

# Conventional and Glyphosate-Resistant Cotton-Corn Rotation under Reduced Tillage: Impact on Soil Properties, Weed Control, and Yield



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## INTRODUCTION

Historically, cotton has been grown in monoculture under conventional tillage system in the lower Mississippi Delta region. Profit margins in cotton production have declined in recent years due to high production costs, low commodity prices, and stagnant yields. There is a need to find profitable crop production systems that increase crop yields without greatly increasing production costs. There has been a renewed interest in producing cotton in a rotation system to overcome chemical and biological factors associated with a yield plateau that occur in cotton monoculture. When crops are rotated, the change in herbicides and practices may often improve control of problem weeds, soil properties, and crop yields. Reduced tillage system minimize input cost due to fewer tillage operations. Transgenic crops resistant to glyphosate introduced during the past decade have provided farmers flexibility to manage weeds and freedom to choose a rotational crop for the following year without restrictions. This study examines cotton and corn production in a rotation under a reduced tillage system.

## OBJECTIVES

To study the effects of rotating cotton with corn using conventional (non-GR) and glyphosate-resistant (GR) cultivars under reduced tillage on soil properties, weed control, and yield.

## MATERIALS AND METHODS

Location: USDA-ARS Southern Weed Science Research farm, Stoneville, MS.

Soil: Dundee silt loam.

Years: 2000, 2001, 2002, 2003, 2004, 2005.

Tillage: 1999 fall – subsoil, disking, and bedding.

Subsequent years – only re-bedding after harvest.

Row spacing: 102 cm, 8 rows/plot.

Production practices: Table 1.

Treatments: Table 2.

One set for glyphosate-Resistant (GR) cultivar.

One set for conventional (non-GR) cultivar.

Crops irrigated as needed.

Plot size: 45.7 m long and 8.2 m wide.

Design: Randomized Complete Block Design with 4 replications.

Data: Soil analysis at planting; weed control at 2 wk after LPOST, cotton and corn yield.

Table 1. Production practices for cotton and corn in 2000-2005.

Production practices	Cotton		Corn	
	GR cultivar	Non-GR cultivar	GR cultivar	Non-GR cultivar
<b>Variety</b>	DP 436RR DP 444BG/RR DP 434RR	Stoneville 474 Sure-Grow 747 DP 493	AG RX 738RR AG RX740RR DKC69-72RR DKC69-71RR2/	Pioneer 3223
<b>Planting date</b>	18 April to 11 May		22 March to 7 April	
<b>PRE (at planting)</b>	Fluometuron + Metolachlor OR Pendimethalin		None	Atrazine + Metolachlor
<b>EPOST (3-4 wk after planting)</b>	Glyphosate	Pyriithiobac fb Sethoxydim OR Fluazifop	Glyphosate	None
<b>Post-directed (5-9 wk after planting)</b>	Glyphosate	Fluometuron + MSMA fb Diuron + Linuron	Glyphosate	Atrazine + Metolachlor + Carfentrazone OR Bentazon
<b>Harvest date</b>	19 to 23 September		10 to 28 August	

## RESULTS

Table 2. pH and organic carbon in soil from 0-5 cm depth in conventional cotton-corn rotation systems in 2000 (1<sup>st</sup> yr) and 2005 (6<sup>th</sup> yr)

Crop rotation system	2000		2005	
	Soil pH			
Cot-Cot-Cot-Cot-Cot-Cot	6.63 b	6.76 a		
Corn-Corn-Corn-Corn-Corn-Corn	6.65 b	5.97 a		
Cot-Corn-Cot-Corn-Cot-Corn	6.75 ab	6.36 a		
Corn-Cot-Corn-Cot-Corn-Cot	6.83 a	6.65 a		
Crop rotation system	2000		2005	
	Soil Organic carbon (%)			
Cot-Cot-Cot-Cot-Cot-Cot	0.57 a	1.21 b		
Corn-Corn-Corn-Corn-Corn-Corn	0.57 a	1.28 a		
Cot-Corn-Cot-Corn-Cot-Corn	0.58 a	1.30 a		
Corn-Cot-Corn-Cot-Corn-Cot	0.67 a	1.27 a		

Note: Means within a column followed by the same letter are not significant at the 5% level as determined by Fisher's protected LSD test.



