

**ASSESSMENT OF SEED TREATMENTS FOR
MANAGEMENT OF NEMATODES IN GEORGIA**

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Abstract

Nematodes are an important problem for cotton growers in Georgia. In addition to crop rotation, growers use nematicides to reduce damage and increase yields. In this study three seed treatments, Avicta, N-Hibit, and an abamectin treatment from Bayer CropScience, have been assessed for efficacy and compared to standard nematicides. Trials were conducted in 2004 and 2005. Field sites were naturally infested with southern root-knot, reniform, or Columbia lance nematodes. Avicta was evaluated in 14 trials and the other two seed treatments were evaluated in four trials each. In each trial the populations of parasitic nematodes were measured multiple times during the season and yield from all nematicide treatments were compared. Despite assessing the seed treatments at multiple locations across the state, it was difficult to establish the efficacy of these products. In some trials Avicta performed as well as the target of 5.0 lb/A Temik 15G. Unfortunately, in many of these trials, the yields from plots treated with Avicta were not significantly different from plots treated only with the insecticide Cruiser. Because the Cruiser seed treatment is not active against nematodes, it is unclear how to interpret the results with regards to management of nematodes. This was also the case for the abamectin seed treatment from Bayer Crop Science. N-Hibit seed treatment, applied with Temik 15G at 5.0 lb/A, was only better than Temik 15G alone in one out of four trials in which it was assessed.

Introduction

Parasitic nematodes are one of the most important pest problems for cotton growers in Georgia today. In a recent random survey conducted by members of the University of Georgia's Cooperative Extension Service, it was found that nearly 70% of the commercial cotton fields included in the survey was infested with some level of parasitic nematodes. The southern root-knot nematode (*Meloidogyne incognita*) is the most important and widespread parasitic nematode on cotton in Georgia; however some growers are severely affected by reniform (*Rotylenchulus reniformis*), Columbia lance (*Hoplolaimus columbus*), and sting nematodes as well.

For the 2004 growing season, it was estimated that nematodes cost growers approximately \$100 in terms of lost yields and cost of nematicides to manage the problem. Cotton growers in Georgia typically manage nematodes with a combination of crop rotation and use of nematicides such as 1,3-dichloropropene (Telone II), aldicarb (Temik 15G) and oxamyl (Vydate C-LV). In 2003, researchers at the University of Georgia began evaluating a seed treatment from Syngenta, abamectin, for its efficacy in the management of parasitic nematodes on cotton. This work continued in 2004 and 2005. In 2005, research was also conducted to evaluate the efficacy of two additional seed treatments, abamectin from Bayer CropScience, and a harpin protein N-Hibit from Eden Bioscience, for management of nematodes on cotton.

The objectives of the current study were to evaluate the efficacy of seed treatments that were reported to benefit cotton growers for efficacy both in small research plots and in large on-farm trials and to compare this efficacy to that of other nematicides commonly used by growers.

Materials and Methods

Assessment of the abamectin seed treatment from Syngenta was initiated in 2003 and continued during 2004 and 2005. Only data from 2004 and 2005 will be presented here. An experimental seed treatment from Bayer CropScience was evaluated in two small-plot and two on-farm studies in 2005. The seed treatment from Eden Bioscience, N-Hibit, was evaluated in three on-farm trials and one small-plot study in 2005.

Avicta (abamectin) was evaluated as a component of AVICTA Complete Pak with treated seed provided by Syngenta. AVICTA Complete Pak is a combination of the fungicide seed treatment Dynasty (azoxystrobin, fludioxonil, and mefenoxam), Cruiser (0.34 mg/seed) and abamectin (0.15 mg/seed). Treated seed was provided annually by Syngenta.

The seed treatment from Bayer CropScience was also a formulation of abamectin. Treated seed was provided by Bayer CropScience for use in these studies and also included a treatment for control of thrips.

The active ingredient in N-Hibit from Eden Bioscience is a harpin protein. In three of the trials where this product was assessed in this study, commercial seed was treated at Triangle Chemical in Sycamore, GA with 5.0 oz/100 lb seed + Cruiser insecticide at 0.34 mg/seed. In a single study (Taylor County), the N-Hibit was mixed with the seed at the time of planting at a rate of 3 oz/100 lbs seed.

Aldicarb (Temik 15G) was evaluated in each study at the rates of 3.5 and 5.0 lb/A. Temik 15G was applied to the open furrows at planting. In a number of studies, a third Temik treatment was assessed and included Temik 15G, 5.0 lb/A applied both at planting and at side-dress between the 2nd and 8th true leaf stage, but prior to the pin-head square growth stage. In the side-dress application, the Temik was incorporated into the soil with a colter 6-8 inches on either side of the cotton plants to a depth of 2-3 inches.

The fumigant Telone II was assessed in a number of the on-farm field trials at a rate of 3 gal/A. Telone II was applied with a single chisel in-row 12-inches deep to appropriate plots at least seven days prior to planting. Temik 15G, 3.5 lb/A, was applied at planting to control early season thrips.

