Evaluation of Variety Tolerance and Use of Vydate C-LV for Management of Southern Root-knot Nematodes

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Summary

The southern root-knot nematode, *Meloidogyne incognita*, is an economically important parasite of cotton in Gaines County, Texas. The objectives of this research were to evaluate the performance of Stoneville (ST) 4288B2RF and Fibermax (FM) 9180 B2F with and without three foliar applications of Vydate C-LV applied at weekly intervals starting at three true leaves. *M. incognita* gall counts and nematode egg counts per 500cm^3 soil provided further information on the impact of root-knot nematodes. Plots were machine harvested and yield, gin turnout, fiber quality, and economics of treatments were determined. Root galls caused by *M. incognita,* were decreased with the use of Vydate C-LV on ST 4288B2RF. In contrast, galling was increased with the use of Vydate C-LV on FM 9180B2RF. Root-knot nematode egg density was affected by variety, but was not affected by chemical treatments. Yield was primarily affected by variety, with ST 4288B2RF greatly out yielding FM 9180B2F. Yield was not affected by foliar applications of Vydate C-LV. Net value was approximately $113/acre higher when ST 4288B2RF was planted rather than FM 9180B2F . Based on these results, planting partially resistant varieties was the most economical and effective method in the management of root-knot nematodes.

Objective

The southern root-knot nematode, *Meloidogyne incognita*, is an economically important parasite of cotton in Gaines County, Texas. Higher populations of this pest tend to occur in sandier fields that have had consecutive cotton crops and very little rotation to a non-host, such as peanut (Kirkpatrick, 2001). Management decisions are dependent upon the level nematode infestation and the estimated nematode-induced yield loss (Kirkpatrick, 2001). Planting partially resistant or tolerant varieties is one of the most effective tools in managing this pest (Zhou et al., 2003). Foliar applications of Vydate C-LV have been recommended for the suppression of nematodes. Therefore, cotton production may be optimized by planting partially resistant cotton varieties in conjunction with the use of Vydate C-LV. The objectives of this study were to evaluate root-knot nematode galling and egg production on two cotton varieties with and without foliar applications of Vydate C-LV and to compare net returns between varieties, use of Vydate C-LV, and their interaction.

Materials and Methods

The on-farm trial was conducted in Gaines County, TX in 2011 in a field with the 5 year crop history of cotton. The field's soil was 93% sand, 3% silt, and 4% clay. The trial was planted on 19 May. Plots had 40-inch row spacing and were center-pivot irrigated. Plots were 8-rows wide by 400 ft. in length and were arranged in a randomized complete block design with three replications. See Table 1 for a complete list of treatments. The number of adult and immature thrips were counted by visually inspecting 10 whole plants per plot on 7 June and 14 June. The number of galls caused by *M. incognita* were counted by visually inspecting 10 plant roots per plot on 28 June. Soil samples were taken on 12 July to determine *M. incognita* populations per 500cm^3 of soil. The trial was harvested on 9 November. All plots were weighed separately using a Lee weigh wagon. Burr cotton grab samples were taken from each plot. All grab samples were weighed and ginned using a sample gin with a lint cleaner, burr extractor and stick machine. Ginned lint was weighed and lint and seed turnouts were calculated. Lint and seed yields were determined by multiplying the respective turn-out by field plot weights. Lint samples were collected for fiber quality analysis. Fiber analysis was conducted by the Texas Tech University Fiber & Biopolymer Research Institute, and CCC lint loan values were determined for each plot. Thirty-five cents was added to the loan values for each plot to represent average loan values that cotton sold for this year. Total value was calculated by multiplying lint loan value by lint yield. Net value was determined by subtracting chemical cost from the total value.

Table 1. Treatments

ST 4288B2RF[1] Untreated
ST 4288B2RF & 17 oz Vydate C-LV*
FM 9180B2F Untreated
FM 9180B2F & 17 oz Vydate C-LV*

*Vydate C-LV was applied in a band at a rate of 17 oz per acre on 7 June, 15 June, and 24 June.