Cotton-corn study – general view in 2003

## CONCLUSIONS

- After 6 years, soil organic carbon was higher in corn grown continuously or in rotation; however, soil pH was similar in all rotation systems.
- Control of most weed species was ≥93% in both cotton and corn, regardless of rotation and herbicide program (data not shown).
- Control of browntop millet and hyssop spurge slightly reduced (83 to 85%) in rotated non-GR cotton after 6 years.
- Control of yellow nutsedge was reduced in continuous non-GR cotton and this shift can be delayed by rotating with corn.
- Cotton yield increased every year following rotation with corn by 10 to 32% in non-GR and by 14 to 19% in GR cotton compared to continuous cotton.
- Corn yield increased by 5 to 13% in non-GR and by 1 to 11% in GR corn when rotated with cotton.
- This 6-yr study under reduced tillage demonstrated that a switch to cotton-corn rotation system is agronomically feasible, economically beneficial, and a potentially sustainable option for farmers in the lower Mississippi delta region.

Table 3. Weed control at 2 weeks after last postemergence herbicide application in cotton-corn rotation systems at Stoneville, MS.

Crop	Cultivar type	Rotation system	Browntop millet		Hyssop spurge		Yellow nutsedge	
			2000	2005	2000	2005	2000	2005
Cotton	Non-GR	Continuous	100 a	93 ab	96 ab	98 a	93 a	55 c
		Rotation	100 a	85 b	93 bc	83 b	93 a	73 b
	GR	Continuous	100 a	100 a	91 c	100 a	95 a	98 a
		Rotation	100 a	98 a	95 bc	98 a	93 a	95 a
Corn	Non-GR	Continuous	100 a	100 a	100 a	100 a	94 a	85 ab
		Rotation	100 a	100 a	100 a	100 a	95 a	88 ab
	GR	Continuous	100 a	100 a	100 a	100 a	98 a	100 a
		Rotation	100 a	100 a	100 a	100 a	90 a	100 a

Note: Means within a column followed by the same letter are not significant at the 5% level as determined by Fisher's protected LSD test.

Table 4. Cotton yield as affected by rotation with corn at Stoneville, MS in 2000 - 2005.

Cultivar type/ Rotation system	Seed Cotton					
	2000	2001	2002	2003	2004	2005
	----- kg/ha -----					
<b>Conventional cultivar</b>						
Continuous	1,960 a	2,440 b	2,320 a	2,500 c	2,500 bc	1,970 d
Rotation	2,180 a	2,690 ab	2,870 a	3,310 ab	2,870 a	2,280 c
<b>Glyphosate-Resistant cultivar</b>						
Continuous	2,130 a	2,410 b	2,140 a	3,010 bc	2,380 c	2,940 b
Rotation	2,200 a	2,870 a	2,440 a	3,600 a	2,730 ab	3,380 a

Note: Means within a column followed by the same letter are not significant at the 5% level as determined by Fisher's protected LSD test.

Table 5. Corn yield as affected by rotation with cotton at Stoneville, MS in 2000 - 2005.

Cultivar type/ Rotation system	Corn Yield					
	2000	2001	2002	2003	2004	2005
	----- kg/ha -----					
<b>Conventional cultivar</b>						
Continuous	12,360 a	13,590 a	10,240 bc	10,440 a	9,500 d	9,310 a
Rotation	12,550 a	15,200 a	11,190 a	10,960 a	10,760 b	10,080 a
<b>Glyphosate-Resistant cultivar</b>						
Continuous	11,150 b	12,220 c	9,770 c	11,450 a	10,370 c	9,120 a
Rotation	11,300 b	12,880 bc	10,380 b	11,610 a	11,470 a	9,350 a

Note: Means within a column followed by the same letter are not significant at the 5% level as determined by Fisher's protected LSD test.