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MANAGEMENT OF RHIZOCTONIA SEEDLING BLIGHT IN GEORGIA WITH FUNGICIDES AND VARIABLE PLANT POPULATIONS

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Abstract

In field trials since 2000, the use of in-furrow fungicides to manage seedling diseases of cotton in Georgia have resulted in improved plant stands from plots where the fungicides were not included. However, significant increases in yield were not associated with the improved stands. In 2002, three field trials were conducted at separate locations across Georgia. The objective was to determine if yields obtained when commercial seed (DP 458 B/RR) was planted at a rate of 4 seed/ft could be maintained when seed was planted at a reduced rate, 2 seed/ft, with an in-furrow fungicide such as Terraclor 15G or Terraclor Super X 18.8G, or a hopper box treatment such as Prevail. Where incidence of sore shin, caused by *Rhizoctonia solani*, was low, yields were not significantly different between either seeding rate, despite the use of additional fungicides at planting. When seedling disease was severe, the use of Terraclor Super X 18.8G improved stand, but yields were significantly lower than yields from plots planted at 4 seed/ft without an additional fungicide. This difference in yield between treatments were biased to some degree by poor weed control in the Terraclor Super X plots.

Introduction

Seedling disease of cotton, primarily sore shin, caused by *Rhizoctonia solani*, is common, yet of only sporadic importance to cotton producers in Georgia. It has been estimated that damage from seedling diseases cost growers in the state over $11 million in 2001. Because much of Georgia's cotton is grown on the southern edge of cotton production in the United States, temperatures during the early part of the season are likely warmer than they are in other production regions of the country. Also, the soils in the Coastal Plain of Georgia are often sands or sandy loams that are well-drained. Thus, it is likely that environmental conditions are generally less conducive for development of widespread seedling disease epidemics in the state than elsewhere. However, severe losses to sore shin can occur in fields that are poorly rotated, i.e. cotton is grown on an annual basis in the same field, and in the northern reaches of the production area where climate and soil types are more favorable for seedling disease.

Multiple trials in commercial fields and on research farms have been conducted across the production region of Georgia since 2000. The focus of these trials has been to assess the efficacy of fungicides such as Prevail (carboxin + metalaxyl + PCNB, Trace Chemicals), Terraclor 15G (PCNB, Uniroyal Chemical), and Terraclor Super X 18.8G (PCNB + etridiazole, Uniroyal Chemical) to reduce the impact of seedling disease on stand and final yield. It was not uncommon to find that in these trials at least one of the additional fungicide treatments, either hopper box or in-furrow, significantly improved stand over the commercially treated seed alone. However, these improvements in stand have not been followed with a corresponding increase in yield. Therefore, use of these fungicides, which are often considered indispensable in cotton production areas elsewhere, was not economically justified.

The use of additional fungicides at planting is often considered as "insurance" for an adequate stand. Growers in Georgia typically plant 3-4 seeds/ft; however it is widely believed that yields can be maintained with a final stand of 1-2 plants/ft as long as this plant population is maintained across a field. The objective of this current study was to determine if the use of additional fungicides at planting coupled with reduced seeding rates would produce yields equal to those achieved at higher seeding rates where neither in-furrow nor hopper box fungicides were added to the commercial seeds. In such cases, the reduced cost of seed and the potential for reduced technology fees could more than offset the cost of the fungicides.

Materials and Methods

Three small-plot trials were conducted in 2002 to evaluate the interaction of variable seeding rates with two or three at-plant fungicide treatments. Two of the trials were conducted in Burke County located along the northern edge of the Coastal Plain in Georgia while the third was located in Decatur County along the southern edge of the Coastal Plain. At least moderate losses to seedling disease had been reported in each of the sites. All of the plots were planted to the cultivar 'DP 458 B/RR'.

