf, D. Pilcher,
C. Tutt, and L. Zen

Soybean yields in Kentucky have increased steadily in the past 20 years as a result of improved varieties and production practices. To achieve even higher yields new varieties and better production practices need to be developed and tested. One possibility for increasing soybean yields is to plant in narrow rows using varieties which respond to this practice. Although previous research in Kentucky has not shown a yield advantage for full season soybeans planted in narrow rows, researchers in other states have recently shown increases in yield with narrowing row widths. A number of new varieties have also been developed specifically for narrow row plantings. These varieties are shorter, lodge less, and have a high yield potential. This study was designed to answer the question: Will narrow row widths provide higher yields for these soybean varieties when grown under full season conditions in Kentucky?

Materials and Methods

Experiments were conducted at Lexington and Princeton, Kentucky in 1980, 1981 and 1982. Effects of different row widths and different soybean varieties on yields and other agronomic characteristics were evaluated. For evaluation purposes varieties for the experiment were selected on the basis of differences in maturity group (MG), plant type, and yielding ability. Nine varieties were grown at both locations. These were: 'Amsoy 71' (MG II); 'Cumberland' (MG III); 'Cutler 71' (MG IV); 'Elf' (MG III, semidwarf); 'Essex' (MG V); 'Mitchell' (MG IV); 'Pixie' (MG IV, semidwarf); 'Union' (MG IV); and 'Williams' (MG III). 'Forrest' (MG V) and 'York' (MG V) were grown at the Princeton location only. The row widths used at Lexington were 9.5, 19, and 33 in. while the row widths used at Princeton were 8, 16, and 32 in. in 1980 and 9.5, 19, and 33 in. in 1982. These row widths will be described as narrow, medium, and wide for both locations. The experiments were planted at Lexington June 4, 1980, June 8, 1981, and May 18, 1982. The Princeton experiments were planted May 21, 1980 and May 25, 1982. No experiment was planted at Princeton in 1981 due to a very late, wet spring. Each individual plot was 20 ft. long. The number of rows per plot depended on the row width of that plot; narrow row widths had 8 rows per plot, medium row widths had 4 rows per plot, and wide row widths had 3 rows per plot. Plots were mechanically planted using a grain drill at the recommended seeding rates of 4, 6, and 10 seeds per foot in the narrow, medium, and wide row widths, respectively. The seeding rates for the determinate, semi-dwarf varieties Elf and Pixie were increased by 10% as recommended by their developer.

Results and Discussion

The mean yields of the nine varieties grown in all five environments are shown for each environment and averaged over all environments (Table 1). At Lexington in 1980 and 1982, soybeans grown in wide row widths were significantly lower in yield than when grown in the medium or narrow row widths. The other 3 environments showed no significant differences between row widths. For the average of all five environments, soybeans grown in the wide row width were significantly lower yielding than soybeans grown in either the medium or the narrow row width. It appears that for full season soybeans, yields can be increased by reducing row width to between 16 and 20 in. Although narrower row widths did not give a further yield increase, there was no reduction in yields from use of the narrow rows.

The yields of the specific varieties in the different row widths are shown in Table 2. There was a statistically significant variety by row width interaction in the analysis of these data. This indicates that all varieties did not respond in the same manner to changes in row width. Yield of Amsoy 71, Pixie and Williams increased significantly as row widths narrowed. Cumberland and Cutler 71 yielded significantly more at the medium row widths than at the other two row widths. Yield of Essex increased as row widths narrowed at Princeton but not at Lexington. The increase due to narrow rows averaged over the five environments, however, was not significant. No other individual variety yield responses to changing row widths were significant. No variety, however, yielded significantly less at the medium or narrow row width than at the wide row width. So the interaction appears to be caused by the magnitude of the varietal yield increase to row width reduction from wide to medium rows and by the differential response of these selected varieties to the further decrease in row width to narrow rows.

The change from wide to narrow row widths was accompanied by an increase in plant height and an increase in the height of the lowest pod (Table 3). Although the increase in plant height was statistically significant it appears the changes would be of little agronomic importance. The increase in the height of the lowest pod as row widths narrow would, however, increase harvesting efficiency, especially for the two semi-dwarf varieties, Pixie and Elf, which showed a 36% and 40% increase, respectively, in pod height as row width decreased from wide to narrow. There were no significant differences in lodging scores at the different row widths.

