EFFECTS OF THE RENIFORM NEMATODE AND SILVERLEAF WHITEFLY ON COTTON

C.G. Cook, A.F. Robinson,
L.N. Namken and D.A. Wolfenbarger
USDA-ARS and Texas Agric. Exp. Stn., Weslaco, TX
and USDA-ARS, College Station, TX

Abstract

The reniform nematode and silverleaf whitefly are serious pests to cotton in the Lower Rio Grande Valley (LRGV) of Texas. A 2-yr study, from 1995 to 1996, was conducted to determine the singular and combined effects of reniform nematodes and silverleaf whiteflies on lint yield and fiber quality. Experimental design was a split-plot, with nematode treatments (Telone II and control) as the whole plots and whitefly treatments (imidacloprid and control) as subplots. First harvest yield was significantly reduced by reniform nematodes, but not by whiteflies. Second harvest and total lint yield were reduced by both reniform nematodes and whiteflies. Micronaire value was significantly lower when whiteflies were not controlled, while fiber elongation was lower when reniform nematodes were not controlled. Fiber length and strength did not appear to be affected by reniform nematodes or silverleaf whiteflies. Across years and whitefly treatments, total yield in the Telone II plots was 590 lb/acre compared to 416 lb/acre in the nematode-infested plots. Averaged across nematode treatments, total yield was 565 lb/acre in the imidacloprid plots and 441 lb/acre in the whitefly-infested plots. No highly significant reniform nematode x silverleaf whitefly interactions were detected; however, there was indication of some interaction ($P \leq 0.20$) occurring for the second harvest. The results indicated lint yield reductions caused by reniform nematodes and silverleaf whiteflies. Since the later maturing percentage of the crop suffured the most loss, managing for early maturity should be an effective strategy for reducing yield losses caused by these two pests.

Introduction

The reniform nematode (*Rotylenchulus reniformis* Linford & Oliveira) and silverleaf whitefly (*Bemisia argentifolii* Bellows & Perring) can be serious pests of cotton (*Gossypium hirsutum* L.). Symptoms caused by reniform nematode parasitism include stunted, unhealthy appearing plants and reduced lint yields (Birchfield, 1961; Jones *et al.*, 1959). Silverleaf whiteflies extract plant nutrients in feeding, which in turn may result in stunting, defoliation, and reduced yields (Toscano *et al.*, 1994). Whiteflies also excrete honeydew which can cause sticky cotton and promote sooty mold growth. The LRGV is one of few places where cotton production is subjected to both of these pests. Consequently, information on the interaction of these pests on cotton lint yield and fiber quality has not been measured. The objective of this 2-yr study was to determine the single and combined effects of the reniform nematode and silverleaf whitefly on early yield, total yield, and fiber quality.

Materials and Methods

In 1995 and 1996, field studies were conducted at the USDA North Farm, Weslaco, TX. Cotton cultivar 'DES 119' was evaluated in a split-plot design, with five replications in 1995 and six replications in 1996. Main plots were the reniform nematodes treatments. One treatment was fumigation with Telone II (TL) and the control (RN) treatment was no nematicide. To insure reniform nematode control, Telone II was applied at 20.5 and 18.5 gal/acre in 1995 and 1996, respectively. Subplots were the two whitefly treatments. In one treatment, the whitefly population was controlled with imidacloprid (IM) applications as needed. The control (WF) treatment received one imidacloprid application on 16 June 1995 and no treatment in 1996. Plots were 30 ft long and spaced 3.3 ft apart. Planting dates were 22 March 1995 and 12 March 1996. Soil samples were taken two weeks after planting to estimate the initial reniform nematode population in the TL and RN plots. In 1995, the third leaf from the terminal was used to determine weekly (22 June to 26 July) whitefly adults, nymphs, and eggs. Using the leaf turn method in 1996, adult counts were made on the fourth and fifth leaf from the terminal on 20 June, 3 July, and 29 July. Harvest dates were 20 July and 3 August 1995 and 11 July, 24 July, and 7 August 1996. The last two harvest dates in 1996 were combined and reported as the second harvest. Subsamples from each harvest were saw-ginned to determine lint percent and the fiber sent to the International Textile Center, Lubbock, TX for fiber analysis.

