BELTWIDE NEMATODE RESEARCH AND EDUCATION COMMITTEE REPORT ON COTTON CULTIVARS AND NEMATICIDES RESPONSES IN NEMATODE SOILS, 2017

T. R. Faske
Lonoke Extension Center, University of Arkansas Division of Agriculture
Lonoke, AR
T. W. Allen
Delta Research and Extension Center, Mississippi State University
Stoneville, MS
G. W. Lawrence
Mississippi State University
Mississippi State, MS
K. S. Lawrence
Auburn University
Auburn, AL
H. L. Mehl
Tidewater Agriculture Research and Extension Center, Virginia Tech
Suffolk, VA
C. Overstreet
Louisiana State University
Baton Rouge, LA
T. Wheeler
Texas AgriLife Research
Lubbock, TX

Abstract

The 2017 National Cotton Council Nematode Research and Education Committee evaluated two seed-applied and one in-furrow applied nematicide to manage *Meloidogyne incognita* or *Rotylenchulus reniformis* in cotton. The susceptible cotton cultivar Stoneville 4949 GLB2 was used at all ten site locations across the United States Cotton Belt. All treatments were arranged in a randomized complete block. None of the nematicides had a significant effect on crop stand or seedling vigor. Southern root-knot nematode infection was ranked from lowest to greatest at three sites based on gall counts per root system, root gall ratings, or eggs extracted from root systems. The nematicide treatment COPeO Prime + Velum Total at 10 oz/A was ranked the lowest for nematode infection. Of the trails conducted in *M. incognita* infested fields, Velum Total at 14 oz/A had the greatest ($P = 0.05$) impact on yield protection compared to the base fungicide and Aeris treated seed. Similarly, in the *R. reniformis* trials, COPeO Prime + Velum Total at 10 oz/A contributed to a lower ($P = 0.05$) nematode population density recovered from soil samples compared to the base fungicide treated seed. Though there was no significant differences in yield protection by the nematicide treatments, the greatest yield protection was observed with Velum Total at 14 oz/A, COPeO Prime + Velum Total at 14 oz/A, and AgLogic at 5 lb/A. Overall, all nematicide treatments provide some degree of nematode suppression and yield protection over the non-nematicide treatments in both southern root-knot and reniform infested fields.

Introduction

The southern root-knot nematode (*Meloidogyne incognita*) and reniform nematode (*Rotylenchulus reniformis*) continue to be among the most yield limiting factors affecting cotton production across the United States Cotton Belt. For the past three years, estimates of yield loss by these two nematode species exceed more than 3% across the Cotton Belt (Lawrence *et al.*, 2015; Lawrence *et al.*, 2016; Lawrence *et al.*, 2017). Though a few cotton cultivars with resistance to southern root-knot nematode are commercially available, none have resistance to *R. reniformis*. Nematicides are an important part of an integrated pest management program and evaluating them across the cotton belt provides an understanding of their performance across production systems. Therefore, the objective of this study was to evaluate the relative impact of two seed-applied and one in-furrow applied nematicides in nematode infested soils at several locations across the cotton belt.

Materials and Methods

Cotton Cultivars

The upland cotton cultivar, Stoneville 4949 GLB2, was selected for this study because it is broadly adapted across the U.S. Cotton Belt and susceptible to *M. incognita* and *R. reniformis*.

Nematicide Treatments

All seed were treated with a base fungicide treatment of Allegiance FL (metalaxyl) + EverGol Prime (penflufen) + Spera 240FS (mycolobutanil) + Vortex (ipconazole) at a rate of 0.75 + 0.33 + 1.8 + 0.08 oz/cwt, respectively, and a storage rate of Gaucho 600F (imidacloprid) at 4.6 oz/cwt. Seed-applied nematicides consisted of Aeris (imidacloprid + thiodicarb) at rate of 0.75 mg ai/seed and COPeO Prime (fluopyram) + Gaucho 600F at a rate of 0.2 mg ai/seed + 4.6 oz/cwt, respectively. All seed were treated by Bayer CropScience. The in-furrow applied nematicide, Velum Total (fluopyram + imidacloprid) was applied at a rate of 14 and 18 oz/A. Different combinations of seed-applied and in-furrow applied nematicides were also evaluated (Table 1). Additionally AgLogic (aldicarb) at 5 lb/A was applied in-furrow at planting in trials conducted in reniform infested fields.

