NO-TILLAGE COTTON WEED MANAGEMENT IN CORN AND SORGHUM STUBBLE

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Abstract

Conservation tillage cotton production has increased in recent years in south Texas but a major factor which prevents producers from adopting conservation tillage practices is the perceived lack of adequate weed control systems. A two year study was conducted on both corn and grain sorghum stubble to evaluate weed control in cotton planted without tillage into corn residue which exceeded 10,000 kg ha^{-1} and grain sorghum stubble which exceeded 6,000 kg ha$^{-1.}$ Sixteen weed management treatments were evaluated for crop injury, control of *Amaranthus Palmeri* and *Panicum Texanum.* Single herbicide treatments did not provide acceptable weed control of both broadleaf and grass weed weed species. Several combinations of herbicide provided season long control of weeds and did not adversely cotton lint yield. These cotton herbicide combinations included pendimethalin plus fluometuron, clomazone plus pyrithiobac, pendimethalin plus pyrithiobac, fluometuron plus pytithiobac, and pendimethalin pllus fluometuron plus pyrithiobac.

Introduction

Many producers are using conservation tillage for corn and grain sorghum production in the Rio Grande Valley of Texas but lack of knowledge of cotton herbicide performance in heavy crop residue is a barrier to the widespread adoption of conservation tillage cotton production. The warm subtropical, semiarid climate of south Texas is much different from many other areas in the cotton belt of the United State where conservation tillage is used for cotton production. Crop residue can intercept many herbicides and decrease their soil activity for weed control. Herbicide resistant cotton varieties are available but at this time there is some problem with availability of high yielding varieties which are both herbicide resistant and adapted to the subtropical semi-arid climate. Because incorporation of herbicides generally destroys or buries much of the surface crop residue herbicides wchich have traditionally been incorporated are not generally used in no-tillage practices. The objective of this study was to determine weed management strategies for no-tillage cotton planted into corn and grain sorghum stubble.

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Materials and Methods

Sixteen weed management treatments, each replicated four times were examined for cotton planted with no tillage into corn and grain sorghum stubble over a two year period. Corn crop residue exceeded 10,000 kg ha^{-1} and grain sorghum crop residue exceeded 6,000 kg ha^{-1}. Weed management treatments were applied immediately after planting each year in early March. Postemergence applications of pyrithiobac and fluazifop were applied 16 days after emergence. Cotton variety was Delta Pine and Land Company 50 and was planted in 0.76 m wide rows at the rate of 110,000 seeds ha^{-1} and a plant stand of approximately 100,000 plants ha^{-1} occurred each year. A seed safener insecticide was used with all cotton planted because some plots would receive clomazone as a weed control treatment which requires a seed safener The studies were conducted on a irrigated Hidalgo silty clay loam soil located near Weslaco, Texas. About 150 mm of water was applied twice via furrow irrigation to supplement the 190 mm of rainfall which fell during the growing season (March through July). Primary weeds present were *Palmer Amaranth* L. (AMAPA) and *Panicum Texanum* L. (PANTE). The fields had been overseeded with both weed species the previous year of the study and allowed to produce seed naturally for the year of the study. Infestation levels were high and ranged from 50 to 60 m^2 for AMAPA and 35 to 85 m^2 for PANTE. Cotton was fertilized twice with 56 kg ha^{-1} N applied as a liquid N32 injected into the soil near the plant with a spoke wheel applicator. Fertilizer applications were made 30 and 50 days after planting. Cotton was defoliated 124 and 123 days after planting in 1996 and 1997 respectively and handpick lint samples were collected from each plot approximately 14 days after the defoliation was applied.

Results and Discussion

The soil surface in the corn stubble treatments had approximately 90% cover and the grain sorghum treatments had approximately 70% cover. Lint yields in corn stubble in 1996 (Table 1) when a single herbiciide was used alone were generally about 50% of the lint yields when a combination of two or more herbicides were used. In 1997 more precipitation occurred within the first week after pre-emergence herbicides were applied and most all herbicides adequately control weeds and cotton lint yields in the corn (Table 1) or grain sorghum stubble (Table 2) were almost twice those yields of mechanical cultivation alone. A single herbicide did not effectively control both AMAPA and PANTE in 1996 or 1997 in either the corn stubble or grain stubble fields (Tables 3 and 4). When combinations of two or more herbicides were used AMAPA and PANTE controlled improved and populations of these weed species decreased significantly. Clomazone applied pre-emergence plus a post emergence application of fluazifop controlled the grass PANTE both years in either type of crop residue but in 1997 this combination did a poor job of controlling

AMAPA. This lack of season long control may due to excessive precipitation (short term flooding) which stimulated more weeds to germinate and may enhance the degradation of clomazone or at least decrease the availability of the herbicide for weed control after flooding conditions have occurred. The pre-emergence herbicides clomazone, pendimethalin, and fluometuron all adequately controlled both grass (PANTE) and broadleaf weeds (AMAPA) when used in combination with a postemergence application of pyrithiobac and very little or no crop injury.

We conclude that PANTE and AMAPA weeds in no-tillage cotton planted into heavy corn or grain sorghum crop residue can be sucessfully managed with available combinations of pre-emergence and post-emergence herbicides. Data from other studies have shown that economics favor a reduced tillage system in the semi-arid subtropical environment of south Texas. The use of no-tillage cotton production systems can reduce the incidence of sand blasting of young seedling cotton, reduce water loss to evaporation and runoff when a crop residue mulch is left on the soil surface and wind and water erosion can be greatly reduced by maintaining crop residue on the soil surface.