Results

Initial reniform field populations in the TL and RN plots were estimated to be 5 and 218 nematodes per pound of soil in 1995 and 85 and 314 nematodes per pound of soil in 1996. Whitefly counts on 3 July 1995 averaged 9.3 adults per leaf in the IM plots versus 53.5 adults per leaf in the WF plots. Whitefly counts on 3 July 1996 showed 6.0 adults per leaf in the IM-treated plots compared to 19.8 adults per leaf in the WF plots. It was observed that whitefly populations in the TL-treated plots were generally greater than or equal to those of the RN plots. Since the years x treatments interactions were not significant ($P \leq 0.05$), combined results over years are presented. Averaged across both years and whitefly treatments, first harvest yield, second harvest yield, and total lint yield differed between the TL and RN treatments (Table 1). Both the first and second harvests and total yield were significantly reduced by reniform nematodes. Total lint yield in the TL-treated plots was 590 lb/acre compared to 416 lb/acre in the RN-infested plots, a 29.5% reduction. Second harvest yield and total yield

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differences were detected between the IM-treated and WF plots, when averaged across years and nematode treatments (Table 2). Total lint yield of the IM-treated plots was 565 lb/acre versus 441 lb/acre in the WF plots, a reduction of 21.9%. No highly significant reniform nematode x silverleaf whitefly interactions were detected; however, results indicated some interaction ($P \leq 0.20$) was occurring for the second harvest.

Means of the four treatments (TL+IM, TL+WF, RN+IM, RN+WF) provide an indication of the singular and combined effects these pests could have on lint yield (Table 3). In general, it appears as if the effects of the two pests on total yield are additive. Compared to the TL+IM (full control) treatment, total yields were reduced approximately 21% in the TL+WF (whitefly infested) treatment, 29% in the RN+IM (reniform nematode infested) treatment, and 45% in the RN+WF treatment. The two pests had rather moderate effects on fiber quality (Table 4). Results indicated that fiber micronaire was reduced from 4.6 to 4.1 units by whiteflies, whereas, fiber elongation was reduced from 6.8% to 6.6% by reniform nematode parasitism. Although these reductions are significant, all fiber samples were in the acceptable market range.

Summary

Individually, reniform nematodes and silverleaf whiteflies have been reported to reduce yields in cotton. The results of this study confirm previous research and also show that reniform nematodes have the ability to reduce yield in both early and late harvests. Yield reductions caused by silverleaf whiteflies were primarily in the second harvest, indicating that the effects of this pest become more severe as the season progresses. In general, the combined effects of the two pests on yield appear to be additive. However, there was some indication that a reniform nematode x silverleaf whitefly interaction could occur in the second harvest, *ie*. the later maturing portion of the crop. The possibility of this interaction occurring could result in premature cutout and lower yields, as both reniform nematode and silverleaf whitefly parasitism can cause severe plant stress by reducing the water and nutritional status of the plant. The significant yield reductions caused by these two pests, especially the potential late-season effects on lint yield and fiber maturity (micronaire), indicate the importance of managing for an early maturing crop.

References

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Table 1. Lint yield of the reniform nematode (RN) and Telone II (TL) treatments, averaged across 1995-1996.

Treatment	First Harvest	Second Harvest	Total Yield
		lb/acre	
Telone II (TL)	344	246	590
Untreated control (RN)	242	174	416
LSD (0.05)	48	35	55

Table 2. Lint yield of the silverleaf whitefly (WF) and Imidacloprid (IM) treatments, averaged across 1995-1996.

Treatment	First Harvest	Second Harvest	Total Yield
		lb/acre	
Imidacloprid (IM)	304	261	565
Untreated control (WF)	282	159	441
LSD (0.05)	ns	35	55

ns = nonsignificant

Table 3. Mean lint yield for each treatment of the reniform nematode-silverleaf whitefly tests, averaged across 1995-1996.

Treatment	First Harvest	Second Harvest	Total Yield
		lb/acre	
TL+IM	352	308	660
TL+WF	335	184	519
RN+IM	255	215	470
RN+WF	228	135	363

Table 4. Fiber data for the reniform nematode-silverleaf whitefly tests, averaged across 1995-1996.

Treatment	Micronaire	Strength	Length	Elongation
	units	g/tex in.	%	
Telone II (TL)	4.4	30.8	1.13	6.8
Untreated (RN)	4.3	31.0	1.13	6.6
LSD (0.05)	ns	ns	ns	0.1
Imidacloprid (IM)	4.6	30.8	1.14	6.7
Untreated (WF)	4.1	31.1	1.13	6.7
LSD (0.05)	0.1	ns	ns	ns

ns = nonsignificant