NEW NEMATICIDE POTENTIALS IN COTTON IN THE SOUTHEAST AND MID SOUTH.

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Abstract

New experimental seed treatment nematicides are being tested to determine their potential in cotton (*Gossypium hirsutum*) production systems in the southern regions of the cotton belt. Efficacy field trials were established in reniform nematode (*Rotylenchulus reniformis*), and root knot nematode (*Meloidogyne incognita*) infested fields. Treatments consisted of standard and experimental nematicides applied as granular in-furrow formulations or as seed treatments. The experimental seed treatment nematicides tested did not cause any plant phytotoxicity or seedling stress that adversely affects the initial growth of the cotton plant. The experimental seed treatments from Bayer Crop Science significantly improved seed cotton yields as compared to the control and were similar to the yields in the Aeris seed treatment in the root-knot field. Syngetna's experimental seed treatments improved cotton yields when contrasted to the control and sustained comparable yields as the standard Temik 15 G treatment.

INTRODUCTION

Seed treatment nematicides appeared on the market in 2005 and began to change cotton production practices in the southern cotton belt region. Management practices moved from the standard granular in furrow applications of Temik 15G (aldicarb) to the seed treatments Avicta (abermectin) and Aeris (thiodicarb). Seed treatments simplified the planting process and reduced producer's exposure to pesticides. More chemical compounds are being tested to determine their efficacy to the major cotton nematodes. The objective of this study was to determine the efficacy of new experimental compounds used in reniform and root-knot nematode infested cotton fields with and without irrigation to determine the optimal fit of each tentative nematicide.

MATERIALS AND METHODS

Experimental nematicide treatments were evaluated for the management of the reniform and root knot nematodes in infested fields in north, central and south Alabama. The northern soil was a Decatur silt loam (24% sand, 49% silt, 28% clay, 34.685 lat, -86.883 long, 612 ft elev.); central soil type was a Wickham fine sandy loam (70% sand, 16% silt, 18% clay, 32.422 lat, -85.888 long, 233 ft elev.); and the southern soils is a Ruston very fine sandy loam (59% sand, 33% silt, 8% clay, 31.232 lat, -87.435 long. and 359 ft elev.). Bayer Crop Science or Syngenta applied all the seed treatments in each test. Temik 15G (Aldicarb) was applied at planting in the seed furrow with chemical granular applicators attached to the planter. Plots at all locations consisted of 2 rows, 25 ft long, with 36 – 40 in. row spacing and were arranged in a randomized complete block designs with five to six replications depending on location. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. The northern reniform location was irrigated while the central root-knot and southern reniform locations were dry land systems. Cotton stand, vigor, and stand uniformity were determined near 30 days after planning (DAP). Population densities of the nematodes were determined near 30 DAP, 60 DAP and at harvest. Reniform soil samples were collected as 10 soil cores, 1 in. diameter and 8 in. deep were collected from the two rows of each plot in a systematic sampling pattern. Nematodes were extracted using the gravity sieving and sucrose centrifugation technique. Root-knot eggs were extracted from 3 roots systems by agitation in 1 10% NaOCl solution. Plots were harvested at maturity with plot combines. Data were analyzed using mixed models methodology as implemented in SAS® procedure MIXED (http://support.sas.com/onlinedoc/913). In all cases each test was analyzed separately. Treatments were considered to be fixed effects and blocks were a random effect. Fisher's protected least significant difference test *(P* $\leq$ 0.05) is presented on the tables for simplicity.

