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EVALUATION OF SEED TREATMENT, OVER-TREATMENT AND IN-FURROW FUNGICIDES FOR COTTON SEEDLING DISEASE CONTROL

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Abstract

A number of seed treatment, over-treatment and in-furrow fungicides were compared to commercially available materials for control of seedling disease of cotton. Several were equal to or superior to currently available materials for control of the cotton seedling disease complex.

Introduction

Seedling disease continues to be a major cotton production problem across the U. S. cotton-belt. In 2002, it was particularly important in the Mid-south production area with losses estimated at 6.5% or 394,000 bales. Control of the seedling disease complex is principally through cultural practices and the use of seed treatment or supplemental fungicides. Virtually all of the cotton seed planted in the U. S. is treated with a fungicide. Industry continues to search for new and better materials to aid producers in control of the seedling disease complex.

Materials and Methods

Several experiments were conducted to evaluate seed treatment, over-treatment materials and in-furrow fungicides for control of the seedling disease complex of cotton. Experiments consisted of four-row plots with rows 40 ft long on 38 inch centers. Deltapine 451 BR was used in all experiments. Each plot-row was planted with 120 seed. Seedling disease pressure was enhanced in two rows of each four-row plot with addition of inoculum of *Rhizoctonia solani* (R-45) and *Pythium ultimum* (PU-1). Inoculum of *R. solani* was grown on winter rye, dried, and ground to 0.003 - 0.08 inch particles. Inoculum of *P. ultimum* was grown in potato carrot broth with wheat germ oil. Four mycelial mats from ten day-old still cultures were macerated for one min in 50 ml of sterile distilled water. The macerate was mixed (2:1, v/v) with medium vermiculite containing 0.5% (w/w) wheat bran for 10 -15 min. Inoculum of *R. solani* and *P. ultimum* was checked for viability and applied in-furrow at planting at 0.07g/row-ft and 0.5g/row-ft, respectively. Treatments were arranged in a randomized complete block design with four replications. Final stands were determined at 28 days after seedling emergence and converted to number of plants/row-ft. Stand and yield data were analyzed with GLM procedures of SAS (SAS Institute, Cary, NC). Means were separated by Fisher's Protected LSD (*P*=0.05).

Results

Seedling survival in rows in which inoculum of *R. solani* and *P. ultimum* was applied was always lower than that in non-infested rows (Tables 1,3,5). This increased level of disease pressure enhanced the evaluation of efficacy of fungicide treatments.

Evaluation of Seed Treatment Formulations

Three azoxystrobin ready-mix seed treatment formulations significantly improved stand establishment over the black seed check and compared favorably with the two most widely used seed treatment packages in the Mid-south (Table 1). A13012 (B) resulted in a significantly greater number of plants/row-ft than commercial seed treatment packages in rows in which inoculum was applied. Yield from this treatment was significantly greater where disease pressure was enhanced than from the black seed check (Table 2).

Efficacy of Azoxystrobin Ready-Mix Seed Treatment Formulations to Standard Over-Treatment Packages

All seed treatments and over-treatment packages significantly increased the number of surviving seedlings compared to the black seed check (Table 3). Where disease pressure was enhanced, the B variant of A13012 resulted in significantly greater stand than the commercial Baytan 30/Thiram 42-S/Allegiance seed treatment package. The addition of Deltacoat AD, as an over-treatment, significantly increased stand of the commercial seed package. However, stand from this seed treatment - over-treatment combination was not significantly different from than obtained with the B variant of A13012 seed treatment alone. Where disease pressure was enhanced, yield obtained with the B variant of A13012 was significantly greater than the black seed check (Table 4).

Efficacy of In-Furrow Applications of Tank Mixes of Quadris and Ridomil Gold

The in-furrow application of materials with activity against *R. solani* significantly increased stand compared to the black seed check (Table 5). Stands from in-furrow applications of the lower rate of Quadris or Ridomil Gold/Quadris tank mixes were significantly greater than in-furrow applications of PCNB.

Impact of Seedling Disease and Seed Treatment on Cotton Yield

Calculated lint yield in the absence of fungicides was over 300 pounds less where disease pressure was enhanced compared to rows with natural disease pressure (Table 6). The use of fungicides increased yield in nearly all cases over that attained with the black seed check. The amount of increase was dependent upon level of disease pressure. Mean yield increase was 114 and 33 pounds for enhanced and natural disease pressure, respectively.

Conclusion

The use of seed treatment and supplemental fungicides is particularly important to stand establishment and yield in cotton under conditions of enhanced seedling disease pressure. A number of seed treatment packages and supplemental materials appear effective in reducing the impact of the seedling disease complex. Some offer improvement over those currently available.

Table 1. Comparison of azoxystrobin ready-mix formulations to seed treatment packages for cotton stand establishment.

	Plants/row-ft[a]	
Treatment (Rate, oz pr/cwt)	**Enhanced Disease Pressure[b]**	**Natural Disease Pressure**
Black Seed Check (0)	0.6 d[c]	2.0 b
A13012[d] B (3)	1.6 a	2.4 a
A13012C (3)	1.5 ab	2.5 a
A13012D (3)	1.4 ab	2.4 a
Apron XL/Maxim/Systane (0.3/0.08/0.8)	1.1 c	2.3 ab
Baytan 30/Thiram 42-S/Allegiance (0.5/1/0.7)	1.2 bc	2.5 a
Mean	1.2	2.4

[a]Mean of four replications, 28 days after emergence; planting rate = 3 seed/row-ft
[b]Inoculum of *Rhizoctonia solani* and *Pythium ultimum* applied in-furrow at planting
[c]Means within a column followed by the same letter do not differ significantly (*P*=0.05, LSD)
[d]Ready-mix formulations of azoxystrobin/Maxim/Apron

Table 2. Comparison of azoxystrobin ready-mix formulations to seed treatment packages for cotton yield.

