POTENTIAL INTERACTION OF PRE-EMERGENCE HERBICIDES ON THE EFFICACY OF FUNGICIDE SEED TREATMENTS IN COTTON

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Abstract

We investigated the potential interaction of fungicide seed treatments with pre-emergence herbicides used in cotton in five experiments during 2013 and 2014. Herbicide treatment did not affect plant stand, but in 2 of 3 tests, the use of Cotoran plus Dual Magnum reduced yield, whereas Cotoran and other pre-emergence herbicides did not affect yield. There were no interactions between the herbicides used and the performance of fungicide seed treatments. Fungicide seed treatments increased plant stands in all five tests. Fungicides also positively affected yield in three of these tests. In some tests, there were indications that the addition of strobilurin fungicide components, (e.g., azoxystobin or trifloxystrobin) tended to increase stand counts by reducing stand loss caused by *Rhizoctonia solani*.

Introduction

The increasing occurrence of glyphosate-tolerant weeds has dramatically increased the use of pre-emergence herbicides especially for control of Palmer pigweed, *Amaranthus, palmeri*, in West Tennessee. These herbicides may cause crop injury, and thus could potentially retard seedling growth and increase susceptibility to seedling diseases. Thus, we performed several experiments using different pre-emergence herbicides and fungicide seed treatments to investigate possible interactions of these factors on disease control.

Materials and Methods

The pre-emergence herbicides and fungicide seed treatments used in five separate studies are listed in Tables 1 and 2. Tests were location at the University of Tennessee Research and Education Centers located in Milan or Jackson. TN. In all cases, treatments were arranged in a factorial or split-plot design within a randomized complete block. Main effects were the pre-emergence herbicide used and the fungicide seed treatment. Each treatment was replicated four times, and individual plots were four rows planted on 38 or 40 inch centers. Plot length was 30-35 feet, and the seeding rate was four plants per foot of row. Pre-emergence herbicides were applied the day of or the day after planting, and depending on the test, at a volume of 10-17 GPA, using a backpack or tractor-mounted sprayer. In four of five tests, plots were inoculated at planting with *Rhizoctonia solani* (strain AG2-2) grown on millet at a rate of 1-2 gm per foot of row. In tests 4 and 5 (Table 1), only the right two rows of each four-row plot were inoculated. We measure plant stands as numbers of living plants in 60 or 70 ft of row at 20-30 days after planting, depending upon the test. Seed-cotton yield were also collected in all plots. Statistical analyses were done using ARM 9.0 Software (Gylling Data Management, Brooking, SD). Mean separations were done using Fischer's LSD at an alpha level of 0.05.

Table 1. Planting date, pre-emergence herbicide treatments, and fungicide seed treatments evaluated in these studies.

Test	Planting date	Fungicide main effects (oz/cwt)*	Herbicide main effects (oz/acre)
1 - 3	14-May-13	None	None
	13-May-14	Apron Max RFC (3.0)	Cotoran 4L (40)
	28-May-14	Dynasty CST (3.5)	Cotoran 4L (40)+Reflex (16)
		Trilex Advanced (1.6)	Cotoran 4L (40)+Dual Magnum (20)
4	24-Apr-13	None	None
		Base	Cotoran 4L (40)
		Base+Evergol Xtend (1)+Allegiance (0.75)	
		Base+Evergol Xtend (1)+Allegiance (0.75)**	
5	5-May-14	None	None
		Base+Evergol Prime (0.32)	Cotoran 4L (32)+Caparol 4L (32)
		Base+Evergol Prime (0.32)+Evergol Xtend (0.5)	
		Base+Evergol Prime (0.32)+Evergol Xtend (0.5)**	

See Table 2 for fungicides and rates included in 'Base' treatments.
* In tests 1, 2, 3 and 5, Cruiser 5F or Gaucho 600 was used for thrips control at a rate of 0.375 mg ai/seed.
** Includes Aeris insecticide seed treatment (Bayer CropScience).

Table 2. List of active herbicide and fungicide ingredients used in these studies.