Results and Discussion

The experimental nematicides by Bayer responded differently in root-knot and reniform fields. In the root-knot test, cotton plant stands were ideal ranging from 3 to 4 plants per foot of row (Table 1). Plants appeared more vigorous in the plots with Aeris and the high rate of Gaucho. Uniformity of the stand was good producing a consistently even appearance to the rows. Thus there were no adverse effects of the experimental nematicides to the cotton seeds or seedlings. In the reniform test (Table 2) similar results were observed in the cotton seedling evaluations. Cotton stand ranged from 3 to 4 plants per foot of row. All the nematicides improved seedling vigor over the untreated control. Uniformity did not vary between any of the treatments and the untreated control. Thus these nematicides did not produce any plant phytotoxicity or seedling stress that adversely affect the initial growth of the cotton plant.
Gall ratings in the root-knot test (Table 1) showed no differences ($P \geq 0.05$) between the nematicides and the control; however the fewest galls were observed in the Poncho + Votivo 12.7 oz/cwt and the Avicta 500 FS 0.15 mgai/seed + Cruiser 600 FS 0.34 mgai/seed treatments. The lowest numbers of eggs per gram of root were also observed in these treatments. Reniform numbers in the experimental nematicides were not different from the control at 30 and 60 DAP (Table 2). Numbers of nematodes were low at 30 DAP but increased to threshold levels by 60DAP. By harvest all nematicide treatments supported larger populations of reniform than the control. This indicated these plants supported a larger root system by the late season which supported the reniform population. Cotton yield is the determining factor of a nematicides success. In the root-knot test (Table 1) yield was increased by all nematicides ($P \geq 0.05$). The increase in yield ranged from 542 to 1051 lb of seed cotton per acre with the average increase of 837 lb. The PonchoVotivo treatment increased yield by 27.5% over the control while Aeris increased yield by 39.6%. The highest yielding combination was Aeris with Votivo with a 53.1% increase over the control. Although, the four compound combination of Aeris Poncho Votivo and Gaucho produced similar increases of 50.5%. In this root-knot field all nematicides tested increase yield significantly over the untreated control. In the reniform field, there were no differences in yield ($P \geq 0.05$) between the control and the nematicides tested (Table 2). Gaucho 600 FS at the 12.7 oz/cwt rate increased yields 28% (633lb seed cotton per acre) over the control. The combination of Aeris and Gaucho 600 FS at the 6.37 oz/cwt rate also increase yield by 24.5%. The new Poncho Votivo combination also increased yield similarly to the Aeris Poncho Votivo combination.

The experimental nematicides by Syngenta responded similarly in the northern and southern reniform fields. In the northern location (Table 3) plant stand was ideal ranging from 2.7 to 4.1 plants per foot of row. The control base fungicide treatment did have lower ($P \leq 0.05$) stand than the two experimental STP 15273 alone and STP 15273 combined with STP 17217 and 17170 (Table 3). Cotton plants appeared more vigorous ($P \leq 0.05$) in all six nematicide or insecticide treatments compared to the fungicide control. In the southern location test (Table 4) similar results were observed in the cotton seedling evaluations. Cotton stand ranged from 2.6 to 3.7 plants per foot of row with all treatments being similar to the base fungicide control. All the nematicide treatments and the Cruiser 5FS insecticide treatment improved seedling vigor over the untreated control. Uniformity did not vary between any of the treatments and the untreated control in either test. These experimental nematicides did not cause any plant stress or visual phytotoxicity that unfavorably influenced growth of the cotton plant during the first 30 DAP.
Reniform numbers in the experimental nematicides were not different from the control at 30 and 60 DAP (Table 3 and 4) at either location. Numbers of reniform nematodes were lower ($P \leq 0.05$) in the Temik 15 G and the STP 15273 treatments as compared to the Cruiser 5FS treatment in the southern location at 30 DAP. No differences in numbers were observed at 60 DAP in July. Alabama was experiencing a drought at that time and nematode numbers appeared to be more influenced by the lack of rainfall than any other factors. By harvest most nematicide treatments supported similar populations of reniform as compared to the control. However, A16115 + Temik 15G supported 70 % fewer reniform than Cruiser 5FS in the northern location (Table 3). In the southern location all populations remained low due to the drought. Field plots don't often depict nematode population effects but are an accurate indication of nematicides success when cotton yield is the detected. In the northern reniform test under irrigation (Table 3) yield was similar between the nematicides and the control ($P \leq 0.05$). The experimental A16115 + Temik 15 G increased yield by 1723 lb seed cotton per acre or 70% over the Cruiser 5FS treatment. In the southern location with was not irrigated all nematicide treatments increased yield ($P \leq 0.05$) over the fungicide control. All five nematicide treatments increased cotton yield by an average of 30 % when evaluated to the control. The experimental A16115 + Temik 15 G treatment which did well in the northern location also increased yield by 705 lb seed cotton per acre or 33% over the control.

