

**BELTWIDE NEMATODE RESEARCH AND EDUCATION COMMITTEE 2015 NEMATODE
RESEARCH REPORT COTTON VARIETAL AND NEMATICIDE RESPONSES IN NEMATODE SOILS**

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Abstract

The 2015 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 2015 Nematode Research Project. Analysis of the data found no significant cultivar by nematicide interactions for the 2015 trials, indicating the nematicide treatment responses were similar on both cotton cultivars. Cotton plant stand was similar across cultivars and nematicides averaging 3.4 plants per foot of row over all tests. The nematode tolerant variety Stoneville 4946 B2RF vigor ratings were significantly better than the susceptible variety Fiber Max 1944 GLB2. Nematicides did affect vigor with the industry standard Temik 15 G, Velum Total in furrow spray over the Aeris seed treatment, and Aeris seed treatment alone, and Gaucho plus Fluopyram seed treatment 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. Seed cotton yields were similar between cultivars. Velum Total plus Aeris ranked highest in yields across all locations across the cotton belt but was not significantly different from the Gaucho control in 2015.

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

Five nematicide treatments were nominated by Bayer Crop Science for evaluation on two cotton cultivars for the 2015 nematode trials. These trials were planted in 9 locations across the cotton belt in 2015 with 8 locations reporting data.

Cotton cultivars

Stoneville 4946 B2RF (ST4946) and Fiber Max 1944 GLB2 (FM1944) were selected for all trials based on these cultivars yield performances in Agronomist trials in multiple states. ST4946 could be considered tolerant to root knot or reniform nematodes due to its good yield history. FM1944 was included as a reference cultivar because of its susceptible to reniform and root knot nematodes and its 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 all seed treatment at the same rate 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 at the standard seed treatment nematicide. Velum Total (imidacloprid + fluopyram) was applied at planting as an in furrow spray (14 oz/A) over the seed treatment AERIS (0.75 mg ai/seed). Gaucho + Fluopyram (12.8 oz/cwt + 0.175 mg ai per seed) comprised a new premium seed treatment nematicide option. 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 12 gallon per acre (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 near 30 DAP. Seed cotton yields were 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 9.4 (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 x Nematicide x Rep(Location). The critical value of $P = 0.05$ was used for testing the fixed effects of nematicide, cultivar and their interaction, though preference was given to models that were significant at $P < 0.10$. Determination of differences in 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 varieties					
Trt#	Cultivar	Nematicide	Rate	Rate unit	Application Type
1	ST4946B2RF	Gaicho 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	14 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	Gaicho + Fluopyram	0.75 + 0.175	mg ai/seed	Seed Treatment
6	FM 1944B2F	Gaicho 600	0.500	mg ai/seed	Seed treatment
7	FM 1944B2F	Temik 15 G	5.0	lbs/A	In furrow granule
8	FM 1944B2F	Velum Total IFS + Aeris	14 oz + 0.75	fl oz/A (IFS) + mg ai/seed (ST)	In-furrow spray + Seed Treatment
9	FM 1944B2F	Aeris	0.75	mg ai/seed	Seed treatment
10	FM 1944B2F	Gaicho + Fluopyram	0.75 + 0.175	mg ai/seed	Seed treatment

Results and Discussion

Nematicides and cotton cultivar influenced cotton stand, vigor, nematode populations, and yield when analyzed across all locations. There were 8 trials with complete data sets in the 2015 National Cotton Council Nematicide Program. Data analysis indicated no significant Cultivar x 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, 2015 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	0.0001	0.0002	0.0494	0.3660
Nematicide	5	0.1826	0.0398	0.3232	0.9471
Cultivar * Nematicide	5	0.1592	0.1600	0.5811	0.5263

Overall, cotton plant stand was greater with the FM 194GLB2 cultivar than the ST 4946B2RF (Table 3) but both stand numbers fell within the acceptable range of 1 to 4 plants per foot of row and averaging 3.4 plants over all tests. Cotton plant stand was similar across all nematicide treatments for both varieties as well. Vigor of the cotton plants near 30 DAP was improved for the FM 194GLB2 susceptible cultivar over the ST 4946B2RF tolerant cultivar. All the nematicide applications improved vigor as compared to the Gaicho control. Nematicides did 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 Gaicho 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 4946 B2RF supported 20 % fewer nematodes than the susceptible cultivar Fiber Max 1944GLB2 (Table 3). The Temik 15 G supported the lowest nematode population densities compared to the Gaicho seed treatment reducing nematode densities by 48% over all (Table 3). The Velum Total plus Aeris nematode levels were statistically similar to those of Temik 15 G. Fluopyram is one ingredient in the Velum Total and the Gaicho plus Fluopyram seed treatment also supported similar nematode population densities as the Velum Total plus Aeris treatments.

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

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).....		3.3	3.2 b ^z	4251	2884
2. Temik 15 G 5lb/A		3.4	3.6 a	2217	2941
3. Velum Total IFS (18oz/a) + AERIS (0.75 mg ai/seed)		3.4	3.5 ab	4082	2943
4. AERIS (0.75 mg ai/seed).....		3.4	3.4 ab	3648	2911
5. Gaucho + Fluopyram (0.5 mg + 0.175 ai/seed)		3.4	3.5 ab	4090	2928
Cultivars					
ST 4946GLB2	(Tolerant)	3.3	3.32 b	2803	2944
FM 1740 B2F	(Susceptible)	3.5	3.58 a	3509	2898

^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-Kramer ($P < 0.10$).

Seed cotton yield varied across locations with lowest yields in the reniform infested Louisiana field and the highest yields in the Mississippi field. The tolerant variety Stoneville 4946 B2RF produced similar yields compared to Fiber Max 1944 GLB2 over all locations (Table 3). Ranking the nematicide treatments by yield indicated the Velum Total in furrow spray added to the AERIS seed treatment produced numerically the greatest yield followed by Temik 15 G, the Gaucho plus Fluopyram seed treatment, AERIS seed treatment alone, and finally the Gaucho control over all locations (Table 3). Velum Total in furrow spray added to the AERIS seed treatment produced numerically the greatest yield in 5 of the 7 trials in 2015. The largest increase in yield occurred in the Arkansas field where the Velum Total in furrow spray added to the AERIS seed treatment increasing seed cotton yields by 462 lb/A. The Alabama, Louisiana, Mississippi, North Carolina, Texas and Virginia locations all produced at least a 4% increases in yields in the same nematicide comparisons.

Disclaimer

This paper reports the results of research only. Mention of a pesticide or variety in this paper does not constitute a recommendation by the any of the Universities represented by the authors.