GROWTH OF PHYMATOTRICHOPSIS OMNIVORA IN FLUTRIAFOL TREATED FIELD SOILS

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Abstract

Flutriafol (Topguard) fungicide has shown efficacy for control of cotton root rot, caused by the soil borne fungus *Phymatotrichopsis omnivora*, in field trials in Arizona, but results have been variable. A laboratory bioassay was developed to determine growth of *P. omnivora* in soils sampled from experimental field plots treated with flutriafol or untreated. Flutriafol was applied at 32 oz/as a T-band spray over the seed furrow, or as an in-furrow treatment. Fields were pre-irrigated, and seed was planted into moisture. Soils were sampled in the seed line after subsequent irrigations and assayed for growth of *P. omnivora*. Growth and fungal strand development of *P. omnivora* was inhibited in all samples from flutriafol treated plots, but was not inhibited in soils from untreated plots. Results indicate that flutriafol moves downward in soil from the application site and is active in the top 8 inches of soil for at least 3 irrigations. It was concluded that variability in disease control is not the result of loss of fungicidal activity in the upper root zone.

Introduction

Flutriafol (Topguard) fungicide has shown efficacy for control of cotton root rot, caused by the soil borne fungus *Phymatotrichopsis omnivora*, in field trials in Texas (1). In 2012 and 2013, similar trials were conducted in Arizona in fields with histories of severe cotton root rot. Most cotton in Arizona is furrow irrigated, and many fields are pre-irrigated before planting. Cotton is planted into moisture and typically not irrigated again for two to six weeks. Since results of flutriafol efficacy trials in Arizona were variable, we wanted to determine if flutriafol remained active in soils until disease symptoms appeared and if the fungicide moved downward in Arizona soils with irrigation water.

The objective of this study was to determine if activity of flutriafol against *P. omnivora* in Arizona soils was affected by time after application. A laboratory bioassay was used to determine growth of *P. omnivora* in soils (1) treated with flutriafol in the field and sampled after several irrigations at different depths and (2) treated in the laboratory with known concentrations of flutriafol.

Materials and Methods

Field treatments

Soils were sampled from field trials in Coolidge and Marana, AZ with replicated treatments where flutriafol was applied at planting at 32 fl oz/A in 4.7 gal water/A as: (1) an in-furrow split line treatment and/or (2) a 5-inch wide T-band spray. Fields had been pre-irrigated, and seed was planted into moisture. Cotton was otherwise grown under standard cultural practices.

Soil samples

Soils were sampled in the seed line of treated and non-treated plots using a two-inch auger (Figure 1) at 0-4 and 4-8 inches after initial irrigations and again after disease symptoms were observed. Samples were taken from 4 replicated plots of treated and non-treated soils in Coolidge and from 6 replicated plots in Marana. Soils were air dried, sieved, and used for assays within 2 days. For growth assays, subsamples of each replication of each treatment were placed in 100x25 mm Petri dishes to 5 mm depth and adjusted to 30% moisture (w/w).

Figure 1. Soil auger used to sample treated and non-treated soils at 0-4 and 4-8 inches.

Growth assays

Growth of *P. omnivora* on soils was assayed using colonized sterile sorghum seed. The sorghum seed was soaked in tap water overnight, placed in glass Petri dishes to form a thin layer, and autoclaved twice on successive days. The seed was inoculated with agar plugs taken from a 5-day-old PDA culture of an isolate of *P. omnivora* from cotton, placed in plastic bags to prevent drying, and incubated for about 21 days at 27°C. As shown in Figure 2, colonized seed was cut into one cm^3 cubes and incubated for an additional two days for the fungus to completely cover the sorghum cubes. Cubes were placed on soils in the center of assay dishes and incubated at 27° C for 7 days. Growth of *P. omnivora* hyphae and strands was rated from 0 (no growth) to 2 (excellent growth with strands).

Non-treated soils from each field were treated in the laboratory to determine growth of *P. omnivora* on soils with known concentrations of flutriafol by wetting to 30% moisture (w/w) with flutriafol at concentrations of 10, 1.0, 0.1, 0.01 and 0.001 mg/L a.i. Colonized sorghum seed cubes were used for growth of *P. omnivora* as in field treated soil assays.

