A POTENTIAL NEW BIOLOGICAL NEMATICIDE FOR *MELOIDOGYNE INCOGNITA* AND *ROTYLENCHULUS RENIFORMIS* MANAGEMENT ON COTTON IN ALABAMA

D. Dyer
K. Lawrence
Auburn University
Auburn, Alabama
D. Long
Albaugh, LLC
Ankeny, Iowa

Abstract

Nematodes were estimated to cause a 4.3% loss in U.S. cotton production during the 2016 growing season. The majority of this damage was a result of the root-knot (*Meloidogyne incognita*) and reniform nematodes (*Rotylenchulus reniformis*) and because of this it is vital to control these nematode populations in cotton fields across the country to ensure high yields. For years, nematicides have been applied to manage these nematodes but with many nematicides becoming unavailable, new nematicides are becoming increasingly important. The objective of this test was to evaluate the effectiveness of different rates and combinations of a new biological nematicide, BioST nematicide produced by Albaugh, LLC, for management of root-knot and reniform nematodes. In root-knot cotton fields, Fluopyram, the high rate of BioST nematicide, and Abamectin all supported increase yields over the untreated control. In reniform fields, the high rate of BioST nematicide was the only treatment tested that supported an increase in yields over the control.

Introduction

Nematodes in cotton have the ability to cause immense amounts of damage, it is estimated that in 2016 nematode caused a 4.3% loss in production in the United States' cotton industry. This is an estimated 672,900 bales of cotton, which at $0.72 per pound this is approximately 242.2 million dollars (Lawrence, et al. 2017). Most of this damage is cause by two main nematodes, *Meloidogyne incognita* (southern root-knot nematode) and *Rotylenchulus reniformis* (reniform nematode). Root-knot nematodes alone cause an estimated 2.15% loss to the industry or 414,700 bales, at $0.72 cotton this is about a 149.3 million-dollar loss (Lawrence, et al. 2017). The reniform nematode was responsible for an estimate 1.43% or 205,300 bales, at $0.72 cotton this is about a 73.9 million-dollar loss (Lawrence, et al. 2017). With this much cotton damage due to nematodes, management strategies to control these nematodes are very important. These management strategies include crop rotation, planting resistant varieties, and applying nematicides.

Both of these nematodes are wide spread throughout tropical and subtropical regions of the world. Root-knot is found across the entire cotton belt while reniform is found from the Texas panhandle east in the United States. A characteristic symptom of root-knot nematode infection on cotton is galling or knotting of the plant roots. Other symptoms of this nematode include wilting of plants even when appropriate moisture is present and stunting of plants. Symptoms of the reniform nematode on cotton can include uneven plant growth, wilting, yellowing of plant, and nutrient deficiency such as tiger striping. The objective of this study was to determine the effectiveness of different rates and combinations of a new biological nematicide to manage both root-knot and the reniform nematodes on cotton in Alabama. The new nematicide tested, BioST nematicide, is a product of Albaugh, LLC. The active ingredient of the BioST nematicide is a heat-killed *Burkholderia rinojensis* strain A396.

Materials and Methods

Nematicide treatments for these tests included: 1. Untreated control; 2. Fluopyram; 3. Abamectin; 4. BioST nematicide low rate; 5. BioST nematicide high rate; 6. BioST nematicide concentrate; 7. BioST nematicide concentrate + Experimental 1; 8. BioST nematicide concentrate + Experimental 2. Albaugh, LLC, applied all of these nematicide seed treatments to NexGen 3406 cotton. The test on root-knot nematode was conducted at Auburn University's Plant Breeding Unit, which is located near Tallassee, AL. This location contains a Kalmia loamy sand (80% sand, 10% silt, and 10% clay) soil type and has an established population of root-knot nematode. Tests for reniform nematode were at Auburn University's Tennessee Valley Research and Extension Center, which is located near Belle Mina, AL. This location has a Decatur silt loam (24% sand, 49% silt, and 28% clay) soil type. This field has been cultivated in cotton for over 16 years and was infested with the reniform nematode in 2007.

Test at both locations were plated in plots that consisted of two rows that were 25 feet long with a 36-inch row spacing. The test was replicated 5 times and arranged in a randomized complete block design. Root-knot testing fields were planted on the 26th of April and reniform testing fields were planted on the 4th of May. Nematode numbers and plant growth data was collected form 4 plants that were randomly selected from each plot 45 days after planting. Yield data was collected at harvest on October 4 and 5, 2016, respectively for the root-knot and reniform fields. Data for the test were analyzed with SAS 9.4 using PROC GLIMMIX and LS-means were compared using Tukey-Kramer's method ($P \leq 0.1$).

