CONSERVATION TILLAGE WITH ROUNDUP CAN DECREASE COTTON PRODUCTION COSTS

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Abstract

The release of Roundup® resistant cotton has opened new options for producers to manage post-emergence weed problems, choices which were unavailable under conventional production systems. Producers are concerned with the high costs of the new technology and whether or not the economic returns are worth the risk of adopting the new technology of using Roundup resistant cotton. Objectives of the study were to compare six weed management treatments over a three year period for effects on cotton lint yields and production economics. The same seed (Variety Paymaster 1220 RR) was used for all treatments, but the additional seed costs and technology fee were charged only to the treatments which included postemergence Roundup in the weed management program. Two of the treatments included conventional tillage, pre-emergence herbicides, with and without post emergence herbicides, and mechanical cultivation during the growing season. Two treatments were no-tillage, with and without pre-emergence treatments, and Roundup. Two treatments were no-tillage and included postemergence Roundup with and without a pre-emergence herbicide. Average lint yields ranged from 471 lbs/acre to 581 lbs/acre, but were not statistically different among treatments. The lowest net returns over the three year period were $110/acre with a pre-plant, burndown no-tillage cotton production using one pre-emergence and two post-emergence herbicides combined with mechanical cultivation during the crop growth period. The greatest net returns of $200/acre were with no-tillage using pre-emergence application of Prowl, Roundup post-emergence broadcast at the four leaf stage of cotton and later in the season applied with a hooded sprayer. Net returns using this no-tillage technology system were $87/acre greater than the conventional tillage treatment of moldboard tillage, using a pre-emergence application of pendimethalin, post-emergence application of fluazifop, plus mechanical cultivation twice during the growing season. Additional costs of resistant seed and technology fee for using the Roundup resistant cotton were more than offset by reductions in trips over the field and superior weed control while achieving similar lint yields.

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 with Roundup resistant cotton technology for South Texas compared with conventional tillage. Traditionally, producers in the area use a moldboard plow and disc tillage system, incorporate a yellow herbicide into the soil prior to planting and rely on post-emergence herbicides and mechanical cultivation to control weeds during the growing season. Conservation tillage without Roundup resistant cotton can be successful, however, the incorporation of pre-emergence herbicide can be troublesome in high crop residue conditions. Post-emergence cotton herbicides such as fluazifop (Fusilade DX) or pyrithiobac (Staple) are expensive and late season weed control may not eliminate yield loss due to early season weed competition. Conservation tillage production practices leaves 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 of using conservation tillage, many producers are reluctant to adopt these practices due to lack of knowledge of the risks and economic benefits of using conservation tillage and Roundup resistant cotton technology. Objectives of this study were to 1) compare cotton yields and production economics of conventional tillage systems to that of conservation tillage plus Roundup resistant technology, and 2) develop guidelines for implementing conservation tillage in combination with herbicide resistant technology.

Materials and Methods

Cotton lint yield and production economics as affected by tillage in a semi-arid subtropical environment were examined. Six weed management treatments were examined over a three year period. The experiment was a randomized complete block design with four replications of each treatment for each of the three years. Plot size was 12-30 inch wide rows, except in 1998 where it was six rows wide, by 60 feet long.

Tillage operations and associated costs are described in Table 1. Treatments 1 and 2 consisted of conventional tillage prior to planting which included the following tillage treatment: shred the grain sorghum residue, heavy tandem disc, moldboard plow, tandem disc at least twice, form beds, and shape beds. Additional cultivations of crop beds were made 4 times to control weeds during the fall, winter, and prior to planting the cotton in the early spring. Treatment 1 was conventional tillage and also had a pre-emergence application of 1.3 lb/ac pendimethalin (Prowl). The second treatment was similar to treatment 1 but a post-emergence application of fluazifop (Fusilade DX) was also applied for grass control at four ounces/acre. Treatments 3 and 4 were planted using no-tillage and both had a pre-plant burndown application of glyphosate applied at 1.5 pints/ac. Treatment 3 also had fluazifop (Fusilade DX) applied at four ounces/ac plus pyrithiobac (Staple) applied at 1.2 ounces of product/ac. Treatment 4 was similar to treatment 3 but an additional pre-emergence application of pendimethalin

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(Prowl) was applied at 1.3 lb/ac plus two mechanical cultivations. Treatments 5 and 6 were also no-tillage but a pre-plant burndown application was not used. Both treatments 5 and 6 had a postemergence application of glyphosate (Roundup Ultra) applied at 1 pint/ac to 4 leaf stage cotton plus a later application of glyphosate (Roundup Ultra) applied at 1 pint/ac applied in a hooded sprayer to control mid/late season weeds. Treatment 6 also had pendimethalin (Prowl) applied at 1.3 lb/ac pre-emergence.

The same cotton variety (Paymaster 1220RR) was planted for all treatments all three years but the technology fee as well as an additional $2/acre seed cost were assessed only to treatments 5 and 6 in the economic analysis because these were the only treatments which used glyphosate (Roundup Ultra) postemergence to the cotton crop. The same insecticide applications, irrigation, and fertilization amounts and techniques were used for all treatments for each of the three years of the study.

