

## COTTON RESPONSE TO TILLAGE IN A CORN ROTATION SYSTEM

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**ABSTRACT:** Seven tillage methods in continuous cotton and cotton following ridge-tillage corn were evaluated on a Marietta silt loam soil in a 3-year (2000-2002) study. The objective of this study was to determine the effect rotation and reduced tillage had on ground residue cover and yield. Rainfall during the growing seasons were highly variable across years with seedcotton mean yields were 3065, 2235, and 2786 lb/ac in 2000, 2001, and 2002, respectively. Rotation had no effect on seedcotton yield in 2001 and 2002. However, the mean rotation yield (averaged over tillage systems and years) was 10% more than continuous cotton. Tillage had no effect on seedcotton yield 2 of 3 years. Tillage only had an effect on yield in 2001. Averaged over rotation in 2001, fall chisel-harrow + paratill-bed-roller + do-all (row conditioner) at planting and the disk + bed-roller + do-all at planting produced the highest yield of 2411 and 2365 lb/ac, respectively. Both were higher in yield than conventional tillage, ridge-tillage + do-all at planting and the fall paratill-bed-roller with no do-all at planting. The fall paratill-bed-roller system without a do-all application at planting (to remove dry soil from the bed) resulted in delayed seedling emergence and 18% lower yield (averaged over rotation) compared to the do-all application at planting. There were no yield differences between conventional tillage, fall disk + paratill-bed-roller + do-all at planting, fall paratill-bed-roller + do-all at planting, and ridge-tillage + do-all at planting. Ground residue cover increased as much as 40% with reduced tillage systems. Compared with continuous cotton, corn residue increased ground residue cover (averaged over tillage) by 20%.

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**KEYWORDS:** Cotton, rotation, tillage

**MATERIALS AND METHODS:** A field study was established in the fall of 1998 on a Marietta silt loam soil at Verona, Mississippi. Since the year 1999 was the establishment year of the rotation, the data was not used for comparison analysis. The experiment was conducted as a split plot arrangement of treatments in a randomized complete block design with 4 replications. Rotation was the whole plot factor and tillage was the subplot factor. Plot size was 8 (30-inch) rows by 85 ft long. Duplicate treatments of corn-cotton rotation were maintained so rotation data was acquired each year.

Fertilizer (N, P, K) were applied based on the Mississippi State Extension Service Soil Testing Laboratory recommendations for a 2 bale/ac cotton yield goal and corn yield goal of 150 bu/ac.

Soil test analysis indicated high levels of P with medium K levels. Potash (K<sub>2</sub>O) at 250 lb/ac was applied broadcast to the soil surface in the fall of each year, prior to fall land preparation. Nitrogen as UAN solution (32% N) was applied as a sidedress application (6 inches from the row and 2 inches deep) at 160 lb N/ac to 6 to 8 leaf corn and 80 lb N/ac to cotton in the pinhead square stage of growth.

All tillage treatments were applied in the fall except the ridge-tillage treatments (Table 1). The conventional tillage treatments also received a field cultivation in late March or April and then were rebedded. The corn, following cotton in the rotation, was planted no-till and received one ridge-till cultivation in early May of each year.

Corn hybrid Pioneer 3223 was planted no-till in mid-April at 28,000 seed/ac. Lorsban 15G (chlorpyrifos) at 1.3 lb ai/ac was applied in-furrow at planting. All corn plots received a preemergence application of atrazine at 2.0 lb ai/ac after planting each year. The continuous corn treatment received an application of Accent (nicosulfuron) + surfactant at 0.5 oz ai/ac + 0.2 pt/ac in mid-May for annual grass control in 2001 and 2002. In 2002, Intrepid (methoxyfenozide) at 0.0625 lb ai/ac was applied postemergence to all corn plots only in 2002 for southwestern corn borer (*Diatraea grandiosella*) control. The center 2 rows of each 8-row plot were harvested in early September of each year with a plot combine equipped with a 2-row corn header.