Descriptions of the individual field trials are presented in Tables 1 and 2. The experimental design in each study was a randomized complete block with 3-6 replications depending on the location. Soil samples were

collected at planting, mid-season, and at harvest and analyzed for nematode populations. Gall ratings were taken at the Gibbs Farm within 28 days after planting to assess damage to the young root systems. Lint yields were calculated at each site based upon an estimated 38% gin turnout for lint. Finally, data were analyzed using analysis of variance and mean separation was performed using Fisher's Protected Least Significant Differences at $p \leq 0.05$.

Results and Discussion

The yield results from the field trials are presented in Table 3 and gall ratings from the Gibbs Farm trials are presented in Table 4. The average number of nematodes per 100 cm³ soil collected at harvest from a site is presented in Table 1.

The efficacies of three seed treatments reported to have benefits in the management of nematodes on cotton were assessed in this study. Two of these, AVICTA Complete Pak and N-Hibit, are currently available to growers in Georgia. The third, an abamectin treatment from Bayer CropScience, should be available to growers in the near future.

In the studies presented in this paper, AVICTA Complete Pak was compared to Cruiser-treated seed in 13 trials. Data from two of these studies could be statistically combined. From the resulting 12 data sets, AVICTA Complete Pak out-yielded the Cruiser-treated seed eight times, though none of the differences were significant at the 5% level. Cruiser-treated seed out-yielded AVICTA Complete Pak in four of the twelve trials. Again, the differences were not statistically different.

Thirteen data sets are presented in this paper comparing AVICTA Complete Pak to Temik 15G, 5.0 lb/A. AVICTA Complete Pak out-yielded Temik 15G, 5.0 lb/A, in six of these trials; however only in one of the six trials were the yields statistically different. Temik 15G, 5.0 lb/A, out-yielded AVICTA in seven trials; however yields were statistically different in only one of the seven trials.

Five data sets are presented in this paper where AVICTA Complete Pak is compared directly to Temik 15G, 5.0 lb/A at-plant and 5.0 lb/A side-dress, and to Telone II, 3 gal/A. These treatments each out-yielded AVICTA Complete Pak in four of the five studies; however the yields were statistically different only once for two applications of Temik and twice for Telone II. Yields from AVICTA Complete Pak were numerically (and statistically) better than two applications of Temik 15G on one occasion and better than Telone II (numerically only) on a single occasion.

In the four studies where they were compared, yields were not statistically different between the AVICTA Complete Pak and the abamectin treatment from Bayer CropScience. In the four studies where N-Hibit + Temik 15G was compared to Temik 15G, 5.0 lb/A, alone, the yields were not statistically different in any trial.

In the studies conducted during 2004 and 2005 in Georgia, it is impossible to determine "how good" AVICTA Complete Pak is in the management of nematodes. In these tests, yields from plots planted with AVICTA Complete Pak-treated seed were often similar to plots where Temik 15G was applied at 5.0 lb/A at planting. However, as there were no statistical differences in yield between plots treated with Temik, AVICTA Complete Pak, or Cruiser alone, it is impossible to say exactly how effective the AVICTA was against nematodes. Also, the fact that Telone II and two applications of Temik 15G did not result in consistent significant yield increases over AVICTA Complete Pak also makes it difficult to determine the efficacy of the product.

In studies conducted at the Gibbs Farm in 2004 and 2005, early season gall rating could be statistically combined as the interaction between years was not significant. Gall ratings were significantly lower for Temik 15G, 3.5 lb/A, than for AVICTA Complete Pak and for Cruiser-treated seed.

Although only assessed in four trials, it appears that the abamectin treatment from Bayer CropScience is similar in efficacy to AVICTA Complete Pak.

Use of N-Hibit seed treatment with Temik 15G did not increase yields over Temik 15G, 5.0 lb/A used alone in four trials.

Conclusion

After reviewing results from multiple field trials in 2004 and 2005, it is difficult to determine the true efficacy of AVICTA Complete Pak in the management of nematodes on cotton. The product performed as well as Temik 15G, 5.0 lb/A, in most trials. However AVICTA Complete Pak typically produced yields that were similar to Cruiser. Further testing will be needed to differentiate AVICTA Complete Pak as a nematicide.

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Table 1. Characteristics of fields sites used in study cotton seed treatments.

County	Site	Year	Soil type	Reps ^z	Irrigation	Nematode	Fall Count ^y
Colquitt*	Perryman	2004	Loamy sand	4	No	Root-knot ^x	
Colquitt*	Perryman	2005	Loamy sand	4	No	Root-knot	855
Mitchell*	Windhausen	2005	Loamy sand	4	Yes	Root-knot	506
Coffee*	Nugent	2004	Loamy sand	3	Yes	Root-knot	177
Coffee*	Nugent	2005	Loamy sand	3	Yes	Root-knot	532
Tift**	Gibbs Farm	2004	Loamy sand	6	Yes	Root-knot	--
Tift**	Gibbs Farm	2005	Loamy sand	6	Yes	Root-knot	456
Burke**	Midville	2004	Loamy sand	5	Yes	Col.lance ^w	167
Burke**	Midville	2005	Loamy sand	4	Yes	Col. lance	72
Burke*	Storey	2005	Loamy sand	4	Yes	Reniform ^u	--
Taylor*	Green	2005	Loamy sand	4	No	Reniform	1311
Floyd*	Jordan	2005	Loamy sand	4	No	Root-knot	234
Elbert*	Evanson	2005	Loamy sand	4	Yes	Root-knot	207

*On-farm trials. Plots were 4-10 rows wide by length of field.

