Interaction of Potassium Fertilization and Row Width for Soybeans[1]

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In the past several years the row width of soybeans has decreased substantially. As row width decreases the amount of soil between rows for soybean roots to explore and from which to extract nutrients has decreased. Also many acres in the Midwest have little or no fertilizer added in the soybean year but rely on residual nutrients left from the previous crop. In this study the effect of row width and method of potassium fertilization for soybeans was investigated.

METHODS

Sprite soybeans were planted in 7.5 and 20 inch rows on a Crosby silt loam soil (Aeric Ochraqualf). This study was established on plots which had been a K study, therefore five residual levels of soil test K existed. The initial soil test K levels ranged from 129 to 236 lbs K per acre. Five potassium rates were employed, 0, 50, 100, 200, and 400 lbs K_2O per acre, with the lowest rate on lowest soil test level plots and highest rate on the highest. One half of each plot had K broadcast before plowing each Fall and the other half had no K added that year. Each year the side of the plot to receive direct application of K fertilizer switched to maintain approximately the same soil test levels.

The design of this study has a randomized complete block split-split plot with four reps.

[Reps(4)*K rates(5)*Row width(2)*Time of K application(2)]

RESULTS AND DISCUSSION

Yield averages for the four study years are presented in table 1. There appears to be an association of yield and total rainfall in July and August, see table 2. In 1983 May was very wet with August being very dry (1.51 inches of rain). The yields for 1983 were low as a result of poor weather in 1983.

The effect of row width on yields is presented in table 3. On average there was a 3.2 bu/a increase then row width was decreased from 20 to 7.5 inches. In 1981 and 1984 yield increases were greatest, 10.3 and 3.1 bu/a respectively. In 1980 and 1983 there were no effect of row width on yields. Narrow rows did not always increase yields but it never caused a yield decrease.

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The average effects of both residual and applied K on yield are presented in table 4. There was a significant yield increase of 16 bu/a for the first 100 lb/a of K_2O added biennially. Higher K rates did not increase yields.

When the K was added it made no difference on multiple years average yield as seen in table 5. There was a year by K method interaction which indicated a significant yield increase to direct application of K in 1983. This is probably due to a poor root system as a result of a wet May and very dry conditions in August. There was no interaction of method of K application and K rates as seen in table 6. The effect of row width and timing of K are presented in table 7. Row width had no effect on yield response as a result of when K fertilizer was applied.

Yields were higher for 7.5 inch rows than for 20 inch rows at all K levels as seen in table 8. There was no interaction between row width and K level indicating a similar response for each row width to various K levels. Soybean yields increased up to 100 K_2O biennial/a rate for both row widths.

Soil test values for each K level is presented in table 9. From the Fall of 1979 to the Fall of 1984 there was very little change in the established soil test values for each K level as a result of adding various rates of fertilizer potassium.

CONCLUSIONS

On soils low in K a yield increase to added K can be expected. The time when it is added does not affect yields unless adverse weather occurs. If poor growth conditions exist then direct applications of K are preferred. There was no difference in the level K required for soybeans in narrow or wide rows.

Table 1. Average Soybean Yield for Each Year

Year	Yield, Bu/A
1980	58.7
1981	43.3
1983	31.8
1984	46.5
LSD 0.05	3.0

Springfield, Ohio
Crosby Silt Loam

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Table 2. Annual Rainfall at the Western Research Center
Springfield, Ohio

