MANAGEMENT OF ROOT-KNOT NEMATODES WITHOUT TEMIK

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Abstract

Two field experiments were conducted to determine the impact of single and multiple tactics for managing root-knot nematodes, including use of nematicide seed treatments, Temik 15G, fumigation with Telone II, Vydate CLV, and nematicide seed treatments combined with Vydate CLV. All chemical combinations were tested with both a susceptible and partially root-knot resistant cultivar. At one site, none of the nematicide management tactics or the partially resistant cultivar had any effect on nematode parameters, yield, or the value of the crop minus management costs. At a second site, both Telone II and Temik 15G controlled root galling better than other tactics. Stoneville (ST) 5458B2F reduced the nematode population density compared with Fibermax (FM 9160B2F). Both Vydate CLV (with or without seed treatment nematicides) and ST 5458B2F resulted in the highest yields and best value/acre.

Introduction

The loss of Temik 15G for nematode and thrips management in cotton will be costly to the Southern High Plains of Texas, where root-knot nematode infests over 40% of the acreage, primarily in the lighter textured soils (Starr et al., 1993; Wheeler et al. 2000). Cotton lint losses for this region, in the absence of nematode control, are estimated at 26% (Orr and Robinson, 1984). Existing tools for managing root-knot nematodes include:

1) Varieties with partial resistance to root-knot nematodes (Stoneville (ST) 5458B2F, ST 4288B2F, Phytogen (PHY) 367WRF, and Deltapine 174RF).
2) Chemical
    a. Fumigation with Telone II (Dow AgroSciences) and Vapam (AMVAC);
    b. Seed treatment nematicides (Aeris (Bayer CropScience), Avicta Complete Cotton or Duo (Syngenta), Poncho/Votivo (Bayer CropScience), and N-Hibit (Plant Health Care Inc.)).
    c. Post-emergence, banded applications: Vydate CLV (DuPont)

The problem is that producers could use Temik 15G in almost any situation with root-knot nematode and improve their profitability. It is likely that in the absence of Temik 15G, a combination of other tools will be necessary. On the plus side, it may be possible to improve profitability in the presence of root-knot nematode, using some other options, which up to now had not been greatly tested. On the negative side, we know very little about many of the combination of varieties with seed treatment nematicides and/or Vydate CLV. The objective of this project was to explore combinations of tools to manage root-knot nematode.

Materials and Methods

Small plot trials were conducted at two sites to examine the effects of using a combination of chemical and partially resistant varieties to manage root-knot nematodes. The plots were 35 ft. long and four rows wide, and treatments were arranged in a randomized complete block design with six replications. Information collected at the sites included plant stand, galls/root at 35 days after planting, root-knot second-stage juveniles (J2) and eggs in late August, and yield. Details that differed for each site are listed below.

Seminole Site:
Susceptible variety: Fibermax (FM) 9160B2F; Partially resistant variety: ST 5458B2F
Cost of each variety: $82.61/acre to plant 58,080 seed/acre.

Fumigation date: 4 May
Planting date: 9 May, replanted test on 31 May
Chemical treatments and cost: None; Cruiser ($8.10/acre); Avicta complete cotton ($17.95/acre); Cruiser + Vydate CLV at 17 oz/acre banded ($14.41/acre); Avicta Complete Cotton + Vydate CLV at 17 oz/acre banded ($24.26/acre); Temik 15G at 5 lbs/acre ($21.25/acre); Cruiser + Telone II at 3 gal/acre ($82.80).
Vydate application: 22 June
Stand counts: 23 June
Dig roots for gall rating: 5 July
Sample soil to determine root-knot nematode density: 22 August
Harvest: 11 November

Whiteface Site:
Susceptible variety: Fibermax (FM) 9160B2F; Partially resistant variety: PHY 367WRF
Cost of each variety: $74.35/acre and $73.59 to plant 52,272 seed/acre of FM 9160B2F and PHY 367WRF, respectively.
Fumigation date: 13 May
Planting date: 13 May
Chemical treatments and cost: None; Cruiser ($8.10/acre); Avicta complete cotton ($16.20/acre); Cruiser + Vydate CLV at 17 oz/acre banded ($13.65/acre); Avicta Complete Cotton + Vydate CLV at 17 oz/acre banded ($21.75/acre); Temik 15G at 5 lbs/acre ($17.50/acre); Cruiser + Telone II at 3 gal/acre ($82.80).
Vydate application: 9 June
Stand counts: 17 June
Dig roots for gall rating: 27 June
Sample soil to determine root-knot nematode density: 18 August
Harvest: 25 October

