2004 BELTWIDE COTTON CONFERENCES, SAN ANTONIO, TX – JANUARY 5-9

COTTON REDUCED TILLAGE SYSTEMS ND EFFECT ON COST AND RETURN

Robert Dobbs, Normie Buehring, and Mark Harrison
North Mississippi Research and Extension Center
Mississippi State University
Stan Spurlock and John Black
Department of Agricultural Economics
Mississippi State University

Abstract

Seven tillage systems were evaluated (1999-2002) in continuous cotton and cotton following corn in a rotation system on a Marietta silt loam soil to determine their influence on input costs and net returns for 8 and 12-row production system. Total specified costs and net returns were affected by equipment size. The 8-row system averaged over tillage system, rotation, and years (2000-2002) showed 7% ($37/acre) more total specified cost per acre (included all costs except land, management, and overhead cost) and 35% ($40/acre) lower net returns above total specified costs than the 12-row system. Averaged over years and rotation, conventional tillage and ridge-till had lower total specified cost ($12 to $32/acre) and lower gross returns than all other tillage systems in both 8 and 12-row systems. This resulted in no difference in net returns for all tillage systems. There was a year by rotation interaction effect on net returns in both 8 and 12-row systems. The year 2000 was the only year where rotation net returns were higher than continuous cotton. Both continuous cotton and cotton following corn in rotation had higher net returns in 2000 and 2002 than 2001. The rotation showed $57/acre more net return than continuous cotton for both for both 8 and 12 row systems.

Introduction

In a global economy, cotton growers need to maximize their net return through crop rotation, reduced tillage, and maximized equipment efficiency. Cotton following high residue crops showed increased yield (Buehring et al. 1998; Spurgeon and Grissom 1963; Keeling et al. 1988; Wesley et al. 1993). Reduced tillage systems have shown equivalent or higher yield than conventional tillage (Buehring et al. 1998; Keeling et al. 1988). Ferguson et al. 2003, reported that in addition to equal or higher yields than conventional tillage, no-tillage and reduced tillage systems showed greater profitability. Parvin et al. 2003, concluded that production systems based on wider equipment and fewer trips across the field reduced costs and improved returns. However, limited information is available on the effect reduced tillage and rotation have on costs and returns for 8 and 12-row equipment. The objective of the study was to determine the effect reduced tillage systems in continuous cotton and cotton-corn rotations have on total specified costs and net returns with 8 and 12-row (30-inch) equipment systems.

Materials and Methods

A non-irrigated reduced tillage study was conducted on a Marietta silt loam soil at the North Mississippi Research and Extension Center from 1999 to 2002. The study was conducted as a split plot with rotation as main plot and tillage systems as the subplot treatments with 4 replications. The reduced tillage systems in Table 2 were evaluated in continuous cotton and cotton following ridge-till corn in a 2-year rotation. Duplicate sets of plots were utilized in the rotation so yield data could be acquired each year. Rates of inputs used and operations performed on each treatment were recorded.

All seed cotton from each plot was ginned with a mini-gin (a state of the art small scale cotton gin equivalent to a commercial gin) to determine the percent gin turn out and lint yield. Treatment gross returns were based on gin turn out, lint yield, and the 2001 USDA National Commodity Credit Corporation base loan price of 52.91¢/lb with adjustments for treatment HVI fiber quality (staple length, grade, micronaire, fiber color, strength, and uniformity). The cottonseed gross return was derived from lint yield x 1.54 x $0.05/lb (cottonseed price).

The 8-row and 12-row 30-inch equipment complement budgets for each tillage system were used to simulate a Northeast Mississippi (1200 acre) and a Mississippi Delta (1800 acre) farm. The equipment was sized for each farm. For the Northeast farm, one mechanical front wheel drive (MFWD) 150 draw bar horsepower (DBH) tractor; one MFWD 190 DBH tractor; one 8-row no-till planter; one combine with an 8-row corn-head; one 60-foot boom sprayer; and one 4-row picker were used in analysis. For the Delta farm, one MFWD 170 DBH tractor; one 225-engine horsepower track tractor; one 12-row no-till planter; one combine with an 8-row corn-head; one 60-ft boom sprayer; and one 6-row cotton picker were used in the analysis. Tillage equipment used was sized for the 8 and 12 row systems.