Results and Discussion

FM 9180B2RF with foliar applications of Vydate C-LV had a higher number of galls (47.5) than ST 4288B2RF with foliar applications of Vydate C-LV (26.6) (*P = 0.07*). There was a significant interaction between variety and use of Vydate C-LV for root galls caused by *M. incognita.* Galling decreased with foliar applications of Vydate C-LV on ST 4288B2RF as compared to the untreated check (*Table 2*). In contrast, foliar applications of Vydate C-LV resulted in a significantly higher number of galls on FM 9180B2RF as compared to the untreated check. Thrips were not a limiting factor since treatments never had more than 0.025 thrips/plant (data not shown).

Table 2. Average number of root galls caused by *Meloidogyne incognita* on 28 June by variety and Vydate C-LV*.

Variety	Treatment	Average No. of Galls
FM 9180B2F	Untreated	39.6 b
FM 9180B2F	Vydate C-LV	47.5 a
		P = 0.04
ST 4288B2RF	Untreated	34.8 a
ST 4288B2RF	Vydate C-LV	26.6 b
		P = 0.03

*Means within the same column with the same letter are not significantly different.

FM 9180B2RF had a higher number of root-knot nematode eggs than ST 4288B2RF (*Table 3*). Foliar applications of Vydate C-LV had no significant effect on root-knot nematode eggs. There was no significant interaction between variety and chemical, indicating that the response was consistent with both varieties. Thus data were pulled over varieties.

Table 3. Average number *Meloidogyne incognita* per 500 cm^3 soil on 12 July by variety*.

Variety	Average No. of root-knot nematode eggs
FM 9180B2RF	7800 a
ST 4288B2RF	4720 b
	P = 0.03

*Means within the same column with the same letter are not significantly different.

Vydate C-LV foliar applications had no significant impacts on lint yield and total value per acre (*Table 4*). ST 4288B2RF had a higher lint yield than FM 9180B2RF, which resulted in a higher total value per acre.

Table 4. Harvest results by variety and treatment*.

Variety	Treatment	Lint Turnout	Seed Turnout	Loan Value	Lint Yield	Total Value (Loan Value X Lint Yield)
		---------%--------		------lb/acre-----		$/acre
FM 9180B2F	Untreated	29.3	49.7 a	0.8892 a	384 b	334.42 b
FM 9180B2F	Vydate C-LV	30.0	50.9 b	0.8998 a	384 b	339.96 b
ST 4288B2RF	Untreated	28.3	47.6 a	0.8920 a	500 a	453.21 a
ST 4288B2RF	Vydate C-LV	29.0	47.8 b	0.8558 b	526 a	459.99 a
		NS	*P* = 0.0001	*P* = 0.0068	*P* = 0.0154	*P* = 0.0001

*Means within the same column with the same letter are not significantly different.

Conclusions

Use of Vydate C-LV showed mixed results in the reduction of root-knot nematode galls on the partially resistant (ST 4288B2RF) and susceptible cotton (FM 9180B2RF) varieties early season. However, at harvest, the differences in galling observed early-season in the treated and untreated plots did not result in differences of yield. Three applications of 17 oz of Vydate C-LV were applied starting at the 2nd true leaf stage. Each Vydate C-LV application cost approximately $10.89 per acre, for a total cost of $32.67 per acre. If treatment cost were subtracted from the Total Value in Table 4, there would be a net loss for those plots treated with Vydate C-LV.

Meloidogyne incognita significantly impacted variety performance. Planting a partially resistant variety resulted in a lower number of root-knot nematode eggs mid season and a higher yield at the end of the season. Based on this trial, planting a partially resistant variety is the most economical and effective method in the management of nematodes.

The environmental conditions prior to and during the growing season were a limiting factor in the varieties performance overall. Above normal temperatures and lack of rainfall during the growing season possibly confounded the year end results. Continued evaluation of the use of Vydate C-LV under various conditions is needed in order to further understand its impact on root-knot nematode management.

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