**Small-plot trials. Plots were 2-4 rows wide by 25-40 ft in length.

^zNumber of replications in the trial.

^yAverage number of nematodes/100 cm³ soil across treatments in sample collected at harvest.

^xSouthern root-knot nematode, *Meloidogyne incognita*.

^wColumbia lance nematodes, *Hoplolaimus columbus*.

^uReniform nematodes, *Rotylenchulus reniformis*.

Table 2. Listing of nematicide treatments included in each trial.

Site	Variety	Cruiser	Temik	Temik	Temik	Telone II + Temik	AVICTA Complete Pack*	N-Hibit + Temik	Bayer seed treat**
		0.34 mg/seed	3.5 lb/A	5.0 lb/A	5.0 lb/A + 5.0 lb/A	3 gal/A + 3.5 lb/A		3.0-5.0 oz/seed + 5.0 lb/A	
Perryman 04	DP 555	X	X	X	X	X	X		
Perryman 05	DP 555	X	X	X	X	X	X	X	
Windhausen 05	DP 555	X	X	X	X	X	X		X
Nugent 04	DP 555	X	X	X	X	X	X		
Nugent 05-1	DP 555	X	X	X	X	X	X		
Nugent 05-2	DP 555	X		X			X	X	X
Gibbs Farm 04	DP 555	X	X	X			X		X
Gibbs Farm 05	DP 555	X	X	X			X	X	X
Midville 04	DP 555	X	X	X			X		
Midville 05	DP 555	X	X	X			X		
Storey 05	DP 555			X			X		
Green 05	DP 555	X	X	X	X		X	X	
Jordan 05	DP 444	X	X	X			X		
Evanson 05	ST 5599	X	X	X	X		X		

*AVICTA Complete Pack is composed of Dynasty CST, Cruiser (0.34 mg/seed) and STAN (abamectin, 0.15 mg/seed).

**The Bayer seed treatment is an experimental formulation of abamectin and other materials.

Table 3. Lint yields from nematicide trials presented in this study.

Site	Cruiser	Temik	Temik	Temik	Telone II + Temik	AVICTA Comp. Pack*	N-Hibit + Temik	Bayer Seed Treatment
	0.34 mg/seed	3.5 lb/A	5.0 lb/A	5.0 lb/A +5.0 lb/A	3 gal/A + 3.5 lb/A		3.0-5.0 oz/seed + 5.0 lb/A	
	LINT YIELD (lb/A)							
Perryman 04	642 cd	632 d	678 cd	786 ab	784 ab	727 bc		
Perryman 05	539 a	647 a	803 a	701 a	699 a	612 a	641 a	
Windhausen	1137 a	1086 d	1119 cd	1126cd	1170 abc	1214 a		1199 ab
Nugent 04	779 d	918 b	904 bc	965 ab	1065 a	737 d		
Nugent 05-1	1103 d	1470 b	1283 bcd	1356bc	1752 a	1137cd		
Nugent 05-2	1439 a		1646 a			1327 a	1465 a	1457 a
Gibbs Farm 2004-2005*	1051 a	1086 a	1175 a			1054 a		
Gibbs Farm 2005	1131 a	1184 a	1143 a			1070 a	1208 a	1154 a
Midville 04	1507 a	1446 a	1678 a			1483 a		
Midville 05	997 a	839 a	1018 a			1109 a		1054 a
Storey 05			722 a			755 a		
Green 05	242 a	197 b	223 ab	240 a		258 a	246 a	
Jordan 05	505 a	549 a	526 a			503 a		
Evanson 05	959 a	973 a	940 a	984 a		977 a		

*The data from the 2004 and 2005 Gibbs Farm trials was combined across years as the interaction between years was not significant.

**Means followed by the same letter are not different at p=0.05 according to Fisher's Protected LSD.

Table 4. Early season gall ratings from Gibbs Farm trials, 2004-2005.

Site	Cruiser	Temik	Temik	Temik	Telone II + Temik	AVICTA Comp. Pack*	N-Hibit + Temik	Bayer Seed Treatment
	0.34 mg/seed	3.5 lb/A	5.0 lb/A	5.0 lb/A +5.0 lb/A	3 gal/A + 3.5 lb/A		3.0-5.0 oz/seed + 5.0 lb/A	
Gibbs Farm 2004-2005*	3.9 a	1.6 c	2.15 bc			3.05 ab		

*Data from 2004 and 2005 Gibbs Farm trials combined across years as the interaction between years was not significant.

** Galls rated on a 1-10 scale where 0 = no observed galling, 1 = 10% galling, 2 = 20% galling, etc.

***Means followed by the same letter are not different at p=0.05 according to Fisher's Protected LSD.