Cover Crops and Tillage Practices for Cotton Production on Alluvial Soils in Northeast Louisiana

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INTRODUCTION

Advances in equipment and herbicide technology have contributed greatly to the increase in producer acceptance of reduced tillage practices. The development of reduced tillage systems that include the use of pre-emerge and post-emerge herbicides in lieu of pre-plant soil incorporated herbicides has greatly reduced the need for spring tillage (Crawford, 1992; Reynolds, 1990). These effective herbicide schemes have, in many cases, made practices such as no-tillage and stale-seedbed possible. These reduced tillage practices have greatly enhanced the opportunities to produce cotton on clay soils in the Mid-South (Boquet and Coco, 1993), and have provided a method for environmental compliance on highly erodible soils (Valco and McClelland, 1995). Reduced soil erosion (Hutchinson, et al., 1991), increased soil organic matter (Boquet and Coco, 1993), and reduced soil moisture evaporation (Wilhelm et al., 1986) are just some of the documented benefits from minimum tillage. Reduced or conservation tillage has also, in many instances, lead to lower equipment and fuel costs resulting from savings in time and labor. In addition, cover crops have been found to be an important component of conservation tillage systems (Hutchinson et al., 1991; Ebelharet al., 1984).

However, questions remain on the importance of deep tillage in relation to reduced tillage practices on some of the common alluvial soil types in the Mid-South. Therefore, a study was initiated in the fall of 1995 to investigate the interaction between deep tillage and various other conservation tillage practices.

MATERIALS AND METHODS

A field study was initiated in the fall of 1995 on a Commerce silt loam (fine-silty, mixed, nonacid, thermic Aeric Fluvaquent) and on a Sharkey clay (very-fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts) at the Northeast Research Station near St. Joseph LA. Tillage treatments included conventional tillage (CT), Fall bedded (FB) and no-tillage (NT). The NT treatments were split for in-season cultivation. Cover crop treatments were native vegetation, hairy vetch *(Vicia villosa* L.), and wheat *(Triticum aestivum* L.). Thus, eight treatments were designed to compare these various conservatino tillage practices (Table 1). The experimental design was a randomized complete block with four replications. Plot size was eight (40 in. row spacing) rows wide by 65 ft long.

In the fall of 1995, the cover crops were planted, the CT treatments were subsoiled, and the FB treatments were re-hipped and rolled. In the spring of 1996, the wheat plots on both soil types received 30 lb N/a as ammonium nitrate. On 4 March, the CT treatments were disked, and were tilled with a field cultivator and hipped on 12 April. Both tests were planted with Sure-Grow 501 seed on May 7 with a John Deere model 7300 series planter equipped with ripple coulters, conventional hoppers, and granular infurrow applicators. At planting, all plots received Temik 15G + Terraclor TSX (0.5 lb + 1.0 lb ai/a). Although the planter was equipped with ripple coulters, in many places on the silt loam, the coulters did not cut through the thick mat of vetch, but only pressed it into the seed furrow. As a result, the stand of cotton *(Gossypium hirsutum* L.) in the vetch plots on silt loam was inadequate, therefore they were replanted on 21 May.

Herbicide applications included Roundup Ultra at 1.0 lb ai/a as a burndown to all cover crops in early April followed by Gramoxone at 1.0 lb ai/a 14 days later. All plots received Cotoran and Prowl, (1.2 lb + 1.0 lb ai/a) preemerge, Staple broadcast at 1.5 oz ai/a, Cotoran + MSMA (0.5 lb + 1.0 Ib) ai/a post-directed, and Bladex + MSMA (0.7 lb + 2.0 lb ai/a) at layby.

The cotton planted in the vetch plots on the silt loam received 60 lb N/a while all other plots received 90 lb N/a Cotton planted in the vetch plots on clay received 90 lb N/a while all other plots received 120 lb N/a. Insect control and other agronomic practices followed Louisiana Extension Service recommendations.

The silt loam test was defoliated on 1 October and the center four rows of each plot were harvested on 10 October with a spindle picker adapted for small plot harvest. The clay test was defoliated on 26 September and the Center four rows of each plot were harvested on 7 October.