The changes seen with decreasing row width are confounded with changes due to increasing plant population. Because plants are spaced more equidistantly as row width narrows, higher plant populations are recommended in narrow rows. Stand counts were made during the three years at Lexington. Plant populations averaged 260,000 plants/acre (5 plants/foot), 220,000 plants/acre (6 plants/foot) and 168,000 plants/acre (9.5 plants/foot) in the narrow, medium, and wide row widths, respectively. The average population in the narrow row widths was higher than recommended (3-4 plants/foot) and was due to very high populations in 1982. The increases in plant height and height of the lowest pod may be due to increased plant populations along with decreased row widths.

These tests were also planted in 1983 at Princeton and Lexington with several newer varieties substituted for the older varieties. Extremely dry weather caused us to abandon the test at Lexington while low yields were produced at Princeton. The mean yields of the three row widths at Princeton in 1983 were 22.1, 19.6, and 17.9 bu/acre in wide, medium, and narrow row widths, respectively. Soybeans grown in the wide row widths yielded significantly more than those grown in the narrow row widths. All varieties grown, with the exception of Pixie, produced the highest yields in wide row widths. Other researchers have shown that the higher populations and more equidistant plant spacings in narrow rows cause greater water usage during the vegetative growth period by plants in the narrower row widths. In 1983, when water was limiting, the greater water use by soybeans in narrow rows led to reduced yields.

Conclusion

In most years with most soybean varieties available in Kentucky, row widths of 20 inches or less will maximize yield. In our tests the yield increase averaged 7% as row widths narrowed from 30 in. to 20 in. This is a small increase compared with the 25% increase in average yield between the lowest yielding variety, Cutler 71, and the highest yielding variety, Essex. Changing the row width can be a management tool for soybean production. As no other variety planted in narrow rows in these tests significantly outyielded Essex grown in either wide or medium row widths, proper selection of a high yielding variety appears to outweigh either the row width or row width by variety combination as a management factor for obtaining higher yields.

Acknowledgement

This research was sponsored by a grant from the Kentucky Soybean Association.

Table 1. Effect of row width on soybean yields averaged over all varieties.

	Princeton		Lexington			
	bu/A					
Row Width	1980	1982	1980	1981	1982	Avg.
Wide	23.2a*	53.3a	41.8b	40.9a	35.5b	39.0b
Medium	26.1a	54.3a	45.3a	44.0a	40.2a	42.0a
Narrow	24.1a	55.8a	44.3a	43.1a	40.2a	41.5a

* Values within a column followed by different letters are significantly different

Table 2. Effect of row width on yield of individual varieties averaged over all environments

Variety	Row Width Narrow	Medium	Wide	Avg.
	bu/A			
Amsoy 71	42.2	39.1	36.0	39.1
Cumberland	41.5	45.2	40.4	42.4
Cutler 71	34.9	39.7	34.6	36.4
Elf	39.7	42.0	37.8	39.8
Essex	46.3	45.6	44.2	45.4
Mitchell	41.7	41.2	42.2	41.7
Pixie	43.5	40.3	38.0	40.6
Union	39.7	40.3	35.8	38.6
Williams	42.0	41.8	35.6	39.8
Forrest*	38.6	43.2	40.8	40.9
York*	39.6	37.0	40.1	38.9

*Grown only at the Princeton location.

Table 3. Effect of row width on plant height and height of the lowest pod averaged over all environments.

Variety	Plant Height (inches) Row Width Narrow	Medium	Wide	Height of Lowest Pod (inches) Row Width Narrow	Medium	Wide
Amsoy 71	36	34	33	4.7	4.5	4.2
Cumberland	35	33	33	5.1	5.0	4.6
Cutler 71	39	39	38	7.7	6.2	6.3
Elf	21	19	20	4.9	4.2	3.5
Essex	36	34	33	9.1	8.3	7.2
Mitchell	40	38	37	6.4	6.0	5.5
Pixie	22	22	21	4.9	4.8	3.6
Union	41	40	40	6.8	6.2	5.3
Williams	38	37	35	6.5	5.6	5.0
Average	34 A*	33 AB	32 B	6.2 A*	5.6 AB	5.0 B

*Plant height or pod height averages followed by different letters are significantly different.