Table 1. Cotton lint yield response to herbicide and weed control in no-tillage corn stubble greater than 10,000 kg ha $^{-1}$.

treatment	kg a.i.ha^{-1}	------------kg ha^{-1} lint ----------	
		1996	1997
clomazone	1.12	278	670
pendimethalin	1.12	368	728
fluometuron	1.34	293	807
prometryn	1.56	477	745
pyrithiobac	0.07	501	798
clomazone	1.12		
+ pendimethalin	1.12	367	749
clomazone	1.12		
+ fluometuron	1.34	418	739
pendimethalin	1.12		
+ fluometuron	1.34	655	565
clomazone	1.12		
+ fluazifop	0.21	441	713
pendimethalin	1.12		
+ fluazifop	0.21	324	840
pyrithiobac	0.07		
+ fluazifop	0.21	277	869
clomazone	1.12		
+ pyrithiobac	0.07	738	814
pendimethalin	1.12		
+ pyrithiobac	0.07	781	807
fluometuron	1.34		
+ pyrithiobac	0.07	665	863
pendimethalin	1.12		
+ fluometuron	1.34		
+ pyrithiobac	0.07	738	824
no-herbicide,	------		
cultivation 2X	------	112	547
minimum significant difference (P=0.05)		270	247

Table 2. Cotton lint yield response to herbicide and weed control in no-tillage grain sorghum stubble greater than 6,000 kg ha^{-1}.

treatment	kg a.i. ha^{-1}	-----------kg ha^{-1} lint----------	
		1996	1997
clomazone	1.12	330	791
pendimethalin	1.12	360	737
fluometuron	1.34	239	805
prometryn	1.56	167	741
pyrithiobac	0.07	362	802
clomazone	1.12		
+ pendimethalin	1.12	283	762
clomazone	1.12		
+ fluometuron	1.34	417	732
pendimethalin	1.12		
+ fluometuron	1.34	461	760
clomazone	1.12		
+ fluazifop	0.21	351	757
pendimethalin	1.12		
+ fluazifop	0.21	468	864
pyrithiobac	0.07		
+ fluazifop	0.21	674	847
clomazone	1.12		
+ pyrithiobac	0.07	376	743
pendimethalin	1.12		
+ pyrithiobac	0.07	553	678
fluometuron	1.34		
+ pyrithiobac	0.07	523	916
pendimethalin	1.12		
+ fluometuron	1.34		
+ pyrithiobac	0.07	631	888
no-herbicide,	-----		
cultivation 2X	-----	291	420
minimum significant difference (P=0.05)		220	292

Table 3. Palmer amaranth population response 36 days after treatment to weed control treatments in no-tillage corn stubble greater than 10,000 kg ha^{-1}.

treatment	kg a.i.ha^{-1}	-------1996------		--------1997-------	
		AMAPA		AMAPA	
		% control 36 DAP	pop m^2	% control 36 DAP	pop. m^2
clomazone	1.12	84	39	82	51
pendimethalin	1.12	90	19	86	18
fluometuron	1.34	64	38	77	46
prometryn	1.56	84	49	86	34
pyrithiobac	0.07	75	31	86	44
clomazone	1.12				
+ pendimethalin	1.12	91	0	99	10
clomazone	1.12				
+ fluometuron	1.34	88	0	99	13
pendimethalin	1.12				
+ fluometuron	1.34	93	18	96	8
clomazone	1.12				
+ fluazifop	0.21	93	0	98	28
pendimethalin	1.12				
+ fluazifop	0.21	92	0	98	14
pyrithiobac	0.07				
+ fluazifop	0.21	93	0	98	15
clomazone	1.12				
+ pyrithiobac	0.07	94	0	99	5
pendimethalin	1.12				
+ pyrithiobac	0.07	96	0	99	7
fluometuron	1.34				
+ pyrithiobac	0.07	97	1	97	6
pendimethalin	1.12				
+ fluometuron	1.34				
+ pyrithiobac	0.07	97	0	99	2
no-herbicide,	------				
cultivation 2X	------	0	55	0	56
min. sig. difference	(P=0.05)	9	8	5	3

Table 4. Panicum Texanum population response 36 days after treatment to weed control treatments in no-tillage grain sorghum stubble greater than 6,000 kg ha^{-1}.

treatment	kg a.i. ha^{-1}	-------1996-----		--------1997-------	
		PANTE		PANTE	
		% control	pop	% control	pop.
		36 DAP	m^2	36 DAP	m^2
clomazone	1.12	90	13	82	51
pendimethalin	1.12	86	35	86	18
fluometuron	1.34	77	34	77	46
prometryn	1.56	86	62	86	34
pyrithiobac	0.07	25	127	86	44
clomazone	1.12				
+ pendimethalin	1.12	91	6	95	4
clomazone	1.12				
+ fluometuron	1.34	88	24	97	3
pendimethalin	1.12				
+ fluometuron	1.34	93	2	91	10
clomazone	1.12				
+ fluazifop	0.21	93	18	98	1
pendimethalin	1.12				
+ fluazifop	0.21	92	20	98	1
pyrithiobac	0.07				
+ fluazifop	0.21	93	13	93	4
clomazone	1.12				
+ pyrithiobac	0.07	94	33	97	1
pendimethalin	1.12				
+ pyrithiobac	0.07	96	30	96	2
fluometuron	1.34				
+ pyrithiobac	0.07	97	14	89	6
pendimethalin	1.12				
+ fluometuron	1.34				
+ pyrithiobac	0.07	97	8	96	1
no-herbicide,	------				
cultivation 2X	------	0	35	0	84
min. sig. difference (P=0.05)		23	23	4	9