BELTWIDE NEMATODE RESEARCH AND EDUCATION COMMITTEE 2014 NEMATODE RESEARCH REPORT COTTON VARIETAL AND NEMATICIDE RESPONSES IN NEMATODE SOILS

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Abstract

The 2014 National Cotton Council Nematode Research and Education Committee's nematode research project evaluated nematicide treatment combination in reniform and root-knot infested cotton fields across the Cotton Belt in diverse cotton production systems. Five nematicide treatments were nominated by Bayer Crop Science for evaluation and compared to a Gaucho insecticide control on two cotton cultivars. The results presented are from the locations where stand, vigor, nematode ratings or populations and yield were collected for the 2014 Nematode Research Project. Analysis of the data detected no significant cultivar by nematicide interactions for the 2014 trials, indicating the nematicide treatment responses were similar on both cotton cultivars. Cotton plant stand was similar across cultivars and nematicides ranging from 1 to 3 plants per foot of row and averaging 2.7 plants over all tests. The nematode tolerant variety Stoneville 4946 B2RF vigor ratings were similar to the susceptible variety Fiber Max 1944GLB2. Nematicides affected vigor with the Velum Total in-furrow spray over the Aeris seed treatment, and Aeris seed treatment plus the foliar Vydate CLV spray, and the industry standard Temik 15 G supporting the most vigorous plants compared to the Gaucho seed treatment. Stoneville 4946 B2RF supported 20% lower nematode population densities than Fiber Max 1944GLB2 at the 30 to 60 day after planting sampling period. The Velum Total plus Aeris nematicide treatment reduced nematode densities ($P \leq 0.05$) 54% compared to Gaucho seed treatment. Seed cotton yields were affected by cultivar and nematicide. Stoneville 4946B2RF produced 5% more seed cotton than the susceptible variety Fiber Max 1944GLB2. Velum Total plus Aeris produced similar yields to Temik 15G which produced significantly more cotton that the Gaucho seed treatment. The Velum Total plus Aeris increase was 9% greater or 273 lb/A of seed cotton averaged over all locations across the Cotton Belt.

Introduction

The objective of the Beltwide Cotton Nematode Research and Education Committee is to build awareness of the growing economic impact of cotton nematodes to the U.S. cotton producers. The committee was initiated in 1986 and is comprised of Extension and Research Specialists from Land Grant Universities across the Cotton Belt. We support this objective by providing information on identification of nematode species, distribution and densities of

nematode populations, and control measures including cultural and chemical practices. The committee meets on an annual basis to report research findings and identify new priority needs for future cooperative projects.

Materials and Methods

Six nematicide treatments were nominated by Bayer Crop Science for evaluation on two cotton cultivars for the 2014 nematode trials. These trials were planted in 9 locations across the Cotton Belt.

Cotton cultivars

Stoneville 4946B2RF (ST4946) and Fiber Max 1944GLB2 (FM1944) were selected based on the cultivar's yield performance in Agronomist trials in multiple states. ST4946 could be considered tolerant to root-knot or reniform nematode due to a good yield history. FM1944 was included as a reference cultivar because of its susceptibility to reniform and root-knot nematode and it's known response to nematicides. The ST4946 and FM1944 were included in each test at each location and treated with all the nematicides. The premium seed treatment fungicide package and Gaucho 600 (12.8 oz/cwt) were applied to standardize the fungicide and insecticide package.

Nematicide treatments

Two standard nematicide treatments, Temik 15 G (aldicarb), applied as an in-furrow granule at 5 lb/A was included as the historical standard, and Aeris (thiodicarb) applied as a seed treatment at 0.75 mg ai per seed was included as the standard seed treatment nematicide. Velum Total (imidacloprid + fluopyram) was applied at planting as an in-furrow spray (18 oz/A) over the seed treatment Aeris (0.75 mg a.i./seed). Gaucho + fluopyram (12.8 oz/cwt + 0.175 mg a.i. per seed) comprised a new premium seed treatment nematicide option. Aeris (0.75 mg a.i. per seed) followed by one or two foliar sprays of Vydate CLV (one spray at 17 oz/A at the 2 – 8 leaf stage or two sprays at 8.5 oz/A at the 2 – 8 leaf stage and 14 days later). Gaucho 600 (12.8 oz/cwt) represented the non-nematicide control and was included to assess the nematode disease pressure in each field. All nematicides and rates are listed in Table 1.