Southeast Georgia Research and Education Center, Midville, Burke County

A trial was established at the Southeast Georgia Research and Education Center, Midville, GA to evaluate fungicide treatments for management of seedling diseases of cotton. Each fungicide treatment was also evaluated at two different seeding rates to determine if use of an additional fungicide at planting could reduce the need for increased seeding rates. Cotton (DPL 458 B/RR) was planted on 16 Apr on 38-in. rows with a John Deere Max Emerge II planter. Seed was planted, hill-drop pattern, at a rate of 2 and 4 seed/ft and Temik 15G was applied in-furrow at a rate of 3.5 lb/A. Treatments included untreated seed; seed treated commercially with fungicides (baytan-thiram RTU-Allegiance FL), and commercially treated seed plus Prevail (12 oz cwt) or Terraclor Super X 18.8G (5.5 lb/A). Tillage in the study was conventional. The experimental design was a split plot with six replications. Whole plots (seeding rate) were eight rows wide by 50 ft. Subplots (seed treatment) were four rows wide by 50 ft. Row spacing was 38 in. Plots were irrigated and managed throughout the study according to guidelines from the Cooperative Extension Service. Stand counts were taken 16 and 30 days after planting (DAP) from the middle two rows of each subplot. The middle two rows of each subplot were harvested on 7 Nov 02.

CSRA Tillage Research and Demonstration Farm, Burke County

A trial was established at the CSRA Tillage Research and Demonstration Farm, Burke County, to evaluate fungicide treatments for management of seedling diseases and to compare the severity of seedling disease in conventional and conservation tillage systems. Each fungicide treatment was also evaluated at three different seeding rates to determine if use of an additional fungicide at planting could reduce the need for increased seeding rates. The soil type at this research farm was a Dothan loamy sand, pH 6.8. Cotton (DPL 458 B/RR) was planted on 16 Apr on 38-in. rows. Seed was planted at a rate of 1.7, 3, and 4 seeds/ft with a Monosem air planter. Temik 15G was applied in-furrow at a rate of 5 lb/A. Treatments included commercially treated seed and commercially treated seed plus Prevail (12 oz cwt) or Terraclor 15G (5.5 lb/A). The experimental design was a split plot where each whole plot was 12 rows wide by approximately 130 ft. Each subplot was four rows wide. Each seeding rate treatment (whole plot) was replicated five times in each tillage system; each fungicide treatment (subplot) was replicated within each seeding rate. One-half of the study was planted on plots with conventional tillage while the other half was strip-tilled into a killed rye cover crop. Plots were irrigated and managed throughout the study according to guidelines from the Cooperative Extension Service. Stand counts were taken 19 and 29 DAP. A skip index was also evaluated for each plot 29 DAP. The plots were picked in 2 Oct, 3 Oct, and 30 Oct following rain delays.

Southwest Georgia Research and Education Center, Attapulgus

A trial was established at the Southwest Georgia Research and Education Center, Attapulgus, to evaluate fungicide treatments for management of seedling diseases of cotton. Each fungicide treatment was also evaluated at two seeding rates to determine if use of an additional fungicide at planting could reduce the need for increased seeding rates. The soil type was a Norfolk loamy sand, pH 6.1. Cotton (DPL 458 B/RR) was planted on 18 Apr on 36-in. rows. Seed was planted at a rate of 2 and 4 seed/ft with a Monosem air planter and Temik 15G was applied in-furrow at a rate of 3.5 lb/A. Treatments included commercially treated seed and commercially treated seed plus Prevail (12 oz per cwt), Terraclor 15G (5 lb/A), and Terraclor Super X 18.8G (5.5 lb/A). Tillage in the study was conventional. The experimental design was a factorial randomized complete block with six replications. Each plot was two rows wide by either 100 or 155 ft. Plots were irrigated and managed throughout the study according to guidelines from the Cooperative Extension Service. Stand counts were taken 13 and 27 DAP. Plots were harvested on 8 and 9 Oct 02.

Results

Seedling disease at the Southeast Georgia Research and Education Center, Midville was severe and was caused primarily by *Rhizoctonia solani*, despite warm, dry conditions at planting that should have been unfavorable for the development of sore shin. Poor weed management in some plots, especially those with Terraclor Super X at the low seeding rate, likely affected yield. The results from the Midville trial are presented in Table 1.