	Lint (lb/A)[a]	
Treatment (Rate, oz pr/cwt)	**Enhanced Disease Pressure[b]**	**Natural Disease Pressure**
Black Seed Check (0)	940 b[c]	1248 ab
A13012[d]B (3)	1242 a	1416 a
A13012C (3)	933 b	1059 b
A13012D (3)	1088 ab	1350 ab
Apron XL/Maxim/Systane (0.3/0.08/0.8)	958 ab	1203 ab
Baytan 30/Thiram 42-S/Allegiance (0.5/1/0.7)	1050 ab	1377 a

[a]Mean of four replications; Calculated from 40 ft of row base on a lint percentage of 35%
[b]Inoculum of *Rhizoctonia solani* and *Pythium ultimum* applied in-furrow at planting
[c]Means within a column followed by the same letter do not differ significantly (*P*=0.05, LSD)
[d]Ready-mix formulations of azoxystrobin/Maxim/Apron

Table 3. Comparison of azoxystrobin ready-mix formulations to a commercial seed treatment package with over-treatment materials for cotton stand establishment.

	Plants/row-ft[a]	
Treatment (Rate, oz pr/cwt)	**Enhanced Disease Pressure[b]**	**Natural Disease Pressure**
Black Seed Check (0)	0.6 d[c]	2.0 b
A13012[d]B (3)	1.6 a	2.4 a
A13012C (3)	1.5 ab	2.5 a
A13012D (3)	1.4 ab	2.4 a
Baytan 30/Thiram 42-S/Allegiance (0.5/1/0.7)	1.2 c	2.5 a
+ Deltacoat AD (12)	1.9 a	2.5 a
+ Azo/Baytan 30/Allegiance (0.45/0.24/0.7)	1.4 bc	2.5 a
V-PCNB/Allegiance/Ascend (6.7/0.7/1)	1.3 c	2.5 a
Azo/Allegiance/Ascend (0.45/0.36/1)	1.2 c	2.5 a
Mean	1.3	2.4

[a]Mean of four replications, 28 days after emergence; planting rate = 3 seed/row-ft
[b]Inoculum of *Rhizoctonia solani* and *Pythium ultimum* applied in-furrow at planting
[c]Means within a column followed by the same letter do not differ significantly (*P*=0.05, LSD)
[d]Ready-mix formulations of azoxystrobin/Maxim/Apron

Table 4. Comparison of azoxystrobin ready-mix formulations to a commercial seed treatment package with over-treatment materials for cotton yield.

	Lint (lb/A)[a]	
Treatment (Rate, oz/cwt)	**Enhanced Disease Pressure[b]**	**Natural Disease Pressure**
Black Seed Check (0)	940 b[c]	1248 ab
A13012[d]B (3)	1242 a	1416 a
A13012C (3)	927 b	1059 b
A13012D (3)	1088 ab	1350 ab
Baytan 30/Thiram 42-S/Allegiance (0.5/1/0.7)	1050 ab	1377 a
+ Deltacoat AD (12)	1172 ab	1243 ab
+ Azo/Baytan 30/Allegiance (0.45/0.24/0.7)	1163 ab	1193 ab
V-PCNB/Allegiance/Ascend (6.7/0.7/1)	1090 ab	1330 ab
Azo/Allegiance/Ascend (0.45/0.7/1)	1033 ab	1284 ab

[a]Mean of four replications; calculated from 40 ft of row base on a lint percentage of 35%
[b]Inoculum of *Rhizoctonia solani* and *Pythium ultimum* applied in-furrow at planting
[c]Means within a column followed by the same letter do not differ significantly (*P*=0.05, LSD)
[d]Ready-mix formulations of azoxystrobin/Maxim/Apron

Table 5. Comparison of in-furrow applications of Quadris -Ridomil Gold tank mixes for control of pre- and post emergence damping-off of cotton.

	Plants/row-ft[a]	
Treatment (Rate, oz pr/A)	**Enhanced Disease Pressure[b]**	**Natural Disease Pressure**
Black Seed Check (0)	1.5 c[c]	2.3
Ridomil Gold (1.3)	1.3 c	2.1
PCNB (27)	1.9 b	2.3
Ridomil Gold PC (238)	2.0 b	2.3
Quadris (5.3)	2.2 a	2.2
Quadris (8.2)	2.2 ab	2.3
Ridomil Gold/Rovral (1.3/5.3)	2.1 ab	2.4
Ridomil Gold/Quadris (1.3/5.3)	2.3 a	2.3
Ridomil gold/Quadris (1.3/8.2)	2.3 a	2.4
A13012[d]B (3 oz pr/cwt)	1.9 b	2.2
Mean	2.0	2.3

[a]Mean of four replications, 28 days after emergence; planting rate = 3 seed/row-ft
[b]Inoculum of *Rhizoctonia solani* and *Pythium ultimum* applied in-furrow at planting
[c]Means within a column followed by the same letter do not differ significantly (*P*=0.05, LSD)
[d]Ready-mix formulations of azoxystrobin/Maxim/Apron

Table 6. Impact of seedling disease and seed treatment on cotton yield.

	Lint (lb/A)[a]	
Treatment	**Enhanced Disease Pressure[b]**	**Natural Disease Pressure**
Black Seed Check	940	1248
Mean All Entries	1035	1275
Mean All Fungicide Treatments	1054	1281
Treatment Impact	(114)	(33)

[a]Mean of four replications; calculated from 40 ft of row base on a lint percentage of 35%