Field experiments

Nine field experiments were conducted by eight cooperators across the U.S. Cotton Belt. Complete data sets were collected from eight locations and are presented. Each location utilized a randomized complete block experimental design, with the number of replications ranging from 4 to 5. Cotton was planted in 2 or 4 rows plots with plot lengths of 25 to 60 feet long and row spacing ranged from 36 to 40 inches. The cotton cultivars were treated with nematicide seed treatments by Bayer Crop Science. Temik 15 G was applied at planting with granular hoppers attached to the planter. The in-furrow Velum Total was applied with nozzles plumed to apply the spray perpendicularly to the row immediately before the seed drop in 3 to 5 gallon per acre (GPA). The foliar Vydate CLV spray applications were applied as broadcast sprays with CO_2 charged back pack sprayers or with small plot tractor sprayer systems applying 5 to 20 GPA. The nematode populations were determined at planting, 30-60 days after planting (DAP) and at harvest. Cotton stand counts and vigor ratings used in the analyses were taken approximately 30 DAP. Seed cotton yield was0 mechanically collected at harvest.

Statistics

The effect of nematicide and cotton variety were analyzed over all locations as a group, using Proc Glimmix, SAS version 9.3 (SAS Institute Inc., Cary NC). The model statement listed the Cultivar and Nematicide and their interaction, and the random statement included Location, Rep(Location), and Cultivar × Nematicide × Rep(Location). The critical value of $P = 0.01$ was used for testing the fixed effects of nematicide, cultivar and their interaction, although preference was given to models that were significant at $P < 0.05$. Determination of differences in the least squares means was based on adjusted P values obtained by using the options adjust = Tukey in the LSMEANS statement. Percent stand, plant vigor, nematode ratings or populations, and yield were analyzed. The Pearson-product correlation method was used to examine the relationship among percent stand, vigor, nematode population densities, and yields over locations.

Table 1. Nematicides formulations, application rates and cotton cultivars included in the 2014 NCC Nematicide Research Program.

Trt#	Variety	Nematicide	Rate	Rate unit	Application Type
1	ST4946B2RF	Gaucho 600	0.500	mg ai/seed	Seed treatment
2	ST4946B2RF	Temik 15 G	5.0	lbs/A	In furrow granule
3	ST4946B2RF	Velum Total IFS + Aeris	18 oz + 0.75	fl oz/A (IFS) + mg ai/seed (ST)	In-furrow spray + Seed treatment
4	ST4946B2RF	Aeris	0.75	mg ai/seed	Seed Treatment
5	ST4946B2RF	Gaucho + Fluopyram	0.75 + 0.175	mg ai/seed	Seed Treatment
6	ST4946B2RF	Aeris + Vydate CLV	0.175 + 16oz (x2)	mg ai/seed + 16oz (x2)	Seed Treatment + foliar applications
7	FM 1944B2F	Gaucho 600	0.500	mg ai/seed	Seed treatment
8	FM 1944B2F	Temik 15 G	5.0	lbs/A	In furrow granule
9	FM 1944B2F	Velum Total IFS + Aeris	18 oz + 0.75	fl oz/A (IFS) + mg ai/seed (ST)	In-furrow spray + Seed Treatment
10	FM 1944B2F	Aeris	0.75	mg ai/seed	Seed treatment
11	FM 1944B2F	Gaucho + Fluopyram	0.75 + 0.175	mg ai/seed	Seed treatment
12	FM 1944B2F	Aeris + Vydate CLV	0.175 + 16oz (x2)	mg ai/seed + 16oz (x2)	Seed Treatment + foliar applications

Results and Discussion

Nematicides and cotton cultivar influenced cotton stand, vigor, nematode populations, and yield when analyzed across all locations. There were 7 trials with complete data sets in the 2014 National Cotton Council Nematicide Program, there were no significant Cultivar × Nematicide interactions in these trials (Table 2), indicating that the cultivar and nematicide response were similar across locations.

Table 2. Significant probability for the combined analysis of variance across locations, 2014 NCC Nematode Research Program.

		Probability of a significant F-test			
	Degrees of freedom	Stand/ ft row	Vigor	Nematodes 30-60 DAP	Yield lb/A
Cultivar	1	0.7579	0.2094	0.2860	0.0006
Nematicide	5	0.1930	0.0010	0.0263	0.0040
Cultivar * Nematicide	5	0.1889	0.6588	0.1543	0.9696

Over all, cotton plant stand was similar across cultivars and nematicides (Table 3) ranging from 0.5 to 4.4 plants per foot of row and averaging 2.7 plants over all tests. Vigor of the cotton plants near 30 DAP was similar for both cultivars but significant between nematicides. The tolerant cultivar Stoneville 4946B2RF vigor rating were comparable to the susceptible cultivar Fiber Max 1944GLB2. Nematicides affected vigor with the Velum Total plus Aeris, and Aeris + Vydate CLV, and Temik 15 G treatments supporting the most vigorous plants compared to the Gaucho seed treatment. These vigor increases suggest the nematicides are important for early season plant health and affect both cultivars.