Conclusion

The effects of reniform and root knot nematodes on cotton, as demonstrated in these studies, may be variable depending on irrigation and the environmental conditions of each location. The nematicide seed treatments used in these studies had did not indicate any phytotoxicty to the cotton plants. The experimental seed treatments from Bayer Crop Science significantly improved seed cotton yields in the root-knot field. Yields were only numerically affected by the same nematicide seed treatments in the reniform field under irrigation. The experimental nematicide seed treatments by Syngenta also significantly improve seed cotton yields in the reniform nematode field location without irrigation. Yields were only numerically affected by the same nematicide seed treatments in the reniform field under irrigation. Seed cotton yields in the Bayer experimental tests were increase by 837 and 627 lb/A when yield was averaged over all of the experimental nematicide seed treatment over the control in the root-knot and reniform locations, respectively. The value of the additional seed cotton yield once converted to lint averaged $251 (root-knot) and $188 (reniform) dollars per acre for cotton selling at $0.75 per pound, respectively. Seed cotton yields in the Syngenta experimental tests were increase by 304 and 604 lb/A when yield was averaged over all of the experimental nematicide seed treatment over the control in the irrigated and non irrigated reniform locations, respectively. The value of the additional seed cotton yield once converted to lint averaged $92.1 and $181.2 dollars per acre for cotton selling at $0.75 per pound for the irrigated and non irrigated reniform fields, respectively.

Disclaimer

The interpretation of data may change with additional experimentation. Information is not to be constructed as a recommendation for use or as an endorsement of a specific product by Auburn University or Mississippi State University.

Table 1. Experimental nematicides effects of cotton stand, vigor, uniformity, root galling, root-knot numbers, and cotton yield in central Alabama, 2010.

	Treatment and rate	Stand/ 10 ft 2-June	Vigor[w] 2-June		Skip index[x] 2-June		Gall index 2-June		Eggs/ gm root 2-June		Seed cotton lb/A 1-Oct	
1	Control[z]	33.4	2.4	c	4.6	a	5.2	abc	2542	b	1979.4	b
2	Gaucho 600 FS 6.39 oz/cwt	39.8	3.8	ab	2.4	a	4.6	abc	5950	a	2877.3	a
3	Poncho + Votivo 12.7 oz/cwt	35.2	3.0	bc	3.2	a	3.8	c	1950	bc	2524.7	a
4	Gaucho 600 FS 6.39 oz/cwt + Poncho + Votivo 12.7 oz/cwt	35.8	3.4	abc	1.8	b	5.4	abc	5190	ab	2786.7	a
5	Aeris 0.75 mg ai/seed	38.8	4.0	ab	2.4	a	5.8	ab	8324	a	2762.3	a
6	Aeris 0.75 mg ai/seed + Gaucho 600 FS 6.39 oz/cwt	38.8	4.2	ab	2.0	b	5.2	abc	3274	bc	2897.0	a
7	Aeris 0.75 mg ai/seed + Votivo 240FS 3.5 oz/cwt	36.6	4.3	ab	4.2	a	4.8	abc	3054	bc	3030.6	a
8	Aeris 0.75 mg ai/seed + Poncho + Votivo 12.7 oz/cwt	44.8	4.6	a	1.2	b	6.2	a	6086	a	2826.2	a
9	Aeris 0.75 mg ai/seed + Poncho + Votivo 12.7 oz/cwt + Gaucho 6.39 oz/cwt	37.4	4.0	ab	2.0	b	4.0	bc	2118	bc	2979.5	a
10	Gaucho 600 FS 12.78 oz/cwt	40.8	4.2	ab	1.0	b	6.2	a	4308	ab	2844.8	a
11	Avicta 500 FS 0.15 mgai/seed +Cruiser 600 FS 0.34 mgai/seed	34.2	3.4	abc	2.0	b	3.8	c	1952	bc	2631.0	a
	LSD (P > 0.05)	8.7	0.7		2.5		1.1		3603		482.4	

