Weed Management in No-Till Cotton Utilizing a Hooded and a Post-Directed Sprayer

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Introduction

No-tillage cotton production continues to increase across the Cotton Belt. Acreage in Tennessee has gone from 85,000 acres in 1992 to 155,000 acres in 1993 (Anonymous, 1993). This is 14 and 24% of the total cotton acreage in the state, respectively. These numbers reflect an increased acceptance by producers and a general shift to no-till production. New practices are typically accepted if they offer advantages over current systems.

Shelton and Mote (1989) found that no-till cotton production reduced soil losses by 2 tons/A when compared to conventional tillage soybeans. Reduction in soil loss is a fundamental advantage of a no-till system. Producers participating in government programs were required by the 1990 Farm Bill to be in compliance with regard to soil erosion on land classified as highly erodible by Jan. 1, 1995. No-till conceivably would enable producers to continue farming land while meeting compliance requirements.

Yields of no-till cotton have been competitive with those of conventional tillage across the Cotton Belt. Bradley (1993) reported no-till cotton averaged 910 lb lint/A versus 894 Ib lint/A in conventional tillage over a 10-year period in Tennessee. In a separate study, Harmon et. al. (1989) found average no-till cotton yields over 4 years to be 41% greater than with conventional tillage in the Texas High Plains. No-till cotton yields were greater than conventional each year of this study.

Weed control systems differ in no-tillage when compared to other tillage systems. Conventional tillage relies on cultivation in addition to herbicides for weed control. This allows producers to band preemergence herbicides over-the-row and cultivate between rows for weed control. Banding of herbicides may be an option in no-till, however cultivation may not be possible or practical. Preemergence broadcast applications afford two disadvantages over banding. Cost is the major factor of consideration. Producers can reduce application cost by half when herbicides are banded (Hudson, 1993).

The second disadvantage is more total herbicide introduction into the environment. Driven by public perception, policies are demanding total usage of herbicides be reduced. Food Systems 2002 is a Canadian research initiative established in 1988, which promotes a reduction in total pesticide usage in Canada 50 percent by the year 2002 (Swanton and Weise, 1989). The United States Department of Agriculture and the Environmental Protection Agency have signed an agreement that will create a program to develop nonchemical pesticides. The goal is to create alternative pest management strategies. This followed announcement by the Clinton Administration to initiate Integrated Pest Management systems on 75% of farm acreage by the year 2000.

The objective of this experiment was to compare herbicide systems for weed control in no-tillage cotton utilizing a hooded and a post-directed sprayer. Systems were evaluated for weed control and cost effectiveness.

Materials and Methods

Preemergence Applications

The experiment was conducted in 1994 on a Loring silt loam soil at Milan, Tennessee. Glyphosate at 1.0 lb ai/A plus 0.5% v/v nonionic surfactant (NIS) was applied on April 18, using a Spra-Coupe sprayer calibrated to deliver 20 gpa. 'Deltapine DPL 5415' cotton seed was planted at 15 lb/A on April 26. Individual plots consisted of four 40-inch rows hand-trimmed to 30 feet in length. Treatments were replicated five times.

Aldicarb insecticide at 0.5 lb ai/A and 0.8 lb ai/A PCNB plus 0.2 lb ai/A etridiazole plus 0.80 lb ai/A disulfoton fungicide was applied into the seed furrow.

Preemergence banded treatments of 0.31 lb ai/A paraquat dichloride plus 1.2 lb ai/A fluometuron plus 0.75 Ib ai/A pendimethalin plus 0.5 % v/v NIS were applied to treatments 1, 2, 3, 4, 5, 6, 7, and 9. Preemergence banded treatments were applied with a tractor-mounted small plot sprayer calibrated to deliver 20 gpa. Band width was 20 inches applied directly over the row. Treatment 8 received a preemergence broadcast application of 0.31 lb ai/A paraquat dichloride plus 1.2 lb ai/A fluometuron plus 0.75 lb ai/A pendimethalin plus 0.5% v/v NIS applied with a tractor-mounted small plot sprayer calibrated to deliver 20 gpa (Table 1).

Cool, wet weather favored seedling disease and contributed to an unacceptable stand. Paraquat dichloride at 0.31 lb ai/A plus 0.5% v/v NIS was applied in 20 gpa to kill existing cotton and other vegetation. 'Chembred CB 1135' was planted on May 12 at a seeding rate of 15 lb/A. Seeds were plant-

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Table 1. Preemergence treatments on no-till cotton.