Field Experiments

Six experiments were conducted in *M. incognita* infested fields in Alabama, Arkansas, Texas (n = 2), North Carolina, and Virginia, while four experiments were conducted in *R. reniformis* infested fields in Alabama, Louisiana, and Mississippi (n = 2). These experiments were conducted by seven cooperators (authors). The experimental design was a randomized complete block design with four to five replications per treatment. Individual plots consisted of two to four rows, 25 to 60-ft-long, spaced either 36 to 40-in apart separated by a 3-ft fallow alley. Velum Total was applied in the seed furrow through a flat fan nozzle oriented perpendicular to the seed furrow using a pressurized sprayer. The sprayer was calibrated to deliver 6 to 7 gal/A. Plant stand counts were taken on 30 to 60 days after planting (DAP) and converted to plants per 10 ft of row. Population densities of root-knot and reniform nematodes were sampled at 30 to 60 DAP by collecting a representative soil subsample from each plot by arbitrarily sampling near each seedling. Root-knot nematode infection was determined at 30 to 60 DAP from 5 to 10 root systems based on galls per root system, rating the root system for galls (six or ten point scale) or by extracting eggs with 1.0% NaOCl. Eggs were counted using a stereoscope and used to calculate eggs per g of root. These data were ranked from lowest to greatest based on each method at each location. Seed cotton yield was collected at harvest.

Statistics

Data were analyzed by mixed GLM procedure and mean separation by Tukey's Honest Significant Difference test at $P = 0.10$ using SPSS (version 19.0). The model statement consisted of location, nematicide, and the interaction with a random statement of block. Ranked data was not analyzed.

Results and Discussion

There was no interaction ($P \geq 0.55$) for stand, nematode population density or yield between location and nematicide in *M. incognita* infested soils. There was an interaction ($P = 0.001$) for vigor between locations and nematicides (data not shown), which was due to a lower vigor rating for the fungicide base treatment compared to a few nematicide treatments in Alabama and compared to Aeris treated seed in North Carolina. The main effect of vigor differed between fungicide base and fungicide base + Velum Total at 18 oz/A (Table 1). No effect of treatment was observed for seedling population density (stand) or nematode population density (soil samples). Ranking of root infection (root-galling assessment and nematode reproduction as eggs) indicated that COPeO Prime was among the best seed-applied nematicide, Velum Total at 14 oz/A among the best in-furrow applied nematicide and COPeO Prime + Velum Total at 10oz/A among the best combination treatment, with the combination treatment being the best overall across three locations (two locations had little or no *M. incognita*). A greater ($P = 0.01$) yield was observed for Velum Total at 14 oz/A than fungicide base or Aeris treatment. Overall, all nematicide and insecticide treatments, except Aeris contributed to a greater numeric yield over the base fungicide treatment.

Table 1. Effect seed-applied and in-furrow applied nematicides in *Meloidogyne incognita* infested fields.

Treatment and rate	Stand[z] 30-60 DAP	Vigor[y] 30-60 DAP	*Meloidogyne incognita*[x] 30-60 DAP	Seed cotton (lb/A)
Fungicide base	26.2	3.7 a[w]	1,007	2,436 ab
Aeris (0.75 mg ai/seed)	26.2	4.1 b	2,098	2,408 a
Base + COPeO Prime (0.20 mg ai/seed)	25.9	4.0 ab	1,196	2,595 abc
Aeris + COPeO Prime	25.3	3.9 ab	852	2,693 bc
Base + Velum Total (14 oz/A)	25.8	3.9 ab	1,045	2,710 c
Base+ Velum Total (18 oz/A)	24.7	4.1 b	369	2,695 bc
Aeris + Velum Total (14 oz/A)	25.1	4.0 ab	715	2,678 bc
Base + COPeO Prime + Velum Total (10 oz/A)	25.1	3.9 ab	698	2,623 abc
Base + COPeO Prime + Velum Total (14 oz/A)	24.9	4.0 ab	1,024	2,610 abc
Prob(F)	0.79	0.04	0.43	0.03

[z] Cotton seedlings per 10 ft. of row
[y] Seedling vigor based on 0-5 scale where 5 = most vigorous seedling growth
[x] Population density of *Meloidogyne incognita* per 100 cm^3 soil
[w] With each treatment category, numbers within a column followed by the same letter are not significantly different at *P* = 0.10 according to Turkey's HSD.

