Cotton Yields as Affected by Previous Crop Tillage and Subsoiling for Cotton

J.T. Touchton, D.W. Reeves, and R.R. Sharpe[1]

Introduction

One of the biggest disadvantages of no tillage in the Southeastern Coastal Plains is the need for in-row subsoiling at planting. This need is created by tillage pans several inches below the soil surface and compaction in the surface few inches of soil. Both of these compaction problems can result in yield reductions if in-row subsoilers are not used at planting.

During the past few years research efforts have been directed towards finding methods of eliminating compaction problems without having to use the in-row subsoilers and without having to abandon conservation tillage. Data collected from these studies indicate that soybeans can be planted directly into wheat stubble on highly compactable soils if the soil is deep tilled (chisel, turned, or subsoiled) prior to planting wheat and if the soybean are planted in narrow row widths (24 inches or less) (Sharpe et at., 1988). This tillage system did not work for grain sorghum (Touchton and Bryant, 1988).

Other studies have shown that both corn and grain sorghum can be no-till planted on these compactable soils if the row middles are subsoiled a few weeks after planting

[1]Agronomy and Soils Dept. Alabama Agric. Exp. Sta., and USDA-ARS, National Soils Dynamics Lab., Auburn Univ., AL. 36849.

(Reeves and Touchton, 1986; Touchton and Bryant, 1988). Although subsoiling is still required. this system will allow for faster planting during critical planting periods.

The objective of this study is to determine the effects of previous crop tillage and inter-row subsoiling on cotton yields.

Material and Methods

This study is located in the Coastal Plains of southern Alabama on a Benndale fine loamy sand, a Lucendale fine sandy loam, and a Dothan fine sandy loam at Auburn University's Brewton Experiment Field, Monroeville Experiment Field, and Wiregrass Substation at Headland, respectively. Tillage treatments consisted of no tillage, disk, chisel plow, moldboard plow, or subsoil on 36-inch center prior to drilling rye each fall. Tillage at cotton planting (Monroeville and Brewton only) consisted of none and inrow subsoiling 10 to 12 inches deep. Row width was 36 inches. The rye was cut and removed from the field just prior to cotton planting. Tillage 4 to 6 weeks after planting cotton consisted of between row subsoiling 10 to 12 inches deep and no subsoiling.

History of experimental sites: These plots were established in the fall of 1980 to determine the effects of tillage prior to planting wheat on the yield of double-cropped soybeans grown in conservation tillage systems. In 1984, the summer crop was changed to grain sorghum, which was double cropped with wheat harvested for grain. In the fall of 1986, the winter crop was changed to rye, and in the spring of 1987 the summer crop was changed to cotton. The rye is harvested for forage yields instead of grain so that cotton can he planted during the optimum planting periods. Although crops have changed over the years, the basic tillage systems (no-till, disk, chisel, and turn) are still on the original plots. and the 1988 cotton crop represents the 8th year of each tillage system and the second year of data for rye and cotton.

Results

Rye 1987 and 1988

Judging from 2 years of forage yields (Table 1), it appears that rye has a greater need for deep tillage than wheat. Disking improved rye yields over that obtained with no tillage, but deep tillage was superior to disk tillage. As with wheat (Sharpe et al., 1988), there was not much difference in rye yields among deep tillage systems, which suggests that chisel plowing or just pulling a subsoiler with 36-inch subsoil shank spacings is as effective as turning. The date from Brewton and Monroeville suggest that rye will benefit from subsoiling the previous crop. This in-row subsoiling for the previous summer crop also improved wheat forage yields in previous tests, hut not wheat grain yields. Higher forage yields at Headland than the other locations were due to February applications of N at Headland but not the other locations

Cotton-1987

Seed cotton yields at each location in 1987 are listed in Table 2. Yield responses among tillage systems varied with locations

Brewton. In-row subsoiling regardless of previous tillage resulted in the best yields. With in-row subsoiling at cotton planting, yields fell into 4 groups, which are:

Table 1. Rye forage yields as affected by tillage prior to planting rye and in-row subsoiling for the previous summer cotton crop.