Results and Discussion

Seminole site: Temik 15G and Telone II both appeared to have superior nematode control compared with the nematicide seed treatments, based on root galling (Table 1). Vydate CLV applications would have been applied after the initiation of root galling, so root galling is not an effective measure of Vydate efficacy. The partial resistance to root-knot nematode associated with ST 5458B2F appeared to be effective, based on the nematode population density in late August (8,147 root-knot/500 cm^3 soil) relative to that of the susceptible variety FM 9160B2F (23,777 root-knot/500 cm^3 soil). Even though root-knot nematode reproduction was reduced on ST 5458B2F, the root-knot nematode density is still considered high for cotton and likely resulted in some loss of yield. The early season advantage of reduced galling caused by Temik 15G and Telone II applications was lost by late August, where root-knot nematode density was similar across all chemical treatments (Table 1). This is typical for Temik 15G, since its effects are temporary and it does not necessarily kill the nematodes, but more likely causes a temporary paralysis that is overcome as the concentration of aldicarb diminishes. However, Telone II should kill a substantial number of nematodes if application is done under good environmental conditions, and reduction of nematode density throughout the summer would have been expected. The recovery of the nematode population density in Telone treated plots indicates that application was not overly successful. It is likely that the irrigation being applied at that time of year did not allow good movement of the fumigant throughout the bed profile. The dry conditions during the spring meant that sufficient soil moisture did not exist to make applications until just before planting when the center pivot was running extensively. More successful applications are typically done when rainfall or irrigation is used, then the soil is allowed to dry for several days to a week, and then the application made, then a light irrigation to seal the soil, and then dry conditions for around one wk. to maximize the gas movement of the product. This spring was very difficult to get good applications of Telone II from a watering standpoint.

The lint yield weight was multiplied by the loan value plus $0.35, which more adequately reflects the equity of cotton prices at this time. Then the cost of the variety (same for both at Seminole) and chemicals were subtracted from this value. Using ST 5458B2F resulted in an average of $144/acre more than planting FM 9160B2F. If planting the susceptible variety FM 9160B2F, then the most profitable treatment was using Cruiser treated seed and making an application of Vydate CLV at 17 oz/acre banded. When planting ST 5458B2F, the most profitable treatment was using AVICTA Complete Cotton with an application of Vydate CLV at 17 oz/acre, banded. Using Vydate CLV with Cruiser treated seed (i.e. no at-plant nematicide) resulted in the second most profitable situation

with ST 5458B2F. So, in general, using ST 5458B2F and Vydate CLV made the most money at the Seminole site. The use of Avicta Complete Cotton without Vydate CLV, Temik 15G, or Telone II did not significantly improve profitability in ST 5458B2F over the nontreated check. With the susceptible cultivar FM 9160B2F, none of the chemical treatments significantly improved yield over the nontreated check.

Table 1. Effect of chemical treatments on root galls caused by root-knot nematode, nematode population density, yield, and value/acre at a field near Seminole in 2011.

Chemical Treatment[1]	Galls/ Root	RK[2]/500 cm^3 soil	Yield Lbs of lint/acre		Yield x Loan value[4] -(Chemical+Variety Costs ($/acre))	
			FM[3]	ST	FM	ST
None	13.8 a	17,385 a	835 abZ[5]	880 cZ	671 abZ	657 bZ
Cruiser (C))	12.8 a	12,315 a	760 bY	1,015 abcZ	603 bY	815 aZ
Avicta (A)	11.6 a	21,330 a	782 abZ	918 bcZ	597 bZ	678 bZ
C+Vydate	13.2 a	16,095 a	913 aZ	1,048 abZ	736 aZ	829 aZ
A+Vydate	13.1 a	18,240 a	742 bY	1,111 aZ	561 bY	848 aZ
Temik 15G	6.1 b	14,670 a	756 bY	1,016 abcZ	562 bY	760 aZ
Telone II	5.3 b	11,700 a	839 abY	1,029abcZ	568 bY	719 bZ