There was no interaction for any dependent variable between location and nematicide in reniform infested fields. Seedling stand and vigor were relatively uniform across treatments (Table 2). Fewer (*P* = 0.10) reniform nematodes were observed on COPeO Prime + Velum Total at 10 oz/A than the fungicide base. Yield protection by nematicides was similar among treatments all treatments (Table 2).

Table 2. Effect of seed-applied and in-furrow applied nematicides in *Rotylenchulus reniformis* infested fields.

Treatment and rate	Stand[z] 30-60 DAP	Vigor[y] 30-60 DAP	*Rotylenchulus reniformis*[x] 30-60 DAP	Seed cotton (lb/A)
Fungicide base	25.0	2.9	3,844 a[w]	2,349
Aeris (0.75 mg ai/seed)	24.0	3.0	2,737 ab	2,531
Base + COPeO Prime (0.20 mg ai/seed)	25.0	3.0	1,735 ab	2,544
Aeris + COPeO Prime	25.0	3.1	2,189 ab	2,512
Base + Velum Total (14 oz/A)	25.0	2.9	1,592 ab	2,649
Base+ Velum Total (18 oz/A)	24.0	3.1	1,382 ab	2,467
Aeris + Velum Total (14 oz/A)	24.0	2.9	1,479 ab	2,607
Base + COPeO Prime + Velum Total (10 oz/A)	25.0	2.9	1,118 b	2,349
Base + COPeO Prime + Velum Total (14 oz/A)	27.0	2.9	1,395 ab	2,658
AgLogic (5 lb/A)	23.0	2.9	2,063 ab	2,626
Prob(F)	0.27	0.97	0.04	0.35

[z] Cotton seedlings per 10 ft. of row
[y] Seedling vigor based on 0-5 scale where 5 = most vigorous seedling growth
[x] Population density of *Rotylenchulus reniformis* per 100 cm^3 soil
[w] With each treatment category, numbers within a column followed by the same letter are not significantly different at *P* = 0.10 according to Turkey's HSD.

Summary

The seed-applied nematicide treatments (COPeO Prime or Aeris) had a positive yield difference in 2017, 78% of the time compared to the fungicide base with an average difference of 145 lb seed cotton/A. Similarly, Velum Total at 14 oz/A had a positive yield difference in 2017, 85% of the time compared to the fungicide base with an average difference of 265 lb seed cotton/A. Overall, the majority nematicide treatments provide some degree nematode suppression and yield protection over the non-nematicide treatments in both southern root-knot and reniform infested field trials.

Disclaimer

This paper reports the result of research only. Mention of a pesticide in this paper does not constitute a recommendation by the University of Arkansas, Division of Agriculture or does it imply registration under FIFRA. This work was supported by a grant from Bayer CropScience.

References

Lawrence, K., A. Hagan, R. Norton, T. Faske, R. Hutmacher, J. Muller, D. Wright, I. Small, R. Kemerait, C. Overstreet, P. Price, G. Lawrence, T. Allen, S. Atwell, A. Jones, S. Thomas, N. Goldberg, R. Boman, J. Goodson, H. Kelly, J. Woodward, and H. Mehl. 2017. Cotton disease loss estimates committee report, 2016. Proceedings of the Beltwide Cotton Conferences; New Orleans, LA. National Cotton Council, Cordova. Pp. 150-152.

Lawrence, K., A. Hagan, M. Olsen, T. Faske, R. Hutmacher, J. Muller, D. Wright, R. Kemerait, C. Overstreet, P. Price, G. Lawrence, T. Allen, S. Atwell, S. Thomas, K. Edmisten, R. Boman, H. Young, J. Woodward, and H. Mehl. 2016. Cotton disease loss estimates committee report, 2015. Beltwide Cotton Conferences; January 5-7; New Orleans, LA. National Cotton Council, Cordova, TN. Pp. 113-115.

Lawrence, K., M. Olsen, T. Faske, R. Hutmacher, J. Muller, J Marios, R. Kemerait, C. Overstreet, P. Price, G. Sciumbato, G. Lawrence, S. Atwell, S. Thomas, S. Koenning, R. Boman, H. Young, J. Woodward, and H. Mehl. 2015. Cotton disease loss estimates committee report, 2014. Beltwide Cotton Conferences; January 5-7; San Antonio, TX. National Cotton Council, Cordova, TN. Pp. 188-190.