Cotton lint yield (Table 2) was calculated by hand harvesting a sample from each plot six rows wide by four meters long. Cotton was ginned and weight of lint from each plot was determined. Total production costs (Table 3) were calculated by adding the costs of tillage passes, herbicide and insecticide costs plus application charges, irrigation, fertilizer, land usage, seed and planting costs, and a technology fee of $9.00/acre for treatments 5 and 6.

Net returns (Table 4) were calculated by subtracting the total production and harvest costs, ginning, bags, ties, receiving and storage costs, and an average $85/acre land use fee from the gross returns. No costs were included for interest on money used.

Results and Discussion

Yields averaged over three years ranged from 471 lbs lint/acre to 581 lbs lint/ac but were not statistically different (Table 2). The conventional tillage treatments (1 and 2) had the highest average production costs/acre (Table 3) of $255 and $269/ac. The no-tillage plus Roundup Ultra (Roundup resistant technology) had the lowest average production costs/acre (treatments 5 and 6) of $188 and $193/acre. Using no-tillage without the Roundup resistant technology did not increase net returns over conventional tillage (treatments 3 or 4 no-till -vs- treatments 1 or 2). The no-tillage treatments which included Roundup resistant cotton technology had the greatest average net returns (Table 4) primarily due to the reductions in passes over the field and timely weed control as compared with the conventional tillage treatments. With the very heavy weed pressure in this study using no-tillage in combination with Prowl applied pre-emergence plus Roundup post-emergence as a broadcast over-the-top spray plus Roundup again later in a hooded sprayer did not produce the greatest lint yield but had the greatest net returns over the three years of the study.

Table 1. Description of conventional tillage equipment operations used for weed management treatments one and two.

Tillage operation	Costs/acre
Shred previous crop residue	$ 7
tandem disc	$ 10
moldboard plow	$ 12
2X tandem disc	$ 20
form beds	$ 8
shape beds	$ 7
4X cultivate beds during fall and winter	$ 28
plant	$ 8
seed	$ 15
2X cultivate crop during growing season.	$ 14
	$ 129

Table 2. Average Cotton lint yields for 1996, 1997, and 1998 as affected by tillage and weed control system at Weslaco, Texas.

	treatment number	3 yr avg. lint yield lbs/acre
1	Conventional tillage preemergence application pendimethalin (Prowl) mechanical cultivation 2X	581
2	Conventional tillage preemergence application pendimethalin (Prowl) mechanical cultivation 2X post-emergence fluazifop (Fusilade DX)	538
3	No-tillage preplant burndown glyphosate postemergence fluazifop (Fusilade DX) pyrithiobac (Staple)	471
4	No-tillage preplant burndown glyphosate preemergence pendimethalin (Prowl) postemergence fluazifop (Fusilade DX) pyrithiobac (Staple) mechanical cultivation 2X	448
5	No-tillage broadcast postemergence (4 leaf stage) glyphosate (Roundup Ultra) postemergence hooded application glyphosate (Roundup Ultra)	507
6	No-tillage preemergence pendimethalin (Prowl) broadcast postemergence (4 leaf stage) glyphosate (Roundup Ultra) postemergence hooded application glyphosate (Roundup Ultra)	554

Table 3. Average cotton production cost per acre for 1996, 1997, and 1998 as affected by tillage and weed control system at Weslaco, Texas.

	treatment number	3 yr. avg. production costs/acre
1	Conventional tillage preemergence application pendimethalin (Prowl) mechanical cultivation 2X	255
2	Conventional tillage preemergence application pendimethalin (Prowl) mechanical cultivation 2X postemergence fluazifop (Fusilade DX)	269
3	No-tillage preplant burndown glyphosate postemergence fluazifop (Fusilade DX) pyrithiobac (Staple)	203
4	No-tillage preplant burndown glyphosate preemergence pendimethalin (Prowl) post-emergence fluazifop (Fusilade DX) pyrithiobac (Staple) mechanical cultivation 2X	224
5	No-tillage broadcast postemergence (4 leaf stage) glyphosate (Roundup Ultra) postemergence hooded application glyphosate (Roundup Ultra)	188
6	No-tillage preemergence pendimethalin (Prowl) broadcast postemergence (4 leaf stage) glyphosate (Roundup Ultra) postemergence hooded application glyphosate (Roundup Ultra)	193

Table 4. Average net returns per acre for 1996, 1997, and 1998 as affected by tillage and weed control system at Weslaco, Texas.

	treatment number	3 yr. avg. net returns $/acre
1	Conventional tillage pre-emergence application pendimethalin (Prowl) mechanical cultivation 2X	$ 168
2	Conventional tillage pre-emergence application pendimethalin (Prowl) mechanical cultivation 2X post-emergence fluazifop (Fusilade DX)	$ 113
3	No-tillage pre-plant burndown glyphosate post-emergence fluazifop (Fusilade DX) pyrithiobac (Staple)	$ 131
4	No-tillage pre-plant burndown glyphosate pre-emergence pendimethalin (Prowl) post-emergence fluazifop (Fusilade DX) pyrithiobac (Staple) mechanical cultivation 2X	$ 110
5	No-tillage broadcast postemergence (4 leaf stage) glyphosate (Roundup Ultra) post-emergence hooded application glyphosate (Roundup Ultra)	$ 189
6	No-tillage pre-emergence pendimethalin (Prowl) broadcast postemergence (4 leaf stage) glyphosate (Roundup Ultra) post-emergence hooded application glyphosate (Roundup Ultra)	$ 200