

EVALUATION OF SEEDLING DISEASE CONTROL STRATEGIES FOR COTTON PLANTED IN CONVENTIONAL AND STALE BED TILLAGE SYSTEMS

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Abstract

Selected cotton seedling disease control strategies were compared under stale or conventional bed systems and differing levels of disease pressure in 1997-1999. Increased seedling death occurred where inoculum of *Rhizoctonia solani* and *Pythium ultimum* was added indicating enhanced disease pressure. Selected supplemental fungicides in the form of in-furrow sprays or hopper box materials were most effective in increasing stand and yield under conditions of enhanced disease pressure.

Introduction

In a ten year study, cotton seedling disease was generally more severe under strict no-till than conventional tillage systems (1), especially in earlier plantings. Even under warm and dry soil planting conditions, stand counts and plant vigor were lower in no-till than conventional tillage. Skip indices and disease indices for roots and hypocotyls were higher in no-till and in most years yields were slightly to moderately lower than in conventional tillage. Supplemental fungicides applied in-furrow as granular, spray or hopper-box treatments in no-till situations reduced seedling disease to levels comparable to those in conventional tillage (1). Young (2) reported that after several years of monoculture, cotton seedling and root disease increased under stale bed culture. The objective of these studies was to evaluate selected cotton seedling control strategies under stale and conventional seedbed systems and differing disease pressures.

Materials and Methods

Experiments were conducted on a Marietta fine sandy loam soil on the R. R. Foil Plant Science Research Center at Mississippi State University. Seedling disease control strategies included: 1) a black seed control, 2) commercial treated seed (CTS), 3) CTS supplemented with Terraclor Super X 2E® (TSX) at 2 qt/A in-furrow, 4) CTS supplemented with TSX at 3 qt/A in-furrow, 5) CTS supplemented with Prevail HB® (PHB) at 8 oz/cwt, and 6) CTS supplemented with PHB at 16 oz/cwt. CTS were coated with fungicides tridimenol at 1 oz/cwt, thiram at 2 oz/cwt and metalaxyl at 0.75 oz/cwt. A common lot of DP 51 seed was

used each year of the three year study. Control strategies were applied to eight-row plots arranged in a randomized complete block design with five replications. Rows were 38 in. wide and 40 ft long. Seed beds for the first four rows of each eight-row plot were prepared conventionally, i.e., stalks were cut and rows ripped and hipped in the Fall, vegetation was burned down with glyphosate in the Spring and rows rehipped. The remaining four rows consisted of stale beds. Their preparation was identical to conventional beds except the beds were not rehipped in the Spring. All beds were knocked-down prior to planting with a do-all. The first two rows of each four-row tillage subset were infested with inoculum of cotton isolates of *Rhizoctonia solani* (R-45) and *Pythium ultimum* (PU-1). The remaining four rows contained indigenous populations of these seedling disease pathogens. Final stands were determined at 30 days after planting and cotton harvested at the end of the season for yield. Data were analyzed by GLM procedures using SAS(Sas Institute Inc., Cary, NC). Means of seedling counts and yield were separated by Fisher's Protected LSD (P = 0.05).

Results and Discussion

Stands were generally lower, indicating enhanced disease pressure where inoculum of *R. solani* and *P. ultimum* was added. Analysis of number of plants/ft over years, tillages and disease pressure indicated significant year by tillage by disease pressure and year by disease pressure by treatment interactions. Therefore data is presented by year, treatment, tillage and disease pressure. In 1997, seed treatment significantly increased stands regardless of tillage or disease pressure (Table 1). Terraclor Super X and PHB at 8 oz/cwt significantly increased stands over that of CTS alone under conditions of enhanced disease pressure in both seed bed systems. Prevail HB at 16 oz/cwt significantly increased stand over CTS in stale beds where inoculum was added. Only TSX at 2 qt/A significantly increased stands over CTS in uninoculated plots. None of the supplemental fungicides increased yield significantly over that attained by CTS alone in 1997. The only significant increases in stand with supplemental fungicides in 1998 occurred with TSX strategies in conventional beds with enhanced disease pressure (Table 2). Significant increases in yield over CTS occurred with use of TSX at 2 qt/A in stale beds and in conventional beds where disease pressure was enhanced (Table 3). TSX at 3 qt/A also significantly increased yield over that of CTS in conventional beds with enhanced disease pressure. In 1999, TSX strategies significantly increased stands under conditions of enhanced disease pressure (Table 4). Yields were increased significantly over CTS under enhanced disease pressure by TSX at 2 qt/A in stale beds and by TSX and PHB at 8 oz/cwt in conventional beds (Table 5).

Conclusion

Supplemental fungicides led to increased stand and yield most often under conditions of enhanced disease pressure.

References

1. Chambers, A. Y. 1995. Conventional tillage vs. conservation tillage and their effects on disease severity. p. 203-204. *In* D. A. Richter and J. Armour (ed.) Proc. Belt. Cotton Prod. Res. Conf., San Antonio, TX. 4-7 Jan. 1995. Natl. Cotton Counc. of Am., Memphis, TN.
2. Young, Jesse. 1995. Conservation tillage practices in Louisiana. p. 204. *In* D. A. Richter and J. Armour (ed.) Proc. Belt. Cotton Prod. Res. Conf., San Antonio, TX. 4-7 Jan. 1995. Natl. Cotton Counc. of Am., Memphis, TN.

