CONSERVATION TILLAGE FIELD COMPARISONS FOR 18 SITES IN SOUTH TEXAS

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Abstract

Adoption of conservation tillage for cotton production in South Texas has increased dramatically over the past few years but there are still many producers unaware of the benefits. The climatic conditions and soil types of South Texas are quite different from the Southeast United States where other producers have been successful with conservation tillage cotton. A greater knowledge of the benefits and risks of conservation tillage practices under a subtropical, semi-arid environment can help producers better evaluate tillage practices as a component of their farming operation. The objectives of this study were to compare the effects between conventional moldboard tillage and conservation tillage on cotton yields, production costs and net returns. Economics of cotton production and lint yields as affected by tillage in a semi-arid, subtropical environment, were examined over a three year period on eighteen different producer fields. Six producer fields in 1997, five fields in 1998, and seven fields in 1999 were split and one-half of each was farmed using conventional tillage practices and one-half of each field was farmed using conservation tillage practices. Seeding rate, fertilizer, irrigation, insect management, and other production factors were the same for both tillage systems. Average cotton lint yields in the conservation tillage fields in 1997, 1998, and 1999 were 137, 87, and 110 pounds greater than in the conventional tillage fields. In 1997 five of the six sites had equivalent or greater yields, four of five fields examined in 1998 had equivalent or greater yields, and in 1999 six of seven fields had equivalent or greater lint yields when conservation tillage was compared to conventional moldboard tillage. Production costs were $55-65/acre less in the conservation tillage fields and net returns averaged $129, $118, and $70/acre more with conservation tillage in 1997, 1998, and 1999 compared with the conventional tillage methods. Results of this three year study apply to cotton following grain sorghum. Conservation tillage cotton was produced with lower input costs and had equal or greater economic returns than the conventional moldboard plow tillage system.

Introduction

An obstacle to cotton production with conservation tillage has been the lack of information available to producers on relative yield data and economics of using conservation tillage for South Texas compared with conventional tillage. Traditionally producers use the moldboard plow and disk tillage system to destroy crop residue from the previous crop and to prepare a seedbed for the next crop. The moldboard plow was the most common method used to destroy post-harvest cotton stalks which can serve as food source for boll weevil populations which overwinter in South Texas. Conservation tillage production practices leave most of the previous crop residue on the soil surface to provide a mulch for the soil, increase water infiltration rates into the soil, and decrease wind and water erosion. Even with these apparent benefits many producers are reluctant to adopt these practices due to a lack of knowledge of the risks and economic benefits for cotton production. The objectives of this study were to compare the effects of conventional tillage and conservation tillage on cotton yields and production costs. Results from these studies will be used to provide farmers with guidelines for implementing conservation tillage.

Materials and Methods

Cotton lint yield and production economics as affected by tillage in a semi-arid subtropical environment were examined. Six cotton producer fields in 1997, five fields in 1998, and seven fields in 1999 were split into halves. One-half of each field was farmed using conventional tillage practices and the other half was farmed using conservation tillage practices. Field size was from 18 to 30 acres. The previous crop from all fields was grain sorghum. Following harvest of the grain sorghum in June, the crop was terminated with an over the top application of glyphosate (Roundup) or shredded, allowing grain sorghum regrowth to occur and then applying glyphosate to the actively growing plants. A burndown application of glyphosate was applied prior to planting cotton in the spring for each conservation tillage field. Three of the producers each year used a sweep to define a larger water furrow between crop rows prior to planting while the other conservation tillage fields had no tillage prior to planting. Most of the fields with conventional tillage used the following tillage management: shred the grain sorghum residue, heavy tandem disc, moldboard plow, tandem disc at least twice, form beds, and shape beds. Additional cultivation of crop beds were made from 2 to 4 times to control weeds during the fall, winter, and prior to planting the cotton in the early spring. Two of the conventional tillage fields used a deep chisel instead of a moldboard plow in 1998 and 1999 but all other field operations were similar. Seeding rate, fertilizer, irrigation and other production factors were the same for each paired tillage treatment.

Cotton lint yield was calculated by either machine harvesting the entire area from each one-half of the field for each tillage system and weighing the entire volume of lint after ginning or hand harvesting six representative sub-sample sites each six rows wide by four meters long in fields which had such a low

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yield that mechanical harvest would not be economical (three fields in 1998).

Production costs from harvesting the previous crop until crop emergence of the cotton for both tillage systems for 1997-1999 are presented in Table 1. The costs for the conventional moldboard tillage include shredding stalks, discing, moldboard plowing or chiseling, at least two passes with a tandem disc, forming and shaping beds, cultivating weeds from the time beds were formed in the fall until planting in March of the next year, as weeds germinate all winter in a sub-tropical environment, application of pre-plant fertilizer, herbicide, seed, and planting costs. The costs for the conservation tillage included shredding stalks, pulling stalks, two or three applications of herbicide (glyphosate) during the fall and winter to control weeds, application of pre-plant fertilizer, herbicide, seed, and planting costs.

