Influence of Tillage on Performance of Soybean Cultivars

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Introduction

No-tillage production results in a unique environment that is characterized by an undisturbed soil profile and abundant plant residues on the soil surface. Production practices involving crop cultivars generally have been developed for conventional tillage agriculture. Because of the unique environment associated with no-tillage production, many of these practices may not be directly transferrable. They must be reevaluated, adapted, and integrated into new systems specifically designed for crop production under no-tillage management.

The influence of tillage on cultivar performance is one such factor which has been heretofore unaddressed. The objective of this study was to evaluate soybean cultivar performance in a double-cropping system under three tillage methods.

Materials and Methods

This study was conducted near Griffin, Georgia over a four-year period, 1979-80 and 1982-83. The soil series was Cecil sandy loam, a member of the clayey, kaolinitic, thermic family of Typic Hapludults.

1979-80

During 1979-1980, six soybean cultivars were evaluated with conventional disk tillage and no-tillage. The six soybean cultivars were: 'Davis', 'Bragg', 'Ransom', 'Hutton', 'GaSoy 17', and 'Duocrop'. The tillage treatments were whole plots and the cultivars were split plots. Individual plot size was 4 rows x 21 ft. Planting dates were in mid-June following wheat (Triticum aestivum L.) grain harvest. Plots were fertilized with 30 lbs P/A and 100 lbs K/A each year before planting. Seed yields were

obtained by combine-harvesting a length of 16 ft from two rows for each cultivar and were calculated at 13% moisture content.

1982-83

Three tillage practices were studied in a randomized complete block design with four replications. The tillage treatments for each fall/spring were: no-tillage/no-tillage, conventional tillage/no-tillage, and conventional tillage/conventional tillage. The conventional tillage treatment was plowed with a moldboard plow (approximately 10 in deep), disked twice, and planted. The no-tillage treatment was planted into standing wheat stubble with a fluted coulter planter. The tillage treatments had been conducted on these plots for six years before these evaluations were conducted. Wheat and soybean were double-cropped during the first five years; wheat and grain sorghum (Sorghum bicolor L. Moench) were grown in the sixth year. The size of each whole plot was 9 x 60 ft. Ten soybean cultivars in maturity groups VII and VIII were planted on each whole plot in a split-plot design. The ten cultivars were 'Agripro-70' 'Bragg', 'Braxton', 'Coker 237', 'Coker 333', 'Duocrop', 'GaSoy 17', 'Hutton', 'Ransom', and 'Wright'. Subplots were two rows wide (5 ft) and 30 ft long. Two border rows were planted on each side of each whole plot. Planting dates were 21 June and 1 July in 1982 and 1983, respectively. Plots were fertilized and limed uniformly over the tillage treatments.

Seed yields were obtained by combine-harvesting a length of 20 ft from two rows for each cultivar and were calculated at 13% moisture content. Analyses of variance were conducted using SAS. Mean comparisons were conducted using Duncan's Multiple Range Test.

Results and Discussion

Analyses of variance for treatment effects showed the following: 1) Results were significantly different between years. 2) Tillage significantly affected soybean yields in 1979 and 1983, but not in 1980 and 1982. 3) Significant differences in yield between cultivars occurred each year, but the interaction of tillage with cultivar was not significant in any year. The soybean yields as influenced by tillage are shown in Tables 1, 2, 3, and 4 for 1979, 1980, 1982 and 1983, respectively. In general, the ranking of cultivars was not affected by tillage; the better cultivars under conventional tillage tended to be the better cultivars under no-ti1lage also.

Table 5 shows the influence of tillage on several crop parameters in 1982 and 1983. The values in Table 5 are averaged over the ten cultivars. The seed yield and seed weight were not affected by tillage in 1982 but were affected in 1983. The lack of significant differences in yield in 1982 is probably a result of moderately good rainfall amounts and distribution. In 1983, continuous no-tillage resulted in the greatest yield and seed weight and conventional tillage in the least yield and seed weight. This is probably a reflection of moisture conservation with no-tillage in a year with less than adequate rainfall. The mean plant height was also affected by tillage and was greater for no-tillage than for conventional tillage.