The Mississippi State University Agricultural Economics Department Budget Generator was used to develop cost and return budgets for each tillage treatment (based on yield, gross returns, inputs used and operations performed on each treatment). The basic operations differences were related to tillage operations performed. These budgets [annual and 3-yr (2000, 2001,

2002) average] determined the fixed and direct costs, total specified costs per acre, and return above specified costs per acre for each tillage treatment. Total specified costs and net returns for 8 and 12-row equipment was analyzed with SAS Mixed procedure and means were separated with Fisher Protected LSD calculated at the 5% significance level.

Results and Discussion

Total specified costs were affected by equipment size and tillage system (Tables 1 and 2). The analysis indicated a year by rotation and year by tillage interaction. There was no rotation, rotation by tillage, or year by rotation by tillage interaction for total specified cost for both 8 and 12-row systems. Total 8-row specified cost, averaged over years and rotation, ranged from $519 to $554/acre with a mean of $537/acre (Table 1). The year 2000 was the only year where the rotation costs were higher than continuous cotton. This was due to the increased lint yield which affected ginning costs and the total specified costs. Conventional tillage and ridge-till across all years had similar total specified costs and were $10 to $35/acre less than all other tillage systems. The disk + bed-roller Fb do-all, disk + terratill-bed-roller Fb do-all, and coulter-chisel-harrow + terratill-bed-roller Fb do-all had similar total specified cost which ranged $588 to $599/acre in 2000 and $526 to $539/acre in 2002. The disk + terratill-bed-roller Fb do-all had the highest total specified costs with $599, $525, and $539 in 2000, 2001, and 2002, respectively. The 12-row total specified costs were similar but $37/acre less than the 8-row system, averaged over years and tillage system (Table 2).

Gross returns ranged from $561/acre for conventional tillage to $611/acre for disk + terratill-bed-roller Fb do-all (Table 3). Gross return indicated differences in tillage and a rotation by year interaction. Although cotton after corn, in the rotation increased gross returns by $41 to $119/acre, 2000 was the only year, which showed differences. The 3-year average gross returns for cotton following corn was $619/acre compared too $552/acre for continuous cotton. Ridge-till Fb do-all, conventional tillage, and fall terratill-bed-roller Fb do-all had similar gross returns and were lower than fall disk + bed-roller Fb do-all, fall disk + terratill-bed-roller Fb do-all, fall coulter-chisel-harrow + terratill-bed-roller Fb do-all, and fall terratill-bed-roll Fb do-all.

Analysis indicated that year by rotation was the only factor which had a significant impact on net returns (Table 4). These results are contrary to Ferguson et al. 2003, who reported no-till and reduced tillage showed greater profitability than conventional tillage. Averaged over years and tillage, the rotation showed $57/acre more than continuous cotton. Years 2000 and 2002 showed greater returns than 2001 in both continuous cotton and cotton following corn in a rotation. The year 2000 was the only year where cotton following corn showed higher net returns than continuous cotton in both 8 and 12-row system. The 12-row systems, however, showed $40/acre more return than 8-row systems. These results are in agreement with other research that rotation and wider equipment reduced costs and improved net returns (Parvin et al. 2003).

Acknowledgement

The research was funded in part by the Mississippi Cotton Incorporated State Support Program.

References

Buehring, N.W., G.A. Jones, and R.R. Dobbs. 1998. Cotton response to row spacing, tillage, and crop rotation on two soils. p.154-164. 1997 Annual Report, North Mississippi Research and Extension Center, Information Bulletin 336.

Ferguson, Greg, and John Bradley. 2003. Multi-year evaluation of no-till, low-till and conventional till cotton in Louisiana and Mississippi. p. 534-538. 2003 Proceedings of Beltwide Cotton Conference.

Keeling, J.W., C.W. Wendt, J.R. Gannaway, A.B. Onken, W.M. Lyle, R.I. Lascano, and J.R. Abernathy. 1988. Conservation tillage cropping systems for Texas southern high plains. p.19-21. Proceedings 1988 Southern Conservation Tillage Conference. Special Bulletin 88-1.

Parvin, D.W., S.W. Martin, and F.T. Cooke. 2003. The effect of tillage system, row spacing, equipment size, soil group, and variety type on yields, costs, and returns. Mississippi Delta, 2003 Proceedings of Beltwide Cotton Conference p450-456.

