

Reduced Tillage for Cotton Production in Arkansas

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INTRODUCTION

Studies conducted in Arkansas during the 1970s indicated that reduced post-plant tillage resulted in reduced cotton yields on certain soil types but not on others. A summary of another study showed that cover crops tended to improve soil tilth in continuous cotton

Preliminary studies were instigated at Marianna, Arkansas, during the 1990 growing season. The primary objective was to obtain experience in various techniques of planting and machinery operations necessary for no-till cotton production. These studies were continued in 1991.

MATERIALS AND METHODS

An area of Memphis silt loam soil that had been in cotton or fallow was selected to establish plots in 1989.

1990: The conventional-till portion of the test was disked twice and then triple-Ked prior to bedding. On May 25 the beds were dragged off with a triple-K, and DPL-50 cotton was planted in all treatments. Soil fertilizer applications consisted of 0-45-90 applied preplant, 60-0-0 applied June 14 and 24-0-0 applied July 16. CotoranTM and DualTM were applied premerge at recommended rates. TemickTM-TerrachlorTM was applied in furrow at planting at the 30-lb/acre rate. FusiladeTM was applied to the no-till plots for grass control on July 3 at 24 oz/acre. Lay-by was done using LoroxTM at 2 pt/acre. Foliar applications of fertilizer, insecticides, etc. followed recommended procedures. Tilled plots were

mechanically cultivated on June 14 and July 3. Plots were hand-hoed on July 15. The harvest consisted of a once-over picking on October 17.

1991: The treatment design was a split split plot with till or no-till main plot, first split was 30 or 38 inch row, and second split was starter fertilizer application or none. The experiment had five replications. Till or no-till strips were established in the fall of 1990 and planted to cover crops. Cover crop vegetation was chemically burned down approximately two weeks prior to target planting date (May 15). Starter fertilizer was applied at 15-15-0, (N-P₂O₅-K₂O) lb/acre. Tilled plots were disk harrowed twice and bedded on 5-30-91, and drug off with a do-all in preparation for planting on 6-1-91. All plots were planted with cotton cultivar 'DPL-SO' on 6-1-91. Subsequent insect, weed, and fertilizer practices followed normal recommendations.

Data were collected on plant ontogeny, yield, tissue nutrient concentrations in the petioles and plant characteristics.

RESULTS AND DISCUSSION

Problems were encountered with equipment settings for no-till operations; however, the equipment was finally set so that it operated properly. There was a special problem with the planter. It was noted that the cotton in no-till plots seemed to grow especially slowly while small. In areas in which adverse problems existed with soil acidity or weeds, no-till tended to accentuate the problems in 1990.

University of Arkansas uses the node location of the uppermost white bloom for crop management. When this bloom is first located five nodes from the top, the harvestable crop is already set on the plant. This occurred on August 13, 1990 and July 25, 1991. There was

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Table 1. Yield, stand and mature plant characteristics for the 1990-91 no-till cotton test at Marianna, Arkansas.

Year	-----1990-----		-----1992-----			
Tillage Practice	<u>Conv.</u>	<u>No-Till</u>	<u>Conventional</u>		<u>NO-Till</u>	
Row Spacing (inches)	38	38	30	38	30	38
Yield or plant characteristics:						
Yield (lb lint/acre)	888 a*	736 b	1117 a	895 b	755 c	611 d*
Stand (Plants/Row-ft)	3.4	3.3	3.4	3.4	3.4	3.4
Nodes below first sympodia	6	5	6.7	6.9	6.9	6.6
Monopodial with fruit	0	0	1.1	1.3	2.6	1.1
Height (inches)	30	31	24	22	23	21
No. effective sympodia	9	10	16	16	16	16
NO. of sympodia	11	11	16	16	16	16
Total Nodes per plant	1.7	16	23	23	23	23
Ave. internode length (inches)	1.8	1.9	1.0	0.9	1.0	0.9
Total bolls per plant	13	12	10.5	11.2	12.6	10.7
% first position boll	71	68	55	45	62	63
% second position boll	25	28	39	46	29	33
% other position bolls	4	4	2	1	1	1
% auxil.	0	0	0	0	0	0
% bolls position one retained	70	75	35	31	45	41
% bolls in position two retained	32	31	26	31	23	22
Boll size (g/boll)	0.66	0.59	0.81	0.78	0.46	0.55

¹Numbers in the same row for the same year followed by different letters are significantly different at the 1% level according to LSD.

no differential between no-tilled and conventionally tilled cotton.

Equivalent stands of about 3.4 plants/row-ft were established. Even though there was an apparent height differential between conventional and no-till early in 1990, the plants were the same height at maturity (Table 1). All of the other plant characteristics were similar regardless of tillage (Table 1).