In summary, significant differences in yield between cultivars occurred each year, but the interaction of tillage with cultivar performance was not significant in any year. In other words, the ranking of cultivars was not affected by tillage; the better cultivars under conventional tillage tended to be the better cultivars under no-tillage also. However, the ranking of cultivars was different between years.

Table 1

Yield of Six Soybean Cultivars as Influenced by Tillage in 1979.

Cultivar	Tillage: Conventional	Tillage: No-Tillage	Mean †
	bu/A	bu/A	
Davis	19.9	12.4	16.2bc
Bragg	19.9	14.6	17.3b
Ransom	16.8	10.3	13.5c
Hutton	28.1	15.5	21.7a
GaSoy 17	24.9	18.5	21.7a
Duocrop	23.8	24.0	23.9a
Mean +	22.2a	16.5b	

+Means in a row or column followed by the same letter are not significantly different at the .05 level of probability.

Table 2

Yield-of Six Soybean Cultivars as Influenced by Tillage in 1980.

Cultivar	Tillage: Conventional	Tillage: No-Tillage	Mean†
	bu/A	bu/A	
Davis	12.9	19.9	16.5b
Bragg	14.6	17.9	16.4b
Ransom	18.8	19.3	19.0ab
Hutton	25.4	22.3	24. Oa
GaSoy 17	24.1	24.9	24.6a
Duocrop	13.4	20.4	17.0b
Mean'	17.9b	20.4a	

† Means in a row or column followed by the same letter are not significantly different at the .05 level of probability.

Table 3

Yield of Ten Soybean Cultivars as Influenced by Tillage in 1982.

Cultivar	Tillage (fall/spring) CT/CT	CT/NT	NT/NT	Mean †
	.....	--bu/A----------		
Agri-Pro 70	35.3	33.5	33.5	34.1 ab
Bragg	32.4	28.6	25.6	28.9c
Braxton	35.3	42.3	33.5	37.lab
Coker 237	36.3	40.3	38.4	38.4a
Coker 338	32.4	31.4	31.4	31.7bc
Duocrop	40.3	35.3	33.5	36.3ab
Ga Soy 17	33.3	38.4	31.4	34.4ab
Hutton	36.3	39.3	39.3	38.2a
Ransom	35.3	34.5	34.5	34.8ab
Wright	37.4	35.3	35.3	36. Oab

Table 4

Yield of Ten Soybean Cultivars as Influenced by Tillage in 1983.

Cultivar	Tillage (fall/spring) CT/CT	CT/NT	NT/NT	Mean +
	.....	bu/A----------		
Agri-Pro 70	9.8	26.6	29.9	22.2abc
Bragg	10.0	24.1	24.1	19.3cd
Braxton	8.8	21.4	23.8	18.0d
Coker 237	10.4	23.5	33.9	22.6abc
Coker 338	10.3	28.6	35.9	24.8a
Duocrop	9.4	23.5	31.5	21.4abcd
Ga Soy 17	11.3	26.3	31.2	22.9abc
Hutton	10.4	23.4	29.8	21.1abcd
Ransom	10.3	25.3	33.8	23.1ab
Wright	9.8	25.6	27.5	21. 0bcd

+Means followed by the same letter are not significantly different at the 0.05 level of probability.

CT = conventional tillage

NT = no-tillage

Table 5

Influence of Tillage on Several Soybean Crop Parameters in 1982 and 1983. (These values are averaged over the ten cultivars.)

Tillage Treatment (fall/spring)	Plant Height	Maturity Date	Seed Yield	Seed Wt
	in	Day of Year	bu/A	g/100 seed
		1982		
CT/CT	37b	294b	36.2a	14.5a
CT/NT	40a	295ab	36.3a	14.5a
NT/NT	36b	296a	34.2a	14.4a
		1983		
CT/CT	14c	306a	10.3c	14.5c
CT/NT	22b	304b	25.lb	15.lb
NT/NT	25a	305ab	30.7a	15.9a

CT = Conventional tillage; NT = No-tillage.
For each year, values within a column followed by the same letter are not significantly different at the .05 level of probability using Duncan's Multiple Range Test.