Root-knot and reniform nematode population densities were measured from extracting from soil or plant roots and overall, the tolerant cultivar Stoneville 4946B2RF supported 20% fewer nematodes than the susceptible cultivar Fiber Max 1944GLB2 (Table 3). The Velum Total plus Aeris supported the lowest nematode population densities compared to the Gaucho seed treatment reducing nematode densities by 54% over all. (Table 3). The Velum Total plus Aeris nematode levels were similar to those of Temik 15 G. Fluopyram is one ingredient in the Velum Total and the Gaucho plus Fluopyram seed treatment also supported similar nematode population densities as the Velum Total plus Aeris and the Temik 15 G treatments.

Seed cotton yield varied across locations with lowest yields in the reniform infested north Alabama field and the greatest yields in the Virginia field. The tolerant variety Stoneville 4946B2RF produced a 5% greater yield compared to Fiber Max 1944 GLB2 ($P \geq 0.0006$) over all locations (Table 3). Stoneville 4946 B2RF produced significantly more cotton by an average of 163 lb/A. Nematicides that increased plant vigor and reduced nematode populations were also the ones with the greatest yields (Table 3). Temik 15 G alone and Velum Total in-furrow spray added to the Aeris seed treatment were statistically similar. The Velum Total in-furrow spray added to the Aeris seed treatment increase yield 9 % over the Gaucho control. The largest increase in yield occurred in the Alabama reniform field were the Velum Total in furrow spray added to the Aeris seed treatment increasing seed cotton yields by 40%. The Arkansas, Louisiana, Mississippi and Virginia locations all produced 10% increases in yield in the same nematicide comparisons.

In addition, combining all locations determined either root-knot or reniform nematodes 30-60 DAP correlated positively (P=0.0001) with stand 0.3584 indicating that more plants supported greater densities of nematodes. This correlation would be expected. The root-knot or reniform nematodes 30-60 DAP also correlated negatively (P=0.0001) with plant vigor -0.0094, and yield -0.2880. Greater population levels of nematodes reduced plant vigor but at a low level. These nematode intensities were found at approximately one to two generations in the early season did reduce the harvested cotton yield by an estimated 28%.

Table 3. Cotton variety and nematicide combinations effects on stand, vigor, nematode densities, and yield over 7 locations in 2014.

Cotton variety	Nematicides and rate	Stand[w] 30 DAP	Vigor[x] 30 DAP	Nematode[y] 30-60 DAP	Seed cotton (lb/A)
	1. Gaucho 600 (0.5 mg ai/seed)……..……	2.80	3.2 b[z]	3698 a	2840 b
	2. Temik 15 G 5lb/A ……..…	2.70	3.6 a	2262 b	3064 a
	3. Velum Total IFS (18oz/a) + Aeris (0.75 mg ai/seed) ……..……	2.83	3.6 a	1670 b	3113 a
	4. Aeris (0.75 mg ai/seed)……	2.76	3.4 ab	3057 ab	2883 b
	5. Gaucho + Fluopyram (0.5 mg + 0.175 ai/seed) …….....	2.79	3.4 ab	2563 b	2981 ab
	6. Aeris (0.75 mg ai/seed) + Vydate 17oz/A..…	2.71	3.5 a	3910 ab	2899 b
Cultivars					
ST 4946GLB2	(Tolerant)	2.78	3.8	2548	3045 a
FM 1740 B2F	(Susceptible)	2.75	3.7	3027	2882 b

[w] Stand is present as number of plants per 1 foot of row.
[x] Vigor is presented on a 1 to 5 scale with 3 being average and 5 being much better than average and 1 being much worse than average.
[y] Nematodes are either *Meloidogyne incognita* or *Rotylenchulus reniformis* and were numbers collected from soil samples, or eggs extracted from roots dug from each plot.
[z] Means followed by same letter do not significantly differ according to Tukey-Krame ($P < 0.10$).

Summary

The results from the eight locations where nematode and yield data were collected for the 2014 National Cotton Council Nematicide Program indicated that nematicides affected cotton cultivars similarly this season. Over all locations, nematicides significantly increase cotton yield and reduced reniform and or root-knot populations at 30-60 DAP. These data across the Cotton Belt indicate the use of a nematicide treatment is an important practice for supporting early season plant health and increasing yield production in nematode infested fields.

Disclaimer

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