Date		1980	1981	1983	1984
			inches		
Oct. (Pre. year)		2.07	2.07	0.46	4.69
Nov.		4.12	1.75	4.86	3.73
Dec.		1.69	1.02	2.98	2.27
Jan. (Cur. year)		2.13	0.41	1.16	1.49
Feb.		1.76	3.20	0.80	3.20
March		3.22	0.80	1.28	2.57
April	1-15	2.29	2.47	3.09	1.97
	16-30	0.30	2.36	0.49	1.42
May	1-15	2.39	4.56	6.35	1.88
	16-31	3.04	3.19	1.70	3.54
June	1-15	2.98	4.13	0.44	0.10
	16-30	4.71	1.03	1.95	1.86
July	1-15	2.47	0.70	2.12	1.76
	16-30	4.54	3.15	2.32	0.36
August	1-15	4.74	0.53	1.02	2.25
	16-31	2.34	1.70	0.49	1.24
Sept.	1-15	1.39	2.98	1.06	0.91
	16-30	0.56	0.90	0.94	1.27
Yearly Total		46.74	36.95	33.51	36.51
30 Yr. Ave.		36.17	36.17	36.17	36.17

Table 3. Effect of Row Width on Soybean Yield

Year	Yield, Bu/A Row Width, Inches		
	7.5	20	Avg.
1980	59.1	58.3	58.7
1981	48.6	38.3	43.4
1983	31.2	32.4	31.8
1984	48.0	44.9	46.5
Avg.	46.7	43.5	
LSD 0.05	Row Width	= 1.1 Bu/A	
	Years	= 3.0 Bu/A	
	Row Width * Years	= 2.3 Bu/A	

Table 4. Effect of K Rate on Soybean Yield

Biennial K_2O Rate Lb/A	Yield, Bu/A Years				
	1980	1981	1983	1984	Avg.
0	56.2	31.2	18.8	29.7	34.0
50	58.6	42.1	30.9	44.2	43.0
100	60.1	48.5	38.5	52.9	50.0
200	57.9	47.6	35.8	54.4	48.9
400	60.9	47.7	35.0	51.0	48.7
Avg.	59.7	43.4	31.8	46.4	
LSD 0.05	K Rate		= 1.7 Bu/A		
	Years		= 3.0 Bu/A		
	K Rate * Years		= 3.5 Bu/A		

Table 5. Effect of Applied and Residual K on Soybean Yield

Year	Yield, Bu/A K Method		
	Applied	Residual	Avg.
1980	59.5	59.2	59.3
1981	46.7	46.2	46.6
1983	37.0	33.0	35.0
1984	49.9	51.5	50.7
Avg.	48.2	47.5	
LSD 0.05	Year	= 3.8 Bu/A	
	K Method	= N.S.	
	Year * K Method	= 2.4 Bu/A	

Note: Check plots not included.

Table 6. Interaction of K Level and Method of Application on Soybean Yield

Biennial K_2O Rate Lb/A	Yield, Bu/A K Method		
	Applied	Residual	Difference
50	43.4	43.8	-0.4
100	50.4	48.5	1.9
200	50.3	48.0	2.3
400	48.2	49.3	-1.1
Avg.	48.2	47.5	0.7
LSD 0.05	K Method	= N.S.	
	K Rate * K Method	= N.S.	

Table 7. Effect of K Timing and Row Width
on Soybean Yield

Method of K Application	Yield, Bu/A Row Width 7.5 Inches	20 Inches	Difference
Direct	47.3	43.7	3.6
Residual	46.2	43.2	3.0
Difference	1.1	0.5	
LSD 0.05	Method of K application = N.S.		
	Method * Row Width = N.S.		

Table 8. Effect of K Level and Row Width
on Soybean Yield

Bienniel K_2O Rate Lb/A	Yield, Bu/A Row Width 7.5 Inches	20 Inches	Difference
0	36.4	32.7	3.7
50	45.0	42.3	2.7
100	50.6	48.3	2.3
200	51.1	47.3	3.8
400	50.8	46.7	4.1
Avg.	46.7	43.5	3.2
LSD 0.05	K Level = 1.7 Bu/A		
	Row Width = 1.1 Bu/A		
	K Level * Row Width = N.S.		

Table 9. Soil Test K Levels

Biennial K_2O Rate Lb/A	Fall 1979 Lb K/A	Fall 1984 Lb K/A
0	129	115
50	152	135
100	196	178
200	216	203
400	236	225
LSD 0.05	12	19

PROCEEDINGS

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