A burndown herbicide was applied in early March of each year to all cotton treatments except conventional tillage treatments in continuous cotton and following corn in the rotation (Table 1). All cotton plots, except treatments 6 and 13, (fall paratill-bed-roller) were do-alled prior to planting cotton early to mid-May. Treatments 6 and 13 were planted no-till. Delta and Pineland DP 20B was seeded at 3 seed/ft of row (30-inch row). Temik 11G (aldicarb) and Ridomil 10G (mefenoxam) at 0.45 and 0.88 lb ai/ac were applied in-furrow at planting.

A burndown after planting was applied either alone or in combination with preemergence herbicides for weed control to all treatments except the conventional tillage treatment. The conventional tillage treatments only received a preemergence herbicide application. Post-directed broadcast herbicide applications were made to all treatments except the conventional tillage and ridge-tillage treatments for weed control. The conventional tillage treatments received 2 cultivations with a 13-inch band application of post-directed herbicide during the growing season. Ridge-till cultivations application with a post-direct herbicide band (13-inch) application were made twice during the growing season to the ridge-tillage treatments.

Tarnished plant bug (*Lygus lineolaris*), cotton bollworm (*Helicoverpa zea*), and budworm (*Heliothis virescens*) were the major cotton insect pests with light to moderate infestations all 3 years of the study. Banded winged white fly (*Trialeurodes abutiloneus*) and cotton aphid (*Aphis gossypii*) also were pest problems in 2000 and 2002. Insecticides were applied when insect pests reached or exceeded threshold levels with a twice-weekly scouting program. All insecticides were applied with TXVS-4 nozzles at 5 gpa carrier volume. Pix (mepiquat chloride) was applied as needed for controlling cotton growth.

All cotton plots were defoliated with a boll opener (ethephon) and appropriate defoliant were applied when all harvestable bolls were 4 nodes above the first position cracked boll. The center

2 rows of each 8-row plot were harvested in early October with a spindle picker modified for plot harvest. Seedcotton weights were recorded. The seedcotton samples were ginned with a mini-gin (a state of art small scale cotton gin) to determine the percent gin turnout and lint yield. All data was subjected to an analysis of variance with the Mixed procedure of SAS. Fisher's Protect least significant difference (LSD) were calculated for comparisons at the 5% significance level.

**RESULTS AND DISCUSSION:** Growing season rainfall was highly variable across years as reflected in seedcotton study mean yields of 3065, 2235, and 2786 lb/ac in 2000, 2001, and 2002, respectively (Table 1). Tillage only affected yield in 2001 and rotation only affected yield in 2000. However, averaged over years and tillage systems, rotation increased yield by 10%. Averaged over rotation in 2001, the disk + bed-roller + do-all at planting produced the highest yield of 2411 lb/ac; and it was higher than ridge-tillage + do-all at planting, conventional tillage and fall paratill-bed-roller with no do-all at planting. There was no yield difference between these lower yielding treatments. The fall paratill-bed-roller without a do-all application at planting (to remove the dry soil from the bed-seedling emergence zone) resulted in delayed germination until rainfall occurred 15 days after planting. This resulted in 359 lb/ac lower yield than where the do-all was used. In 2000 and 2002 with adequate soil moisture in the bed-seedling emergence zone, the do-all application had no effect on seedling emergence or yield.

Reduced tillage systems had 20 to 45% more ground residue cover (Table 2). Ground residue was 11 to 25% greater with corn residue. After fall tillage in 2000 with continuous cotton, ridge-tillage (no fall tillage) had 57% ground residue cover compared to 29% for fall paratill-bed-roller and 12% for conventional tillage. This was in contrast to 78, 58, and 23% ground residue cover for ridge-tillage, fall paratill bed-roller and conventional tillage following corn in a rotation, respectively. In continuous cotton on 5/02/02, the fall paratill bed-roller and ridge-tillage treatments had similar ground residue cover (40%) and were higher than all other tillage treatments which had 6 to 24% ground residue cover. In the corn rotation, these treatments had 50 to 68% ground residue cover compared to 11 to 27% for the other treatments.