The growing season during most of 2002 was hot and dry at the CSRA Conservation Tillage Farm. The harvest season was filled with numerous rain events and was unfavorable for harvest. Losses to seedling disease were minimal and the result of sore shin caused by *Rhizoctonia solani*. In this study, there was no interaction between tillage, seeding rate and the effect of the fungicide treatments, so results were pooled across these variables (Table 2). Terraclor 15G improved stand and reduced the skip index (not significantly) over the untreated control at 29 DAP; however stands were generally better in plots treated with Terraclor and control plots than in plots treated with Prevail. Plots in the conventional tillage block had stands that were better than in the conservation tillage. Neither seeding rate nor fungicide treatment made a significant difference in yield. Yield was significantly greater in conventional tillage than in the conservation tillage.

Hot and dry weather conditions during the season in Attapulgus were generally unfavorable for the development of seedling disease. Seedling disease in this study appeared to be caused primarily by *Rhizoctonia solani*; however, *Pythium* spp. may also have played a role in pre-emergent damping-off. There was no interaction between seeding rate and the effect of the fungicide treatments. Prevail and Terraclor Super X 18.8G generally improved stand over the untreated control and plots treated only with Terraclor 15G. The improved stand associated with Prevail and Terraclor Super X, but not Terraclor, sug-

gests that *Pythium* may be a more important pathogen of seedling cotton in Georgia than previously recognized. Plots treated with Terraclor Super X had the greatest numerical yields at both seeding rates; however the means were not significant (P=.05). Yields between seeding rates (across treatments) were not significantly different.

Discussion

A 50 lb bag of DP 458 B/RR seed will cost approximately $70.95 in 2003. If a grower were to plant 4 seed/ft, the cost to plant a field on 38-in. rows would be approximately $14.02/A. If the grower could plant only 2 seed/ft, the cost would be reduced by one-half, or $7.01/A. Growers might also reduce the technology fee associated with planting the transgenic seed by approximately $10.00/A. Thus, a reduction from 4 to 2 seed/ft could save the grower approximately $17.00/A, which would more than offset the cost of Prevail (approximately $2.50/A), Terraclor 15G or Terraclor Super X 18.8G (approximately $12.50/A) to treat the field. In two of the trials included in this study (Attapulgus and CSRA Conservation Tillage Farm) the incidence of seedling disease was not severe enough to result in major differences in stand. However, because the difference in yield between the highest and lowest seeding rates was not significant, it is clear that the yield potential of 2 seed/ft is equal to 4 seed/ft. Therefore, if the use of in-furrow fungicides can "insure" a good stand at the reduced seeding rate, then use of additional fungicides at planting is likely to be of benefit to growers in Georgia.

Sore shin was quite severe in the Midville study, especially in plots where untreated seed was planted. However, the improved stands associated with Terraclor Super X at 2 seed/ft were not sufficient to match the yields of the treated seed alone at 4 seed/ft. Unfortunately, a failure to control weeds in an area of the field where several plots treated with Terraclor Super X at the low seeding rate were located reduced the final yield. Had weed control been better, it is possible that the yield from plots where seed was planted at a rate of 2/ft and treated with Terraclor Super X 18.8G might have been closer to yields from plots planted at a rate of 4 seed/ft.

Conclusions

From the results of this study, cotton growers in Georgia can expect similar yields from a seeding rate of 2 seed/ft and 4 seed/ft, if the seedlings at the reduced rate can be adequately protected from losses to seedling disease. It is also clear that the use of an in-furrow fungicide, such as Terraclor Super X, can produce an adequate stand, even when the potential for losses to seedling disease is great. However, data from this study does not conclusively show that growers planting cotton at 2 seed/ft with an in-furrow fungicide can equal yields of commercially treated seed alone planted at 4 seed/ft.

Table 1. Stand and yield response to multiple fungicides and variable seeding rates at the Southeast Georgia Research and Education Center, Midville.