[w]Vigor based on a 1 to 5 scale with 3 representing the control of each rep. Four is better than the control and 5 is much better than the control. Two is worse that the control and 1 is much worse that the control.

[x] Uniformity is the amount of empty row without plants. Every skip over 1 ft increased the liner row feet that are bare.

[z] Baytan 30 0.5 oz/ cwt + Allegiance FL 0.75 oz/cwt +Vortex FL0.085 oz/cwt seed treatment was placed on all seed.

Table 2. Experimental nematicides effects of cotton stand, vigor, uniformity, reniform numbers, and cotton yield in north Alabama, 2010.

	Treatment and rate	Stand/10 ft 25-May		Vigor[x] 25-May		Skip index[y] 25-May	Reniform per 150 cc soil 25-May		29-Jun	1-Oct		Seed cotton lb/A 1-Oct
1	Control[z]	31.6	b	2.6	c	1.4	278.1	b	1158.8	1344.4	b	2189.1
2	Gaucho 600 FS 6.39 oz/cwt	38.4	ab	3.5	ab	0.6	278.1	b	1081.5	1576.0	b	2392.3
3	Poncho + Votivo 12.7 oz/cwt	36.4	ab	3.5	ab	1.4	648.9	a	865.2	2271.2	ab	2597.7
4	Gaucho 600 FS 6.39 oz/cwt + Poncho + Votivo 12.7 oz/cwt	39.2	a	3.7	ab	0.4	108.2	b	1575.9	1684.4	b	2410.1
5	Aeris 0.75 mg ai/seed	33.6	ab	3.6	ab	1.6	139.1	b	1745.9	2008.6	ab	2669.8
6	Aeris 0.75 mg ai/seed + Gaucho 600 FS 6.39 oz/cwt	35.8	ab	3.8	a	1.6	216.3	b	865.2	2039.4	ab	2725.1
7	Aeris 0.75 mg ai/seed + Votivo 240FS 3.5 oz/cwt	36.0	ab	3.8	a	0.2	355.4	a b	1854.0	2487.4	ab	2378.2
8	Aeris 0.75 mg ai/seed + Poncho + Votivo 12.7 oz/cwt	35.6	ab	3.6	ab	1.2	200.9	b	1189.7	2271.6	ab	2567.4
9	Aeris 0.75 mg ai/seed + Poncho + Votivo 12.7 oz/cwt + Gaucho 6.39 oz/cwt	33.4	ab	3.5	ab	0.4	324.5	b	1066.1	2626.4	ab	2195.4
10	Gaucho 600 FS 12.78 oz/cwt	38.0	ab	3.5	ab	0.4	216.3	b	741.6	1962.2	ab	2821.8
11	Avicta 500 FS 0.15 mgai/seed + Cruiser 600 FS 0.34 mgai/seed	35.6	ab	3.3	b	0.8	185.4	b	865.2	3198.2	a	2179.7
	LSD (P > 0.05)	7.5		0.5		1.5	318.9		1401.7	1344.5		722.5

[x]Vigor based on a 1 to 5 scale with 3 representing the control of each rep. Four is better than the control and 5 is much better than the control. Two is worse that the control and 1 is much worse that the control.
[y] Uniformity is the amount of empty row without plants. Every skip over 1 ft increased the liner row feet that are bare.
[z] Baytan 30 0.5 oz/ cwt + Allegiance FL 0.75 oz/cwt +Vortex FL0.085 oz/cwt seed treatment was placed on all seed.