PRE BAND	20-in. Band*	Paraquat	0.31 lb ai1A
		Fluometuron	1.20 lb ai1A
		Pendimethalin	0.75 lb ai1A
PRE BDCST	Broadcast*	Paraquat	0.31 lb ai1A
		Fluometuron	1.20 lb ai1A
		Pendimethalin	0.75 lb ailA

*Preemergence treatments included .25 % v/v nonionic surfactant.

ed directly into previous rows. Seed furrow applications of fungicide and insecticide were repeated as previously mentioned.

Postemergence Stage I Application

A Custom Ag Products, Inc., Redball™ chemical cultivation spray hood was used for postemergence, hooded applications. The unit consisted of three 28-inch-wide hoods for the three inside row middles and two 20-inch-wide spray hoods for the outside middles. The 28-inch hoods contained 3 nozzles per hood, and 20-inch hoods contained 2 nozzles per hood. Adjustable spray nozzles mounted on the outside, trailing edge of hoods were used for postemergence directed applications. Cone tanks (15 gal) mounted on the sprayer tool bar delivered spray solutions through two power takeoff (PTO) driven six-roller pumps. A post-directed sprayer with two nozzles per row and two nozzles between each row was utilized on treatment 8. This treatment received post-directed applications only.

Postemergence hooded or directed applications were first made on June 7. All applications were made according to cotton growth stages (Table 2). Cotton stage was 2- to 4-leaf, 2- to 4-inches tall. Weed species present were smooth pigweed *(Amaranthus* hybridus) and tumble pigweed *(Amaranthus albus)* at 1 per square foot, 0.5- to 6-inches tall. Treatments 3 and 4 were applied through the hooded sprayer utilizing the hoods and post-directed nozzles simultaneously. Paraquat dichloride at 0.31 lb ai/A plus 0.8 lb ai/A cyanazine plus 0.5% v/v NIS were applied under hoods while 1.0 lb ai/A fluometuron plus 2.0 lb ai/A MSMA were applied under cotton through directed nozzles. Treatment 5 received 0.31 lb ai/A paraquat dichloride under hoods only. Treatment 6 received 0.75 lb ai/A glyphosate under hoods only. Treatment 7 received 0.06 lb ai/A pyrithiobac over-the-top of row in a 20-inch band. In a secondary separate application, 0.75 lb ai/A glyphosate was applied under hoods to treatment 7. Treatment 8 received 1.0 lb ai/A fluometuron plus 2.0 lb ailA MSMA post-directed with the previously described post-directed sprayer.

Postemergence Stage II Application

Second cotton stage postemergence applications were made when cotton was 5- to 6-leaf, 6 to 9 inches tall. Pigweed spp. continued to be the predominant weed present and plants were 2 to 18 inches tall.

Treatments 1 and 2 received their first postemergence applications. Paraquat dichloride at 0.31 lb ai/A was tank mixed with 0.8 lb ai/A cyanazine plus 0.5% v/v NIS and applied under the hoods to treatment 1. A post-directed application of 1.0 lb ai/A prometryn plus 2.0 lb ai/A MSMA was made simultaneously to treatment 1. Treatment 2 received 0.75 lb ai/A glyphosate plus 0.5% v/v NIS under the hoods, while 1.0 lb ai/A prometryn plus 2.0 lb ai/A MSMA were applied through post-directed nozzles.

Table 2. Preemergence and postemergence treatments for weed control in no-till cotton.