	# Plants / 100 row feet				Skip Index/ 100 ft		Seed Cotton Yield	
	Emergence		Stand		30 DAP		lb/A	
Treatment and rate/A	16 DAP		30 DAP					
Untreated seed (2 seed/ft)	34.7	e*	29.5	e	166.5	a	632.5	d
Treated seed (2 seed/ft)	69.8	de	66.7	d	140.2	ab	959.2	abc
Treated seed (2 seed/ft) + TSX** (5.5 lb/A)	84.5	d	81.3	cd	119.5	bc	773.6	cd
Treated seed (2 seed/ft) + Prevail (12 oz CWT)	71.8	de	61.8	de	141.8	ab	891.2	bcd
Untreated seed (4 seed/ft).	97.3	cd	88.3	cd	120.5	bc	964.6	abc
Treated seed (4 seed/ft).	150.8	ab	129.8	b	84.8	de	1113.4	ab
Treated seed (4 seed/ft) + TSX (5.5 lb/A)	184.5	a	179.2	a	59.0	e	1181.4	a
Treated seed (2 seed/ft) + Prevail (12 oz CWT)	129.5	bc	111.7	bc	107.5	cd	1147.4	ab

*Means followed by the same letter do not differ significantly as determined by Fisher's protected least significant difference test (P≤0.05).

**TSX is an abbreviation for Terraclor Super X 18.8G.

Table 2. Stand and yield response to multiple fungicides and variable seeding rates at the CSRA Conservation Tillage Farm, Burke County, GA.

	# Plants / 100 row feet				Skip Index/		Lint Cotton	
	Emergence		Stand		100 ft		Yield	
Treatment and rate/A	19 DAP		29 DAP		29 DAP		lb/A	
Seed alone	222.1	a	217.4	ab	16.1	b[w]	570.1	a
Prevail (hopper box) 12 oz/cwt	209.2	b	207.9	b	19.9	a	566.9	a
Terraclor 15G (5 lb/A)	220.6	ab	223.1	a	14.7	b	571.7	a
Low seeding rate (1.7 seed/ft)	139.4	c	144.1	c	26.8	a	557.6	a
Mid seeding rate (3 seed/ft)	233.4	b	230.9	b	11.8	b	584.1	a
High seeding rate (4 seed/ft)	279.0	a	273.4	a	12.2	b	567.0	a
Conservation tillage	203.0	B	201.2	B	22.4	A	537.3	B
Conventional tillage	231.6	A	231.0	A	11.4	B	609.9	A

[z]The interaction between tillage, fungicide treatment and seeding rate was not significant so results are pooled across both treatments.
[y]Skip Index for 100 feet: missing stand 6 in. or greater in length summed over 100 ft.
[x]Yield is for lint cotton calculated at 36% of seed cotton weight.
[w]Means followed by the same letter do not differ significantly as determined by Fisher's protected least significant difference test (P≤0.05).

Table 3. Stand and yield response to multiple fungicides and variable seeding rates at the Southwest Georgia Research and Education Center, Attapulgus.

	Plants / 50 row feet					
	Emergence		Stand		Yield[x]	
Treatment and rate/A[z]	13 DAP		27 DAP		lb/A	
Seed alone	129.1	b[w]	129.1	bc	1035.4	a
Prevail (hopper box) 12 oz/cwt	134.9	a	133.2	a	1040.6	a
Terraclor 15G (5 lb/A)	130.7	ab	126.1	c	1013.6	a
Terraclor Super X 18.8 G (5.5 lb/A)	133.4	ab	132.8	ab	1084.1	a
Low seeding rate (2 seed/ft)	82.4	B	82.2	B	1003.8	A
High seeding rate (4 seed/ft)	181.6	A	178.3	A	1083.0	A

[z]The interaction between fungicide treatment and seeding rate was not significant so results are pooled across both treatments.
[y]Skip Index not presented in preliminary report.
[x]Yield is for seed cotton.
[w]Means followed by the same letter do not differ significantly as determined by Fisher's protected least significant difference test (P≤0.05).