Spurgeon, W.I. and P.H. Grissom. 1963. The influence of cropping systems on soil properties and crop production. MAFES Bulletin 710.

Wesley, Richard A., Dennis Elmore, and Ray Williford. 1993. Effect of crop rotation on yields of cotton, soybean, and sorghum grown in 30-inch conventional and ridge tillage production system, conservation tillage systems for cotton. p.72-75. Arkansas Agricultural Experiment Station, Special Report 160.

Table 1. The 8-row total specified costs for cotton-corn rotation tillage system in 2000-2002.

Rotation/fall tillage system	8-row specified cost 2000	2001	2002	Mean
A. Cotton tillage system	---------- $/acre ----------			
1. Conv.tillage; fall disk + chisel –harrow + bed + spring fld cult+ bed + do-all[1] + 2 cult	571	492	504	522
2. Disk + bed-rollers Fb do-all	588	521	526	545
3. Disk + terratill–bed-rollers Fb do-all	599	525	539	554
4. Coulter-chisel-harrow + terratill-bed-rollers Fb do-all	597	529	537	554
5. Terratill-bed-rollers Fb do-all	589	520	530	546
6. Terratill-bed-rollers	578	497	527	534
7. Ridge-till Fb do-all + 2 cult.	568	486	504	519
Mean				537
WI year LSD.05: 8				
WI tillage system LSD.05: 9				
B. Rotation system				
Continuous cotton	576	508	519	
Cotton after corn	592	513	527	
WI year LSD.05: 10				
Across year LSD.05: 5				

[1] Do-all prior to planting.

Table 2. The 12-row total specified costs for cotton-corn rotation tillage system in 2000-2002.

Rotation/fall tillage system	12-row specified cost $/acre 2000	2001	2002	Mean
A. Cotton tillage system	---------- $/acre ----------			
1. Conv. tillage; disk + chisel–harrow + bed + spring fld cult + bed + do-all[1] + 2 cult	526	452	467	482
2. Disk + bed-rollers Fb do-all	548	487	491	509
3. Disk + terratill–bed-rollers Fb do-all	554	486	501	514
4. Coulter-chisel-harrow + terratill-bed-rollers Fb do-all	550	489	497	512
5. Terratill-bed-rollers Fb do-all	544	482	492	506
6. Terratill-bed-rollers	534	460	489	494
7. Ridge-till Fb do-all + 2 cult.	526	451	473	483
Mean				500
WI year LSD.05: 8				
Across year LSD.05: 9				
B. Rotation system				
Continuous cotton	532	470	483	
Cotton after corn	548	475	491	
WI year LSD.05: 10				
Across year LSD.05: 5				

[1] Do-all applied prior to planting.

Table 3. Cotton gross returns in a cotton-corn rotation tillage system (2000-2002).

Rotation/fall tillage system	$/acre[1]
A. Cotton tillage system	
1. Conv. tillage; disk + chisel–harrow + bed + spring fld cult + bed + do-all[2] + 2 cult	561
2. Disk + bed-rollers Fb do-all	608
3. Disk + terratill–bed-rollers Fb do-all	611
4. Coulter-chisel-harrow + terratill-bed-rollers Fb do-all	605
5. Terratill-bed-rollers Fb do-all	594
6. Terratill-bed-rollers	556
7. Ridge-till Fb do-all + 2 cult	563
Tillage LSD.05: 29	

B. Rotation system	2000	2001	2002	Mean
	----------	$/acre	----------	
Continuous cotton	636	486	533	552
Cotton after corn	755	527	574	619
Across rotation LSD.05: 58				
WI rotation LSD.05: 31				

[1] Averaged over rotation system and years (2000-2002).
[2] Do-all applied prior to planting.

Table 4. The 8 and 12-row equipment net returns in 2000-2002.

Rotation/system	2000	2001	2002	Mean
	--- 8-row net returns $/acre --			
Continuous cotton	60	-22	14	17
Cotton after corn	163	14	46	74
WI rotation LSD.05: 27				
Across rotation LSD.05: 49				
	-- 12-row net returns $/acre --			
Continuous cotton	104	16	50	57
Cotton after corn	207	52	83	114
	156	34	67	
WI rotation LSD.05: 27				
Across rotation LSD.05: 49				