Tmt No.	Treatment	Appl. Timing	Appl. Stage in.	Appl. Rate lb ai/A	Pigweed Control %	Lint Yield lb/A	Herbicide Cost $/A
1	PREBAND	Pre	0		78	749	36.00
	Paraquat**	Hooded	6-9	0.31			
	Cynazine	Hooded	6-9	1.00			
	Prometryn	Directed	6-9	1.00			
	MSMA	Directed	6-9	2.00			
2	PREBAND	Pre	0		64	703	36.00
	Glyphosate**	Hooded	6-9	0.75			
	Prometryn	Directed	6-9	1.00			
	MSMA	Directed	6-9	2.00			
3	PREBAND	Pre	0		90	975	40.00
	Paraquat**	Hooded	2-4	0.31			
	Cyanazine	Hooded	2-4	0.80			
	Fluometuron	Directed	2-4	1.00			
	MSMA	Directed	2-4	2.00			
	Paraquat**	Hooded	6-9	0.31			
4	PREBAND	Pre	0		82	923	43.00
	Glyphosate**	Hooded	2-4	0.75			
	Fluometuron	Directed	2-4	1.00			
	MSMA	Directed	2-4	2.00			
	Glyphosate**	Hooded	6-9	0.75			
5	PREBAND	Pre	0		82	890	31.00
	Paraquat**	Hooded	2-4	0.31			
	Paraquat**	Hooded	6-9	0.31			
6	PREBAND	Pre	0		75	797	39.00
	Glyphosate**	Hooded	2-4	0.75			
	Glyphosate**	Hooded	6-9	0.75			
7	PREBAND	Pre	0		61	797	?
	Pyrithiobac**	Banded	2-4	0.06			
	Glyphosate**	Hooded	2-4	0.75			
8	PREBDCST	Pre	0		95	787	68.00
	Fluometuron	Directed	2-4	1.00			
	MSMA	Directed	2-4	2.00			
	Cyanazine	Directed	6-9	0.80			
	MSMA	Directed	6-9	2.00			
9	PREBAND	Pre	0		0	410	25.00*
	Untreated Check						
				LSD (0.05)	18	228	

*The untreated check received a 20-inch preemergence band treatment only.

**Applications included .25% v/v nonionic surfactant (not included in cost analysis).

Treatments 3, 4, 5, 6, and 8 received a postemergence sequential application at the second growth stage. Paraquat dichloride plus NIS were applied under the hoods at 0.31 lb ai/A and 0.5% v/v, respectively, to treatments 3 and 5. Glyphosate at 0.75 lb ai/A plus 0.5% v/v NIS were applied under the hoods to treatments 4 and 6. Cyanazine at 0.8 lb ai/A plus 2.0 lb ai/A MSMA were applied with the post-directed sprayer to treatment 8.

Results and Discussion

Percent pigweed control and lint yields are listed in Table 2. These data were recorded 30 days after the 6- to 9-inch cotton stage applications. All stage 1 and/or stage 2 applications improved pigweed control and cotton lint yield over the pre-band treatment. The standard (treatment 8) broadcast preemergence application followed by two post-directed applications resulted in some of the highest yields. Lint yields with banded preemergence herbicides followed by hooded applications were similar to the standard.

There were notable trends in weed control among treatments without significant differences. Applications of glyphosate and paraquat applied at 6- to 9-inch cotton did not perform as well as sequential treatments. Paraquat alone and tankmixed with cyanazine under the hoods controlled pigweed better than glyphosate alone. Glyphosate under the hoods and a post-directed application in the row improved control over glyphosate applied under the hoods alone. Cotton injury was less than 10 percent for all treatments (data not shown).

A complete cost analysis was not performed for the treatments; however herbicide costs were compared (Table 2). Cost of hooded programs, which included a banded preemergence application, ranged from $31 to $43/A. The post-directed "standard" program, which included a broadcast preemergence application (treatment 8), cost was $68/A. Differences in cost can be attributed to the banded versus broadcast preemergence applications.

Literature Cited

Anonymous. 1993. Tennessee 1993 tillage systems. Tenn. Ag. Stat. Service, Nashville, TN.

Bradley, J.F. 1993. Success with no-till cotton. pp. 46-48. *In* M.R. McClelland, T.D. Valco and R.E. Frans (ed.) Conservation-tillage systems for cotton. Ark. Agric. Exp. Stn. Spec. Rep. 160.

Harmon, W.L., G.J. Michels and A.F. Wiese. 1989. A conservation tillage system for profitable cotton production in the Central Texas High Plains. Agron. J. 81:615-618.

Hudson, E.H. 1993. Economic considerations of no-tillage farming. AE & RD Info. #49, The University of Tennessee Agricultural Extension Service. pp. 24-25.

Shelton, C.H., and C.R. Mote. 1989. Soil erosion and related water quality. Tenn. Farm and Home Sci. 152:26-31.

Swanton, C.J., and S.F. Weise. 1991. Integrated weed management: The rationale and approach. Weed Technol. 5:657-663.