Effect of In-row Chisel at Planting on Yield and Growth of Full Season Soybeans

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Sandy surface soils, such as those in the Coastal Plains of Alabama, are highly susceptible to traffic and tillage compactions. Wheel traffic of tractors and combines often compacts the plow layers, and disks and plows can create severe compaction at the bottom of the tillage zone, which is referred to as a disk, plow, or tillage pan. These compacted layers often prevent proper root development and prevent roots from reaching available moisture in the subsoil horizons. Tillage pans are present in almost all soils, but they do not restrict root development in all soils.

During 1974 and 1975, the Alabama Agricultural Experiment Station conducted a study at the Wiregrass Substation to determine the effects of in-row subsoiling, conventional tilled soil, and planting date on growth and yields of Forrest, McNair 600, and Bragg soybean varieties. The conventional treatment seedbed was prepared by turning soil 9 inches, disking, and rotary tilling (prior to planting). The chisel treatment was prepared with a 2-inch subsoil shank run to a depth of 14 inches and the soil bedded over the chisel opening (Table 1).

Table 1. Effect of planting date and in-row chiseling on soybean yield and plant height when grown at Wiregrass Substation, 1974-75

Planting date	Soil preparation	Variety	Yield			Plant height		
			1974	1975	2-yr. Av.	1974	1975	2-yr. Av.
			(bu./acre)			(inches)		
Early	Chisel	Forrest	45	27	36	28	24	26
Early	Chisel	McNair 600	47	34	41	30	25	28
Early	Chisel	Bragg	45	29	37	33	29	31
				Av.	38			28
Early	Conventional	Forrest	30	25	28	23	21	22
Early	Conventional	McNair 600	36	36	36	21	24	23
Early	Conventional	Bragg	33	27	30	27	28	28
				Av.	31			24
Late	Chisel	McNair 600	44	31	38	30	37	34
Late	Chisel	Bragg	54	27	41	35	31	33
				Av.	40			34
Late	Conventional	McNair 600	33	30	32	25	23	24
Late	Conventional	Bragg	39	25	32	31	26	29
				Av.	32			27

[1]Planting dates were May 10 and May 30 for 1974 and May 22 and June 3 for 1975.

There was a yield increase to chiseling under the row with all varieties at both planting dates in 1974. However, yields were not different due to chiseling in 1975. There was a planting date interaction on yield of McNair 600 and Bragg in 1974 in that McNair 600 produced a higher yield for May 11 planting but was lower in yield than Bragg for the May 30 planting (Table 1). All varieties responded with increased plant height at both planting dates and in both years where the subsoil chisel was used.

From 1977 through 1981 the Alabama Agricultural Experiment Station conducted studies at nine locations in Alabama to determine if disrupting the tillage pans with an in-row subsoiler at planting, in both conventional and no-tillage cropping systems, would improve soybean plant growth and yields.

The conventional tillage treatment consisted of either chiseling or turning soils 8-10 inches deep and then disking, rotary tilling, or using a combination seedbed conditioner to prepare a seedbed. The no-tillage treatment was planted into a killed stand of small grain or old crop residue with only a double disk opener planter. The in-row subsoil treatments were planted with a Brown Harden Super Seeder®. Subsoil depth was 12–14 inches.

Essex soybeans were planted in the three northern Alabama locations and Ransom soybeans were planted in the six southern locations. All plantings were made for full season production using a 36-inch row width. The yield and growth of soybeans are reported as relative yield and plant height in relation to the conventional tillage treatment, tables 2 and 3.

When compared to the conventional tillage treatment, no-tillage without subsoiling resulted in reduced soybean yields and plant growth on all Coastal Plain and River Terrace soils. The use of the in-row subsoiler with the conventional tillage system at planting increased yields over the conventional tillage system at Tallassee and Headland. The Tallassee soil had a strong plow pan and the soil at Headland developed a very compact layer in the lower plow layer during the herbicide incorporation with rotary tiller and disk.

Yields of soybeans under the no-tillage system with the in-row subsoiler were equal to those grown on the conventional system with and without the in-row subsoiler except for the Crossville location. At Crossville, the highest yields were from conventional tillage. The most noticeable effect of tillage treatments on vegetative growth was reduced plant height in the no-tillage treatment at Tallassee, Prattville, Monroeville, Headland, and Fairhope. At Belle Mina, all plots produced good growth and yield with all tillage systems.

The results of these studies suggest that for full season soybeans, yields from no-tillage systems may be comparable to or higher than yields from conventional tillage systems provided an in-row subsoiler is used on Coastal Plain and River Terrace soils.

Table 2. Relative Plant Height of Soybeans as Affected by Preplant Soil Preparation and In-Row Subsoiling on Eight Soils in Alabama[1]

Tillage treatment	Relative plant height by location						
	Belle Mina 2 yr. (1978–79)	Cross-ville 2 yr. (1977–78)	Tallassee 5 yr. (1977–81)	Pratt-ville 5 yr. (1977–81)	Monroe-ville 2 yr. (1977&79)	Headland 1 yr. (1978)	Fairhope 1 yr. (1978)
Conventional tillage	100	100	100	100	100	100	100
Conventional tillage plus in-row subsoiling	100	101	107	100	102	125	103
No-tillage	97	101	82	71	87	71	76
No-tillage plus in-row subsoiling	102	109	107	94	100	118	94
Av. plant height (in.) for conventional tillage	26	25	31	31	33	23	37

[1]Soil types: Belle Mina, Decatur clay; Crossville, Hartsells fine sandy loam; Winfield, Savannah fine sandy loam; Prattville, Lucedale fine sandy loam; Monroeville, Lucedale fine sandy loam; Fairhope, Malbis fine sandy loam; Headland, Dothan fine sandy loam; Tallassee, Cahaba fine sandy loam.

Table 3. Relative Yield of Soybeans as Affected by Preplant Soil Preparation and In-row subsoiling on Eight Soils in Alabama

Tillage treatment	Relative yield by location							
	Belle Mina 2 yr. (1978–79)	Cross-ville 3 yr. (1977–79)	Win-field 2 yr. (1978–79)	Tallassee 4 yr. (1977–78) (1980–81)	Pratt-ville 4 yr. (1978–81)	Monroe-ville 3 yr. (1977–79)	Head-land 3 yr. (1978–80)	Fairhope 2 yr. (1978–79)
Conventional tillage	100	100	100	100	100	100	100	100
Conventional tillage + in-row subsoiling	113	92	106	115	105	99	156	98
No-tillage	114	71	87	84	66	85	85	79
No-tillage plus in-row subsoiling	116	87	91	100	104	105	152	100
Av. yield (bu./acre) for conventional tillage	37.4	33.9	28.8	28.4	19.5	37.1	15.6	33.9