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RESULTS AND DISCUSSION

On the silt loam, there were no differences in biomass production between the wheat and vetch cover crops prior to herbicide application (data not shown). The cotton in the no-till vetch plots was significantly later than the other treatments in maturity due to replanting. This was evidenced by the shorter plant height and lower number of nodes measured on 24 June (Table 1). The delay in maturity was also evident in the nodes above white flower counts, with the vetch plots averaging 7.4 and 5.5 at the last two sample dates compared to 6.0 and 4.3 for all the other treatments. This may also account for the lower seedcotton yield produced in the no-till vetch plots. Among the no-tillage plots, there were no significant differences due to cultivation.

The. CT treatment was subsoiled in the row with a Paratill in the fall. Cotton has been shown to respond to subsoiling on this soil type (Crawford 1978), and in this experiment the CT treatment resulted in significantly more seedcotton than any of the no-tillage treatments (Table 1). This may reinforce the hypothesis that annual fall subsoiling is needed on this soil type, however the CT treatment was not significantly different (at P=0.05 level) than the FB treatment, which was not subsoiled. Therefore, the yield increase associated with CT may be partially related to other factors.

On the Sharkey clay, the FB treatment resulted in significantly more seedcotton than all the other treatments (Table 2). The plants in the FB treatment were also taller and had more main stem nodes by 24 June than the plants in the other treatments, with 9.1 nodes and 12.0 in. in height compared to averages of 8.3 nodes and 8.7 in. for the other treatments. This could possibly be due to a higher soil temperature early in the season which resulted in more rapid early growth. There were no differences in yield with respect to cover crop or in-season cultivation among the six no-till treatments. There were also no significant differences with respect to crop maturity as measured by nodes above white flower counts.

PRELIMINARY CONCLUSIONS

On the Commerce silt loam, it appears from the first year results that annual fall subsoiling may be an important factor in the success of any reduced tillage system. In order to further investigate the effect of deep tillage on the growth and development of cotton in reduced tillage systems, all of the treatments on both soil types were split for in-row subsoiling with a Paratill in the 1996. On the Sharkey clay, the fall bedded tillage system was superior, possible due to a higher early growth rate.

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Table 1. Growth and yield of cotton grown on Commerce silt loam under various tillage and cover crop regimes.

Tillage	Cover Crop	Cultivation	Seedcotton Yield	Main-Stem Nodes'	Plant Height'	Node Above White Flower — Sample dates —		
			lb/a	#	in.	July 8	July 15	July 29
None	None	No	3303	11.7	20.5	7.74	6.34	4.19
None	Wheat	No	3145	11.7	18.6	7.65	5.95	4.10
None	Vetch	No	2666	9.0	11.4	--	7.41	5.67
None	None	Yes	3445	12.2	20.0	7.40	5.85	4.45
None	Wheat	Yes	3128	11.5	18.0	7.84	6.39	4.45
None	Vetch	Yes	2598	8.9	12.2	--	7.45	5.30
Conventional	None	Yes	3857	12.2	23.7	7.30	6.04	4.39
Fall bedded	None	Yes	3563	11.8	20.9	7.21	5.93	4.44
LSD (0.05)			323	0.56	1.19	0.24	0.30	0.28
C.V. *(Yo)*			6.8	8.9	11.5	10.4	15.2	19.7

† Number of main-stem nodes counted on June 24,1996.

‡ Plant height **was** also measured on June 24,1996.

Table 2. Growth and yield of cotton grown on Sharkey clay under various tillage and cover crop regimes.

Tillage	Cover Crop	Cultivation	Seedcotton Yield	Main-stem Nodes	Plant Height	Node Above White **Flower** — Sample dates —		
			lb/a	#	in.	July 8	July 22	July 26
None	None	No	2553	8.4	9.0	6.10	4.90	4.41
None	Wheat	No	1754	7.3	7.5	5.56	4.88	4.44
None	Vetch	No	2129	8.6	8.3	6.30	4.70	4.31
None	None	Yes	2552	8.5	9.5	6.09	4.89	4.16
None	Wheat	Yes	2029	8.0	8.1	5.76	4.61	4.05
None	Vetch	Yes	1992	8.8	8.5	6.25	4.97	4.86
conventional'	None	Yes	2541	8.7	10.0	6.11	5.14	4.16
Fall bedded'	None	Yes	2994	9.1	12.0	6.19	4.66	3.64
LSD (0.05) =			419	0.49	0.97	0.25	0.29	0.29
C.V. *(Yo)*=			6.8	10.3	18.8	13.1	19.0	22.2

† The Conventional tillage consisted of Spring tillage and rebedding.

‡ The Fall bedded tillage consisted of Fall rebedding and rolling.