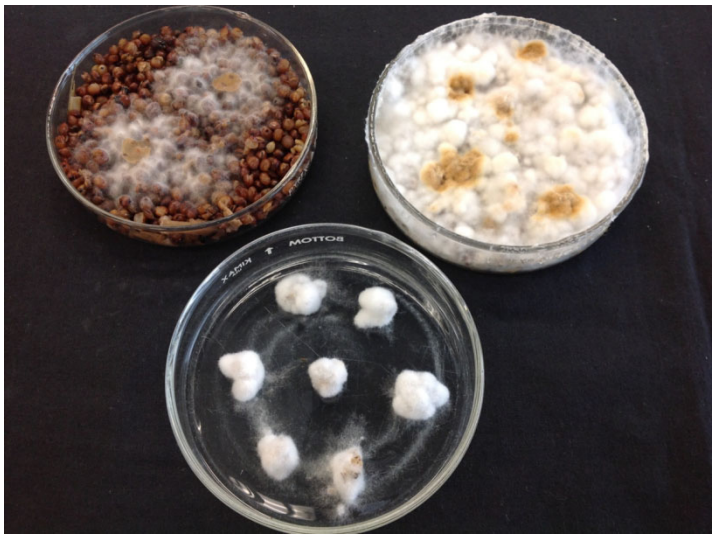

Figure 2. Colonized sorghum seed cubes used to assay soils for growth of *Phymatotrichopsis omnivora*.

Results and Discussion

Growth of *P. omnivora* was inhibited in all soil samples from field plots treated with flutriafol applied as a T-band spray or in-furrow split line (Figure 3). In all dishes with flutriafol treated soils, *P. omnivora* did not grow at all, or grew only slightly as sparse hyphae and did not produce the characteristic strands shown in the dish on the left in non-treated soil in Figure 3 below.

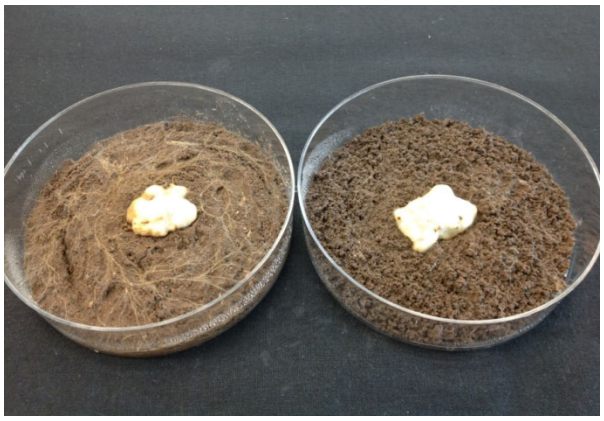

Figure 3. Growth of *Phymatotrichopsis omnivora* on non-treated soil (left) or flutriafol treated soils (right).

Flutriafol remained active for the sampling period up to 8 inches deep in the root zone (Table 1). Activity of known concentrations of flutriafol added as aqueous solutions to soils in assay dishes showed significant growth inhibition as low as 0.001 mg/L a.i.

Table 1. Results of assays for flutriafol activity in Arizona field soils.

Location	Planting date	Type(s) of application	Sample dates	Depth (inches)	# reps	[1]Growth treated	[1]Growth non-treated
Coolidge	April 9	T-band spray	April 25	0-4	4	0	2.0
		In-furrow split line					2.0
		T-band spray	May 7	0-4	4	0.1	1.5
				4-8	4	0.1	1.4
		In-furrow split line		0-4	4	0	1.6
				4-8	4	0.2	1.5
		T-band spray	Aug 5	0-4	4	0.1	1.8
				4-8	4	0.4	1.8
		In-furrow split line		0-4	4	0.1	1.7
				4-8	4	0.3	1.6
Marana	May 9	T-band spray	July 9	0-4	6	0.0	1.5
				4-8	6	0.2	1.7
			Aug 2	0-4	6	0.8	1.8
				4-8	6	0.7	2.0

[1]Average growth of hyphae and strands where 0=no growth and 2=growth across plate at 7 days. Treatment was highly significant within each assay at all sample dates (ANOVA, $P<0.001$).

Summary

Results indicate that flutriafol moves downward in soil and is active in the top 8 inches of soil after at least three irrigations. Treated soils were suppressive to growth of *P. omnivora* until after disease symptoms began in the field. It was concluded that variability in disease control was not the result of loss of fungicidal activity in the upper root zone. Further studies of root symptoms in mature plants in treated soils may show whether roots are protected at the upper root but not at the lower root where root rot usually begins on cotton in Arizona, and if variability in lower root protection results in the variability in control in field trials.

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References

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