Conventionally tilled cotton yielded 152 lb lint/acre more than no-till cotton in 1990. The source of the reduced yield for the no-till cotton was boll size reduction of 17% (Table 1). Visual observation during the growing season indicated onset of drought symptoms in the no-tilled cotton earlier than in the tilled plots. Soil moisture analysis with a dual source probe failed to confirm a difference in soil moisture usage.

In 1991, starter fertilizer was not found to influence lint yield but tillage and spacing both did (Table 1). Conventional-tillage yielded significantly more lint than no-till at either row spacing. Narrow rows were significantly better than wide rows in either tillage systems. Analysis of plant characteristics and stand data show that the yield increase from narrowing rows within a tillage system was obtained from increasing the number of some size bolls per acre. Yield differences resulting from tillage operations again resulted from a reduction in boll size.

To get some idea of profitability, Coop. Ext. Budgets (1) were completed and are summarized in Table 2. Budgets (Table 2) indicate that in 1991 narrow rows were worth \$133.23 per acre if cotton sold for \$0.64 per lb. of lint. The loss in yield for no-till was not overcome by the reduction in tillage costs. Narrow rows in no-till were worth \$84.86.

Yield enhancement obtained with narrowing rows from 38 to 30 inches was also shown to be profitable on both conventional and no-till systems. Starter N and P fertilizer had no effect on yield. No-till systems are currently

less profitable than conventional systems for cotton production on Arkansas silt loam.

LITERATURE CITED

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Table 2. Estimated costs and returns for various cotton production systems in 1991.

SPECIFIED OPERATING COSTS				
Tillage Practice:	Conventional		No-till	
Row Spacing (inches)	30	38	30	38
Resource or input:				
Seed	\$10.51	\$8.30	\$10.51	\$8.30
Fertilizer	31.40	31.40	31.40	31.40
Lime + Application	10.01	10.01	10.01	10.01
Herbicide	57.38	57.38	87.32	87.32
Fungicide	0	0	0	0
Insecticide	16.20	16.20	16.20	16.20
Defoliant	26.15	26.15	26.15	26.15
Aerial Application	9.54	7.53	9.54	7.53
Machinery:				
Fuel, Oil, Lubricants	25.05	25.05	18.84	18.84
Repairs	44.30	44.30	38.35	38.35
Labor	22.18	22.18	19.53	19.53
Irrigation:				
Fuel, Oil, Lubricants	0	0	0	0
Repairs	0	0	0	0
Irrigation Labor	0	0	0	0
Custom Spread	6.08	6.08	6.08	6.08
Custom Haul	0	0	0	0
Custom Dry or Ginning	0	0	0	0
Miscellaneous	4.00	4.00	4.00	4.00
Crop Insurance Premium	0	0	0	0
Interest on O.P.C.A.P.	12.01	11.85	12.72	12.55
Total Specified Operating costs	\$274.20	\$270.43	\$290.67	\$286.26
	Returns per acre			
Base price \$0.64/lb lint	\$440.68	302.37	192.53	104.78

(continues)

Table 2. Continued.

SPECIFIED OWNERSHIP COSTS				
Tillage Practice:	Conventional		No-till	
Row spacing (inches)	30	38	30	38
Resource or input:				
Tractors:				
Depreciation	\$ 8.13	\$ 8.13	\$ 2.17	\$ 2.17
Interest	6.71	6.71	2.12	2.12
Equipment:				
Depreciation	7.26	7.26	5.78	5.78
Interest	4.10	4.10	2.91	2.91
Special Equipment:				
Depreciation	32.21	32.21	32.21	32.21
Interest	13.55	13.55	13.55	13.55
Miscellaneous:				
Depreciation	0	0	0	0
Interest	0	0	0	0
Irrigation:				
Depreciation	0	0	0	0
Interest	0	0	0	0
Taxes & Insurance	5.54	5.54	2.89	2.89
Interest	0.61	0.61	0.61	0.61
Overhead Labor	0	0	0	0
Other Overhead	0	0	0	0
Land & Property Tax	0	0	0	0
Management	0	0	0	0
Total Specified Ownership Costs	\$78.11	\$78.11	\$62.24	\$62.24
Total Specified Operating and Ownership Costs	\$352.31	\$348.54	\$352.91	\$348.42
Returns per acre				
Base price \$0.64/lb lint	362.57	224.26	130.29	42.62'

NOT INCLUDED IN THIS REPORT ARE CHARGES FOR LAND RISK, OVERHEAD LABOR, OTHER OVERHEAD, CROP INSURANCE, REAL ESTATE TAXES, AND MANAGEMENT.