Results

In both root-knot and reniform nematode field trials produced positive yield returns for least one of the BioST nematicide treatments. In the root-knot nematode field, the number of nematode eggs that were found on the four plants sampled was not significantly reduced from the control by any seed treatment. Biomass, which is the total weight of the plant in grams, indicated a larger plant in the BioST concentrate treatment as compared to the high rate of the BioST and the Fluopyram seed treatments. Seed cotton yield increases were measured. Abamectin, Fluopyram, and BioST nematicide at a high rate all supported a significant increase in seed cotton yield. The highest yield produced was in the Abamectin treatment, which produced 565 lbs/A more seed cotton than the untreated control. The Fluopyram seed treatment increased yield by 416 lbs/A and the high rate of BioST nematicide increased yield by 413 lbs/A of seed cotton over the control.

Table 1. Seed treatment nematicide effects on root-knot egg densities, plant biomass, and seed cotton yields, 2016.

Treatment	Root-knot eggs [a]	Biomass [b]	Seed cotton yield lbs/A
Untreated control	41823 b	21.5 ab	2826 c
Fluopyram	37389 b	19.1 b	3242 ab
Abamectin	38378 b	22.4 ab	3391 a
BioST Low	48899 ab	21.3 ab	3013 bc
BioST High	47586 ab	19.5 b	3239 ab
BioST concentrate	58339 ab	27.8 a	2846 c
BioST concentrate + Experimental 1	75056 a	23.9 ab	2812 c
BioST concentrate + Experimental 2	41561 b	22.3 ab	3089 abc

Means followed by the same letter do not significantly differ by Tukey-Kramer's method ($P \leq 0.1$).
[a] Total number of eggs extracted from the roots of four plants.
[b] Total weight of to plant measured in grams.

In the reniform nematode field, the number of reniform eggs that was found on the plants samples ranged from 7330 to 1451. Flupyram and BioST concentrate + Experimental 2 showed a significant reduction in the number of reniform eggs compared to the untreated control. Plant biomass was increased by the high rate of BioST nematicide as compared to all other seed treatments. This BioST high rate treatment increased biomass by 4.4 grams over the untreated control. In this test, the increase in biomass translated to an increase in yield. The high rate of BioST nematicide produced 592 lbs. more seed cotton per acre than the untreated control. The high rate of BioST nematicide and the Bio ST concentrate + Experimental 2 produced similar yields.

Table 2. Seed treatment nematicide effects on reniform nematode egg densities, plant biomass, and seed cotton yields, 2016.

Treatment	Reniform eggs [a]	Biomass [b]	Seed cotton yield lbs/Acre
Untreated control	7330 a	11.5 b	1865 b
Flupyram	1451 b	10.2 bc	2008 b
Abamectin	3588 ab	10.6 bc	1901 b
BioST Low	6591 ab	10.7 bc	1926 b
BioST High	7161 a	15.9 a	2457 a
BioST concentrate	3080 ab	8.4 c	1915 b
BioST concentrate + Experimental 1	5652 ab	8.6 c	2008 b
BioST concentrate + Experimental 2	1719 b	9.5 bc	2097 ab

Means followed by the same letter do not significantly differ ($P \leq 0.1$).
[a] Total number of eggs extracted from the roots of four plants.
[b] Total weight of to plant measured in grams.

Summary

Between the tests for root-knot nematode and reniform nematodes, one treatment improved yield consistently. This treatment was the high rate of the BioST nematicide. Between the two tests the high rate of BioST nematicide increased yield by an average of 503 lbs/A over the untreated control. It is important to note that in both instances where this treatment increased yield there was not a significant reduction in the number of nematode eggs. Due to this, the increase in yield might be attributed to a promotion of growth that, in reniform nematode testing, was observed in plant biomass early in the season. The larger plant may have been able to compensation for some of the yield loss typically cause by the nematode damage.

References

Lawrence, K., A. Hagan, R. Norton, T. Faske, R. Hutmacher, J. Mueller, D. Wright, I. Small, R. Kemerait, C. Overstreet, P. Price, G. Lawrence, T. Allen, S. Atwell, A. Jones, S. Thomas, N. Goldberg, R. Bowman, J. Goodson, H. Young, J. Woodward, and H. Mehl. 2017. Cotton disease loss estimate committee report, 2016. Proceedings of the 2017 Beltwide Cotton Conference Vol. 1. National Cotton Council of America, Memphis, TN.