Table 3. Experimental nematicides effects of cotton stand, vigor, reniform numbers, and yield throughout the season in north AL, 2010.

	Treatment[z] and rate	Stand/10 ft 25-May		Vigor[y] 25-May		Reniform per 150 cc soil 25-May		29-Jun	1-Oct		Seed cotton lb/A 1-Oct	
1	Control[z]	27.8	c	2.2	c	386.3	abc	571.7	2379.2	ab	2632.1	ab
2	Cruiser 5FS 0.34mgai/seed	33.4	bc	3.4	ab	633.5	a	710.7	4341.8	a	2445.2	b
3	A16115 0.5mgai/seed	30.8	bc	3.4	ab	278.1	bc	463.5	1792.4	ab	3112.5	ab
4	A16115 0.5mgai/seed + Temik 15G 5 lb/a	33.0	bc	3.2	b	494.4	ab	540.8	1282.8	b	3575.4	a
5	Temik 15G lb/a	30.6	bc	3.4	ab	139.1	c	278.1	2549.6	ab	3294.3	ab
6	STP 15273 0.375mgai/seed	41.4	a	3.8	a	154.5	c	231.8	2317.8	ab	3035.3	ab
7	STP 15273 0.375mgai/seed + STP 17217 0.375mgai/seed + STP 17170 10.0 mgai/seed	35.6	b	3.6	ab	370.8	abc	401.7	2982.2	ab	2509.6	b
	LSD (P > 0.05)	5.79		0.55		312.2		594.8	2246.7		1019.4	

[y]Vigor based on a 1 to 5 scale with 3 representing the control of each rep. Four is better than the control and 5 is much better than the control. Two is worse that the control and 1 is much worse that the control.
[z] Apron XL 3LS 15 g/100kg + Maxim 4 FS 2.5 g/100kg + Systhane 40 WP 21 g/100kg + Dynasty CST 125FS 0.03mgai/seed were placed on all the seed.

Table 4. Experimental nematicides effects of cotton stand, vigor, root knot numbers, and yield throughout the season in south AL, 2010.

Treatment[z] and rate		Stand/10 ft		Vigor[y]		Reniform per 150 cc soil				Seed cotton lb/A	
		8-June		8-June		8-June	22- July	1-Oct		1-Oct	
1	Control[z]	30.2	bcd	3.0	c	321.9	571.7	772.5	ab	2101.6	c
2	Cruiser 5FS 0.34mgai/seed	36.5	a	4.2	b	412.0	710.7	785.3	ab	2524.8	b
3	A16115 0.5mgai/seed	32.7	abc	4.8	a	682.4	463.5	759.8	ab	2706.0	ab
4	A16115 0.5mgai/seed + Temik 15G 5 lb/a	29.5	cd	4.7	ab	476.4	540.8	759.8	ab	2806.9	ab
5	Temik 15G lb/a	25.5	d	4.8	a	566.5	278.1	592.7	b	2812.8	a
6	STP 15273 0.375mgai/seed	34.7	ab	5.0	a	347.6	231.8	721.2	b	2633.8	ab
7	STP 15273 0.375mgai/seed + STP 17217 0.375mgai/seed + STP 17170 10.0 mgai/seed	34.3	abc	5.0	a	515.0	401.7	1223.2	a	2751.0	ab
	LSD (P > 0.05)	4.98		0.51		487.0	190.0	471.2		286.6	

[y]Vigor based on a 1 to 5 scale with 3 representing the control of each rep. Four is better than the control and 5 is much better than the control. Two is worse that the control and 1 is much worse that the control.

[z] Apron XL 3LS 15 g/100kg + Maxim 4 FS 2.5 g/100kg + Systhane 40 WP 21 g/100kg + Dynasty CST 125FS 0.03mgai/seed were placed on all the seed.