Chemical	Company	Active ingredients (% concentration)
Cotoran 4L	Makhteshim-Agan N. A.	Fluometuron (41.7)
Reflex	Syngenta	Fomesafen (22.8)
Dual Magnum	Syngenta	S-metolachlor (83.7)
Caparol 4L	Syngenta	Prometryn (44)
Apron Max RFC	Syngenta	Fludioxonil (2.31), Mefenoxam (3.46)
Dynasty CST	Syngenta	Azoxystrobin (6.64), Fludioxonil (1.11), Mefenoxam (3.32)
Trilex Advanced	Bayer CropScience	Trifloxystrobin (8.55), Triadimenol (4.27), Metalaxyl (12.82)
Spera 240 FS	NuFarm America	Myclobutanil (22.37)
Vortex FL	Bayer CropScience	Ipconazole (40.7
Allegiance FL	Bayer CropScience	Metalaxyl (28.35)
Evergol Prime	Bayer CropScience	Penflufen (22.7)
Evergol Xtend	Bayer CropScience	Trifloxystrobin (13.3), Penflufen (13.3)
Base1		Spera (1.8 oz/cwt), Vortex FL (0.8 oz/cwt), Allegiance (0.75 oz/cwt)

Results and Discussion

The number of plants per acre (i.e., plant stand) was not affected by herbicide treatment in any test. In contrast, there were main effects of fungicide seed treatment in each of the five tests, regardless of whether tests were inoculated with *Rhizoctonia* (Table 3). Plots not having a fungicide seed treatment had significantly fewer plants than those treated with fungicide. The only exception occurred in test 3 of 2014, where stand counts in the Apron Maxx treatment were statistically similar to untreated seed. It is important to note that Apron Maxx is not labeled for use in cotton. In several tests, there were indications that the addition of strobilurin fungicide components, (e.g., azoxystobin or trifloxystrobin in Dynasty CST, Trilex Advanced, and Evergol Xtend) increased the number of plants per acre. This was especially evident in tests 2 and 3 where, other than the prescribed fungicide treatment, no base fungicide treatments were used. There was a significant interaction between inoculated and not inoculated rows in test 5 where, in plots not treated with a fungicide seed treatment, there was relatively greater stand loss in inoculated rows compared with those not inoculated.

Table 3. Numbers of plants per acre as affected by fungicide seed treatment.

Test	None	Apron Maxx	Dynasty CST	Trilex Advanced
1 (2013)	39,910 b	42,860 a	43,560 a	44,092 a
2 (2014, early planted)	3,827 c	7,878 b	20,030 a	10,099 b
3 (2014, late planted)	41,609 c	42,468 bc	43,961 ab	44,596 a
	None	Base*	Base + E. Xtend*	Base + E. Xtend + Aeris*
4 (2013)	14,305 b	24,278 a	24,965 a	25,516 a
5 (2014, inoculated rows)	17,859 e	36,015 ab	32,554 c	35,098 bc
5 (2014, not inoculated)	26,799 d	35,052 bc	36,657 ab	38,606 a

Means not followed by a common letter are significantly different within each test.
* Refer to Table 1 for complete description of fungicide seed treatments.

Seed-cotton yield was affected by pre-emergence herbicide treatments in tests 1 and 3 (data not shown). In these tests, treatment with Cotoran plus Dual Magnum reduced yield by ≈ 200-300 pounds of seed cotton per acre compared to Cotoran applied alone or where no pre-emergence herbicide was used. Fungicide seed treatment also significantly affected yield in three of five tests (Table 4). There were no interactions of fungicide or herbicide treatments on yield in any test. In tests 2, 4 and 5, substantial yield loss occurred if no fungicide seed treatment was used. Compared with Dynasty CST and Trilex Advanced, yield was lower in plots treated with Apron Maxx during 2014 where substantial stand loss was observed (test 2). In test 4, the addition of Aeris increased yield likely due to thrips control because, unlike the other tests, an insecticide seed treatment was not part of the base treatment. In test 5, there was a significant decrease in seed-cotton yield between row inoculated with *Rhizoctonia* (2,808 lbs/acre) and those not inoculated (3,078 lbs/acre), but there was no interaction between the factors of inoculation and fungicide seed treatment.

Table 4. Seed-cotton yields (lbs/acre) as affected by fungicide seed treatment.

Test	None	Apron Maxx	Dynasty CST	Trilex Advanced
1 (2013)	3,528 a	3,561 a	3,683 a	3,620 a
2 (2014, early planted)	1,378 c	2,001 b	3,008 a	2,673 a
3 (2014, late planted)	2,237 a	2,267 a	2,227 a	2,382 a
	None	Base*	Base + E. Xtend*	Base + E. Xtend + Aeris*
4 (2013)	2,646 c	3,102 b	3,149 b	3,412 a
5 (2014)	2,568 b	2,962 ab	3,048 a	3,196 a

Means not followed by a common letter are significantly different within each test.
* Refer to Table 1 for complete description of fungicide seed treatments.

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