Total production costs included fertilizer, irrigation water and labor charges, post-planting cultivation and chemical weed control, insect control, defoliation, harvest, and associated ginning costs. Net returns were calculated by subtracting the total production and harvest costs, ginning, bags, ties, receiving and storage costs from the gross returns and an average $80/acre land use fee. No costs were included for interest on money borrowed.

Results and Discussion

Average cotton lint yields in 1997, 1998, and 1999 in the conservation tillage fields were 137, 87, 110 pounds/acre more than in the conventional tillage fields (Table 1). In 1997, four of the sites had yields of up to 39% more lint in the conservation tillage fields, one site was equal and one site had a 3% lower yield with the conservation tillage. In 1998 two fields did not differ between tillage treatments and three fields had up to 53% more lint in the conservation tillage side of the field. In 1999 three of seven conservation tillage fields had more lint, three were not substantially different, and one had a lower yield than the conventional moldboard tillage system. This greater yield in all years from the conservation tillage treatment was likely due to the moisture retention and decreased evaporation under the heavy crop residue mulch.

Production costs, averaged over fields and years for cotton up to seedling emergence time, was $46/acre less in the conservation tillage fields (Table 2) than the conventional moldboard tillage fields. Reduced production costs were primarily a result of fewer trips over the field and using herbicides to manage weeds instead of mechanical tillage. Gross returns for seed and lint were higher in the conservation tillage fields due to greater average yields for both years compared with the conventional moldboard tillage methods.

Conservation tillage net returns (Table 3) in 1997, 1998, and 1999 were $129 , $118, and $70/acre, respectively, more than the conventional moldboard tillage fields. Greater net returns in the conservation tillage fields were a result of lower production costs and higher yields on average when compared with the conventional moldboard tillage fields. Even when yields were about the same or slightly less in the conservation tillage fields, net returns were higher due to reduced production input costs. Results of this three year study indicate that conservation tillage can be a more profitable alternative to the conventional moldboard plow and disc tillage systems traditionally used in the Lower Rio Grande Valley of Texas. Future studies will continue to compare tillage systems over years and locations.

Table 1. Cotton lint yields in 1997-99 for 18 moldboard plowed fields compared with 18 adjacent conservation tillage fields. Paired plot comparisons were used and within a field number if a value is followed by an asterisk the tillage treatment is significantly different from the adjoining tillage treatment within the same field site.

Year	Field number	Conventional Tillage lbs/acre	Conservation Tillage lbs/acre
1997	1	740	966*
	2	711	796*
	3	600	540
	4	505	520
	5	720	993*
	6	720	1001*
1998	7	510	605
	8	623	521
	9	48	158*
	10	222	416*
	11	119	253*
1999	12	282	588*
	13	616	718*
	14	797	874
	15	820	964*
	16	931*	753
	17	899	963
	18	862	884
Average		585	695

Table2. Cotton production costs per acre from harvest of the previous crop to planting of the cotton crop with seed and pre-emergence herbicide costs included.

Year	Field number	Conventional Tillage dollars/acre	Conservation Tillage dollars/acre
1997	1	$101	$53
	2	$119	$41
	3	$113	$41
	4	$ 88	$39
	5	$ 88	$45
	6	$101	$53
1998	7	$127	$80
	8	$127	$80
	9	$101	$55
	10	$100	$55
	11	$122	$70
1999	12	$101	$57
	13	$119	$72
	14	$113	$72
	15	$ 88	$72
	16	$ 88	$59
	17	$101	$59
	18	$113	$72
Average		$106	$60

Table 3. Net returns for conventional moldboard plow system and conservation tillage cotton production system during 1997 using a standard of $80/acre for land usage, $0.1223/lb for cotton harvest, ginning, bag, tie, rec.,and storage and $ 0.68 for cotton in 1997 and 1998 and $0.52 in 1999.

		---------- Net Returns/acre ----------		
	Field number	Conventional	Conservation Tillage	Difference
1997	1	$ 225	$ 398	$ 173
	2	$ 190	$ 316	$ 126
	3	$ 135	$ 174	$ 39
	4	$ 107	$ 165	$ 58
	5	$ 239	$ 421	$ 182
	6	$ 218	$ 418	$ 200
1998	7	$(-133)	$ (-8)	$ 125
	8	$ (-69)	$ (-34)	$ 35
	9	$(-226)	$ (-92)	$ 134
	10	$ (-99)	$ 69	$ 30
	11	$(-213)	$(-83)	$ 130
1999	12	$(-180)	$ 16	$ 196
	13	$ (- 65)	$ 22	$ 87
	14	$ 24	$ 95	$ 71
	15	$ 58	$ 131	$ 73
	16	$ 102	$ 59	$(- 53)
	17	$ 66	$ 133	$ 67
	18	$ 39	$ 89	$ 50
avg.		$ 23	$ 120	$ 97