**COOPERATORS:** None

**PUBLICATIONS:** None

Table 1. Seedcotton yield response to tillage and rotation on a Marietta silt loam soil in 2000 and 2001, Verona, MS.

Rotation/fall tillage	Seedcotton		
	2000	2001	2002
	-----lb/ac-----		
<b>A. Continuous Cotton</b>			
1. Conventional tillage: disk + chisel – harrow + bed + spring rebed + do-all <sup>1</sup> (CT)	2956	2027	2632
2. Disk + bed with rollers + do-all	2770	2343	2646
3. Disk + paratill – bed-rollers + do-all	2922	2204	2845
4. Chisel-harrow + paratill-bed-rollers + do-all	2981	2387	2551
5. Paratill-bed-rollers + do-all	2814	2338	2615
6. Paratill-bed-rollers	2901	1982	2737
7. Ridge-tillage + doall	<u>2675</u>	<u>1958</u>	<u>2528</u>
Mean	2860	2177	2651
<b>Cotton following ridge tillage corn</b>			
8. CT	3258	2179	2683
9. Disk + bed-rollers + do-all	3350	2478	2907
10. Disk + paratill–bed-rollers + do-all	3416	2445	2967
11. Chisel-harrow + paratill-bed-rollers + do-all	3373	2342	3091
12. Paratill-bed-rollers + do-all	3266	2324	2949
13. Paratill-bed-roller	3125	1961	3010
14. Ridge-tillage + doall	<u>3102</u>	<u>2320</u>	<u>2843</u>
Mean	3270	2293	2921
Overall mean	3065	2235	2786
Rot. LSD (0.05)	410	NS	NS
Till LSD (0.05)	NS	228	NS
Rot x Till LSD (0.05)	NS	NS	NS
% CV	6	10	8

<sup>1</sup> Doall applied prior to planting.

Table 2. Ground residue cover on 11/26/01 and 5/02/02 as influenced by rotation and tillage in cotton production systems on a Marietta silt loam soil, Verona, MS.

Rotation/fall tillage	----- Cotton -----		
	Continuous	After corn	Mean
	--- % ground residue cover 11/26/01 <sup>1</sup> ---		
1. Conventional tillage; disk + chisel – harrow + bed + spring rebed + do-all <sup>1</sup> (CT)	12	23	18
2. Disk + bed with rollers + do-all	12	25	19
3. Disk + paratill – bed-rollers + do-all	14	37	26
4. Chisel-harrow + paratill-bed-rollers + do-all	20	38	29
5. Paratill-bed-rollers + do-all	31	56	44
6. Paratill-bed-rollers	29	58	44
7. Ridge-tillage + doall	<u>57</u>	<u>78</u>	<u>68</u>
Mean	25	45	35
Rot LSD.05 = 4			
Till LSD.05 = 6			
Rot x till LSD.05 = NS			
	--- % ground residue cover 5/02/02 <sup>2</sup> ---		
1. Conventional tillage; disk + chisel – harrow + bed + spring rebed + do-all <sup>1</sup> (CT)	6	11	8
2. Disk + bed with rollers + do-all	15	24	20
3. Disk + paratill – bed-rollers + do-all	17	27	22
4. Chisel-harrow + paratill-bed-rollers + do-all	24	27	26
5. Paratill-bed-rollers + do-all	43	50	47
6. Paratill-bed-rollers	40	51	46
7. Ridge-tillage + doall	<u>40</u>	<u>68</u>	<u>54</u>
Mean	26	37	32
WI Rot LSD.05 = 8			
VI Till LSD.05 = 7			

<sup>1</sup> % ground residue 23 days after fall tillage operations.

<sup>2</sup> % ground residue 8 days after burndown application and 14 days before planting.