[1]Vydate CLV was applied at 17 oz/acre banded around the 3-4 leaf stage; Temik 15G was applied at planting at 5 lbs/acre; Telone II was applied 4 days before planting at 3 gal/acre.
[2]RK is root-knot nematode, sampled on 22 August.
[3]FM is Fibermax 9160B2F and ST is Stoneville 5458B2F.
[4]Loan value was increased by $35/lb to reflect current prices more accurately.
[5]The letters a,b,c were used to indicate which chemical treatments were significantly different ($P \leq 0.05$), within a column. The letters Z and Y were used to indicate which varieties were significantly different, within a chemical treatment.

Whiteface: Stand was lower for Telone II treated plots than almost all other treatments. This product was applied just before planting, and apparently did not get sealed in properly. It resulted in poorer stands (Table 2) and no reduction in root galling or nematode reproduction (Table 2). Root galling was relatively low at this site, except for that associated with Cruiser + Vydate CLV treatment (Table 2). Root-knot nematode population density varied widely from plot to plot, with no consistent differences between varieties (FM 9160B2F averaged 6,364 root-knot/500 cm^3 soil and PHY 367WRF averaged 4,264 root-knot/500 cm^3 soil, $P=0.29$) or chemical treatments (Table 2). In general, PHY 367WRF did not express any sign of being root-knot nematode resistant at this site, though it has performed well and reduced root-knot nematode populations at many other sites. This experiment was essentially reduced to looking at chemical treatments, not at the combination of chemicals and nematode resistant varieties.

There was no effect of chemicals on yield for either variety, but when loan value and chemical costs were factored in, then profitability was improved for varieties treated with Avicta Complete Cotton, Cruiser alone, or Temik 15G compared to fumigation with Telone II. None of the treatments improved profitability over the nontreated check (Table 2).

Table 2. Effect of chemical treatments on root galls caused by root-knot nematode, nematode population density, yield, and value/acre for a site near Whiteface.

Chemical Treatment[1]	Plants/ Ft. row	Galls/ Root	RK[2]/500 cm^3 soil	Yield Lbs of lint/acre		Yield × Loan value[4] -(Chemical+Variety Costs ($/acre))		
				FM[3]	PHY	FM	PHY	Average
None	2.25 ab[5]	4.18 b	8,307	1,235	1,033	1,056	872	964 ab
Cruiser (C))	2.44 ab	3.43 b	5,000	1,196	1,255	1,012	1,067	1,040 a
Avicta (A)	2.62 a	4.94 b	2,590	1,259	1,217	1,062	1,024	1,043 a
C+Vydate	2.61 ab	8.97 a	5,163	1,151	1,142	965	958	962 ab
A+Vydate	2.18 b	3.37 b	5,268	1,178	1,141	982	949	966 ab
Temik 15G	2.40 ab	3.18 b	938	1,259	1,216	1,061	1,022	1,042 a
Telone II	2.07 b	4.01 b	9,930	1,117	1,094	865	846	855 b

[1]Vydate CLV was applied at 17 oz/acre banded around the 3-4 leaf stage; Temik 15G was applied at planting at 5 lbs/acre; Telone II was applied on the same day as planting at 3 gal/acre.
[2]RK is root-knot nematode, sampled on 22 August.
[3]FM is FIbermax 9160B2F and PHY is Phytogen 367WRF.
[4]Loan value was increased by $35/lb to reflect current prices more accurately.
[5]The letters a,b,c were used to indicate which chemical treatments were significantly different ($P \leq 0.05$), within a column.

Summary

At one site, there was a tremendous economic advantage for using ST 5458B2F over a susceptible variety. The combination of the partially resistant variety and Vydate CLV application resulted in the highest yields and profitability. However, at the second site, the variety with partial nematode resistance did not reduce the nematode reproduction or out yield the susceptible variety. None of the chemical treatments at this site appeared to improve yield or profitability over doing nothing. Clearly more information needs to be collected on combinations of tools to manage root-knot nematode.

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