Table 1. Evaluation of control strategies for number of plants/ft under stale and conventional bed systems and differing disease pressures¹ in 1997.

Control Strategy	Stale		Conventional	
	Enhanced	Natural	Enhanced	Natural
Black seed control	0.7 d ²	1.9 c	0.6 d	2.0 c
CTS	2.0 c	2.8 b	2.1 c	2.6 b
CTS + TSX @ 2qt/a	2.8 a	3.1 a	2.7 a	2.9 a
CTS + TSX @ 3qt/a	2.7 a	3.0 ab	2.8 a	2.7 ab
CTS + PHB @ 8oz/cwt	2.3 b	2.7 b	2.3 b	2.6 b
CTS + PHB @ 16oz/cwt	2.4 b	2.7 b	2.2 bc	2.6 b

¹Enhanced = inoculated with *R. solani* and *P. ultimum*, natural = indigenous populations of seedling disease pathogens.

²Means followed by the same letter within a column are not significantly different (P = 0.05) as determined by Fisher's protected LSD test.

Table 2. Evaluation of control strategies for number of plants/ft under stale and conventional bed systems and differing disease pressures¹ in 1998.

Control Strategy	Stale		Conventional	
	Enhanced	Natural	Enhanced	Natural
Black seed control	0.9 d ²	1.1 b	1.3 d	1.9
CTS	1.8 ab	1.6 a	1.6 cd	2.2
CTS + TSX @ 2qt/a	2.0 a	1.6 a	2.1 a	2.2
CTS + TSX @ 3qt/a	1.7 abc	1.6 a	1.9 b	2.1
CTS + PHB @ 8oz/cwt	1.4 c	1.6 a	1.5 cd	2.0
CTS + PHB @ 16oz/cwt	1.5 bc	1.6 a	1.7 bc	2.2

¹Enhanced = inoculated with *R. solani* and *P. ultimum*, natural = indigenous populations of seedling disease pathogens.

²Means followed by the same letter within a column are not significantly different (P = 0.05) as determined by Fisher's protected LSD test.

Table 3. Yield of seed cotton (lb/A) under stale and conventional bed systems and differing disease pressures¹ in 1998.

Control strategy	Stale		Conventional	
	Enhanced	Natural	Enhanced	Natural
Black seed control	1405 b ²	2625 a	1657 c	3450
CTS	1616 b	2053 b	2443 b	3158
CTS + TSX @ 2qt/a	2558 a	2926 a	3198 a	3181
CTS + TSX @ 3qt/a	1702 b	1965 b	3178 a	3092
CTS + PHB @ 8oz/cwt	1717 b	2391 ab	2909 ab	2990
CTS + PHB @ 16oz/cwt	1906 ab	2511 ab	2432 b	3071

¹Enhanced = inoculated with *R. solani* and *P. ultimum*, natural = indigenous populations of seedling disease pathogens.

²Means followed by the same letter within a column are not significantly different (P = 0.05) as determined by Fisher's protected LSD test.

Table 4. Evaluation of control strategies for number of plants/ft under stale and conventional bed systems and differing disease pressures¹ in 1999.

Control strategy	Stale		Conventional	
	Enhanced	Natural	Enhanced	Natural
Black seed control	0.8 c ²	1.8 c	0.5 d	1.7
CTS	0.9 bc	2.4 abc	0.7 cd	2.5
CTS + TSX @ 2qt/a	2.1 a	2.8 a	2.2 a	2.4
CTS + TSX @ 3qt/a	2.5 a	2.7 ab	2.2 a	2.1
CTS + PHB @ 8oz/cwt	1.4 b	2.4 abc	0.9 bc	2.2
CTS + PHB @ 16oz/cwt	1.4 b	2.0 bc	1.2 b	2.1

¹Enhanced = inoculated with *R. solani* and *P. ultimum*, natural = indigenous populations of seedling disease pathogens.

²Means followed by the same letter within a column are not significantly different (P = 0.05) as determined by Fisher's protected LSD test.

Table 5. Yield of seed cotton (lb/A) under stale and conventional bed systems and differing disease pressures¹ in 1999.

Control strategy	Stale		Conventional	
	Enhanced	Natural	Enhanced	Natural
Black seed control	1734 c ²	2475	2149 b	3820
CTS	1877 bc	2237	2177 b	2629
CTS + TSX @ 2qt/a	3234 a	2741	3166 a	3160
CTS + TSX @ 3qt/a	3097 ab	2891	3585 a	2679
CTS + PHB @ 8oz/cwt	2917 abc	2543	3142 a	3544
CTS + PHB @ 16oz/cwt	2113 abc	2620	2842 ab	3148

¹Enhanced = inoculated with *R. solani* and *P. ultimum*, natural = indigenous populations of seedling disease pathogens.

²Means followed by the same letter within a column are not significantly different (P = 0.05) as determined by Fisher's protected LSD test.