Tillage at rye planting	Subsoiling previous crop	Location and year					
		Headland		Brewton		Monroeville	
		1987	1988	1987	1988	1987	1988
		--rye yield, lb/acre --					
No-till	Yes	3870	2429	1170	786	1700	760
	No	-----	-----	530	493	1700	765
Disk	Yes	4960	2429	1220	1399	2520	1500
	No	-----	-----	660	946	2690	1330
Chisel	Yes	5690	2631	1400	2012	2680	1740
	No	-----	-----	1400	1866	3140	1570
Turn	Yes	5320	0744	1370	1652	2940	1840
	No	-----	-----	860	1400	2890	1540
Subsoil	Yes	5320	3238	1450	1652	2700	1720
	No	-----	-----	1240	1586	2780	1580

Previous crop tillage:	Between row subsoiling	
	Yes	No
	— Seed cotton, lb/acre —	
No-till, Disk, Chisel	3060	3330
Turn. Subsoil	3260	3590

Evidently, waiting until cotton is 10 to 12 inches tall is too late for deep subsoiling between the rows. It also appears that cotton response to tillage prior to the previous winter crop is more like grain sorghum than soybean, in that subsoiling does not eliminate the benefits that deep tillage prior to planting the winter crop has on yields of the summer crop. In addition, for cotton as with sorghum, deep tillage prior to planting the winter crop did not eliminate the need for in-row subsoiling at planting. Seed cotton yield without in-row subsoiling averaged 2960 Ib/acre, which is 630 lb/acre less than the *best* group shown above.

Monroeville. Yields at Monroeville averaged 2500 lb/acre, but they were too erratic to draw conclusions about the effects of various tillage systems (Table 2). It does appear, however, that tillage systems did not have much effect on cotton yields.

Headland. Yields at Headland fell into 3 basic groups: 1) when the in-row subsoiler was used (which resulted in the highest yields), there were no differences among tillage treatments prior to planting rye, and average yield was 2570 Ib/acre; 2) when the in-row subsoiler was not used, no-tillage and disk-tillage prior to planting rye resulted in the lowest yields (2140 lb/acre); and 3) there were not differences in yields (2310 lb/acre) among the 4 deep tillage systems.

Cotton-1988

Cotton yields in 1988 were not as responsive to treatments as in 1987 (Table 3). There was little relationship between previous crop tillage and cotton yield. The only striking response to in-row subsoiling at cotton planting occurred at Monroeville, which is unusual because yield responses to in-row subsoiling for any crop seldom occur at the Monroeville Experiment field. As in the previous year, there was

Table 2. Seedcotton yields in 1987 as affected by tillage prior to planting rye, in-row subsoiling at cotton planting, and between-row subsoiling when cotton plants were 10 to 12 inches tall.

Loc.	Subsoiling In-row	Subsoiling Between row	Tillage prior to planting rye NT	Disk	Chisel	Turn	Sub[1]
Brewton							
	Yes	Yes	2940	3190	3050	3390	3290
		No	3260	3310	3210	3670	3610
	No	Yes	2590	2870	2900	3040	2760
		No	2960	2950	3170	2890	2930
Monroeville							
	Yes	Yes	2180	2540	2260	2420	2810
		No	2450	2380	2530	2610	2850
	No	Yes	2620	2310	2550	2630	2550
		No	2600	2300	2510	2440	2590
Headland							
	Yes	-2	2560	2430	2620	2510	2610
	No	--	2170	2100	2250	2310	2310

[1]Sub is subsoiling prior to planting wheat on 36-inch centers.
'Between-row subsoiling was not a treatment at Headland.

no benefit to between-row subsoiling after crop emergence.

Based on two years of data collected at 3 south Alabama locations, it appears that if cotton is grown on a soil that needs some type of deep tillage, the tillage will have to be done either prior to or at planting. Data from previous tests with corn (Reeves and Touchton, 1986) and grain sorghum (Touchton and Bryant, 1988) suggest that subsoiling row middles after stand establishment is a good substitute for in-row subsoiling at planting.

Table 3. Seedcotton yields in 1988 as affected by tillage prior to planting rye, in-row subsoiling at cotton planting, and between-row subsoiling when cottonplants were 10 to 12 inches tall.

Loc.	Subsoiling In-row	Subsoiling Between row	Tillage Prior to planting rye NT	Disk	Chisel	Turn	Sub[1]
Monroeville							
	Yes	Yes	2870	2550	2610	2670	2860
		No	2830	2600	2730	2620	2500
	No	Yes	2670	2320	2510	2670	2630
		No	2580	2470	2720	2660	2700
Brewton							
	Yes	Yes	2180	2080	1930	2130	2090
		NO	2020	1990	1910	2140	2210
	No	Yes	2040	2200	1800	2390	2100
		No	2090	2450	2080	2310	2290
Headland							
	Yes	-2	1410	1530	1320	1810	1600
	No	--	1560	1440	1520	1700	1470

[1]Sub is subsoiling prior to planting wheat on 36-inch centers
[2]Between-row subsoiling was not a treatment at Headland.

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