ECONOMIC ANALYSIS OF CONSERVATION TILLAGE ON PRODUCER FIELDS

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Abstract

Adoption of conservation tillage for cotton production in South Texas has been slow. 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 producers will help producers make better decision regarding tillage practices. Objectives of this study were to 1) compare the effects of conventional moldboard tillage and conservation tillage on cotton yields and production costs, and 2) provide farmers with guidelines for implementing conservation tillage. Economics of cotton production and lint yields as affected by tillage in a semi-arid, subtropical environment were examined. Six producer fields in 1997 and five fields in 1998 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 1997 and 1998 were 137 and 87 pounds respectively, greater in the conservation tillage than in the conventional moldboard tillage fields. In 1997 five of the six sites had equivalent or greater yields and in 1998 four of five fields examined had equivalent or greater yields under conservation tillage when compared to conventional moldboard tillage. Production costs were $55-65/acre less and net returns in 1997 and 1998 averaged $129 and $118/acre more compared with the conventional tillage methods. Results of this two 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 in South Texas 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. Objectives of this study were to 1) compare the effects of conventional tillage and conservation tillage on cotton yields and production costs, and 2) 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 and five fields in 1998 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. 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 in the conservation tillage system 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.

Four of the fields with conventional tillage had the following tillage treatments: 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 but all other field operations were the same. Seeding rate, fertilizer, irrigation and other production factors were the same for both tillage systems.

Cotton lint yield was calculated by either 1) machine harvesting each one-half of the field for each tillage system and weighing the volume of lint after ginning or 2) hand harvesting six representative samples each six rows wide by four meters long in fields. The latter was done in fields which had such a low yield that mechanical harvest was not economical (three fields in 1998).

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Production costs from harvesting the previous crop until crop emergence of the cotton for both tillage systems for 1997 and 1998 are presented in Tables 3 and 4. 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 (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 tillage, 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 $85/acre land use fee. No costs were included for interest on money used.

Results and Discussion

Average cotton lint yields in 1997 and 1998 (Tables 1 and 2) in the conservation tillage fields were 137 and 87 pounds/acre more than in the conventional tillage fields. 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. This yield difference in 1998 was likely due to increased moisture retention and decreased evaporation under the heavy crop residue mulch in the conservation tillage treatment.

Production costs averaged over fields and years for cotton up to seedling emergence time was $52/acre less in the conservation tillage fields (Tables 3 and 4) than the conventional moldboard tillage fields. This reduced production cost was primarily a result of fewer trips over the field and using herbicides to manage weeds instead of mechanical tillage. Average gross returns for seed and lint was 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 (Tables 5 and 6) in 1997 and 1998 were $129 and $118/acre more than the conventional moldboard tillage fields. Greater net returns in the conservation tillage fields were a result of lower production costs and higher average yields when compared with the conventional moldboard tillage fields. Even when yields were about the same or slightly less in the conservation tillage fields, the net returns were higher due to reduced production input costs. Results of this two year study indicate that conservation tillage is an economical alternative to the conventional moldboard plow and disc tillage systems traditionally used in the Lower Rio Grande Valley of Texas. These studies will be continued to compare tillage systems over several years.

Table 1. Cameron County cotton lint yields in 1997 for six conventional moldboard plow fields compared with six conservation tillage fields located next to each conventional field.

Field number	Conventional lbs/acre	Conservation Tillage lbs/acre
1	740	966*
2	711	796*
3	600	540
4	505	520
5	720	993*
6	720	1001*
Average	666	803

Table 2. Cameron County cotton lint yields in 1998 for five conventional moldboard plow compared with five conservation tillage fields located next to each conventional field.

Field number	Conventional lbs/acre	Conservation Tillage lbs/acre
1	510	605
2	623	521
3	48	158*
4	222	416*
5	119	253*
Average	304	391

Table 3. Cameron County 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 in 1997.

Field number	Conventional dollars/acre	Conservation Tillage dollars/acre
1	$101	$ 53
2	$119	$ 41
3	$113	$ 41
4	$ 88	$ 39
5	$ 78	$ 45
6	$101	$ 53
Average	$100	$ 45

Table 4. Cameron County cotton production costs per acre from harvest of the previous crop to planting of the cotton crop with seed pre-emergence herbicide costs included in 1998.

Field number	Conventional dollars/acre	Conservation Tillage dollars/acre
1	$ 127	$ 80
2	$ 127	$ 80
3	$ 101	$ 55
4	$ 100	$ 55
5	$ 122	$ 70
Average	$ 116	$ 68

Table 5. Net returns for conventional moldboard plow system and conservation tillage cotton production system in Cameron County during 1997.

Field number	Net Returns/acre		
	Conventional	Conservation Tillage	Difference
1	$ 225	$ 398	$ 173
2	$ 190	$ 316	$ 126
3	$ 135	$ 174	$ 39
4	$ 107	$ 165	$ 58
5	$ 239	$ 421	$ 182
6	$ 218	$ 418	$ 200
Average	$ 186	$ 315	$129

Table 6. Net returns for 1998 conventional moldboard plow system and conservation tillage cotton production system in Cameron County during 1998.

Field number	Net Returns/acre		
	Conventional	Conservation Tillage	Difference
1	$(-133)	$(-8)	$125
2	$(-69)	$(-34)	$ 35
3	$(-226)	$(-92)	$134
4	$(-99)	$ 69	$ 30
5	$(-213)	$(-83)	$130
Average	$(-148)	$(-30)	$118