EFFICACY OF RENIFORM RESISTANT CULTIVARS AND COMMERCIALLY AVAILABLE NEMATICIDES TO MANAGE THE RENIFORM NEMATODE

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Abstract

Rotylenchulus reniformis, the reniform nematode, is one of three major nematode pests in the cotton production system of the southern United States. In Mississippi, cotton yield can be severely reduced in situations where soil populations of reniform nematode exceed economic thresholds (≥ 1,000/pint of soil in spring and ≥ 5,000/pint of soil post-harvest). Currently, management options are limited; however, resistant cultivars and seed-applied/in-furrow products with nematicidal activity remain potential options. The specific objectives of these trials were to determine the benefits of cultivars, previously observed to be tolerant of the reniform nematode, and seed-applied/in-furrow nematicide treatment combinations in managing the reniform nematode using an integrated approach. Field trials were established in 2019 and 2020 and included treatment combinations of some reniform-resistant cotton germplasm compared to a susceptible commercial standard. In addition to the germplasm treatments, seed-applied or in-furrow nematicide products were used. Soil samples were at three different timings during the season to confirm the ability of the treatments at managing the reniform nematode. Reniform populations fluctuated during the season but were above threshold at harvest sampling. Reniform nematode numbers increased numerically, up to 32%, from planting to harvest when all reniform tolerant cotton lines and treatment combinations were compared to the commercial susceptible check regardless of treatment combination. Although not significant, an up to 8% increase in seed cotton was observed with all reniform tolerant cotton lines with the base seed treatment when compared to the commercial check with the base treatment during 2020. Combinations of reniform nematode-resistant cultivars and seed-applied nematicide treatment may provide an integrative management option to reduce the losses due to the reniform nematode.

Introduction

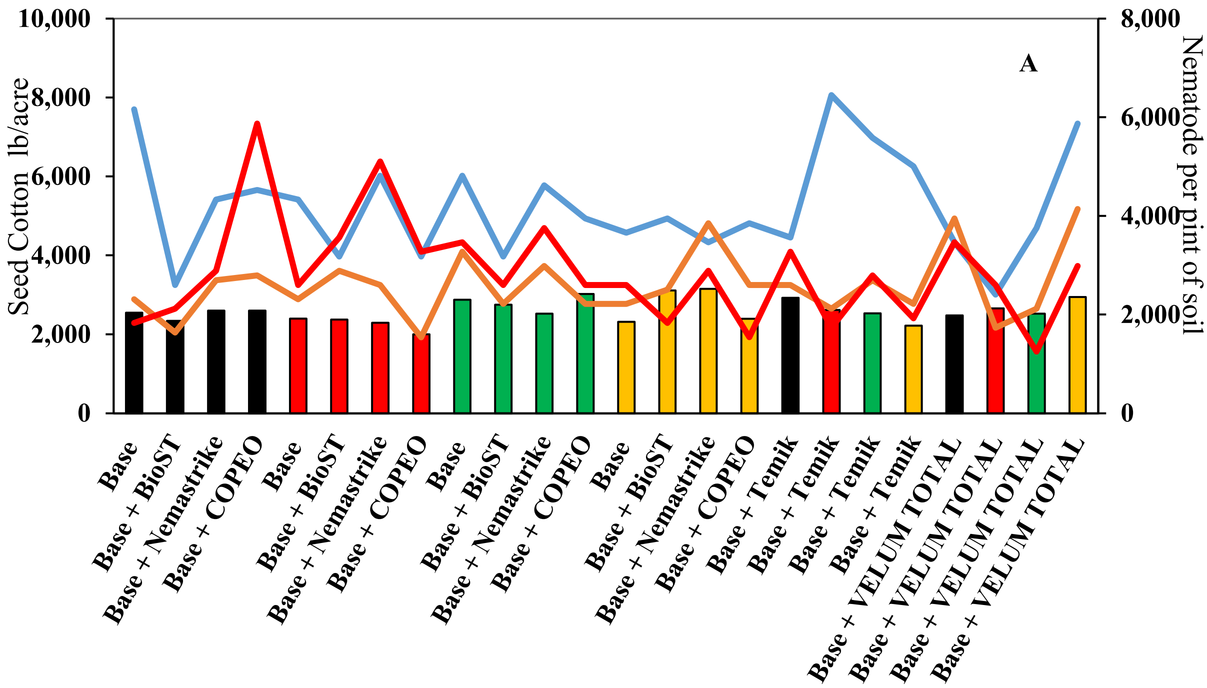
Yield losses have been documented in cotton fields across the southern United States in the cotton production systems in Alabama, Arkansas, Georgia, Louisiana, Mississippi, Missouri, and Texas as a result of the reniform nematode, *Rotylenchulus reniformis* (Lawrence et al., 2017; Lawrence et al., 2018; Lawrence et al., 2019; Lawrence et al., 2020). Nematodes remain a substantial consideration for cotton farmers, especially in field situations where continuous cotton has been the prevalent cotton production method. Currently, management options to control high populations of the reniform nematode are limited; however, resistant cultivars and seed-applied/in-furrow nematicide treatments are potential options. Economic thresholds serve as a guideline to determine when yield losses may occur based on nematode numbers present in a given amount of soil. In Mississippi, economic thresholds suggest that reniform nematode populations ranging from 1,000 reniform nematodes/pint in the spring to 5,000 reniform nematodes/pint at harvest may cause yield losses. In field situations where the soilborne population of reniform nematode is greater than the economic threshold, significant yield reductions oftentimes up to 40%, can be observed. The specific objectives of these trials were to determine the benefits of cultivars, previously observed to be tolerant to the reniform nematode, and seed/in-furrow treatment combinations in managing the reniform nematode with an integrated approach.

Materials and Methods

During 2019 and 2020, trials were established at the Delta Research and Extension Center in Stoneville, MS, in two fields with a history of moderate reniform nematode infestations. Trials were planted in a randomized complete block design (RCBD) with a split-plot constraint (cultivar; n=4). Plots consisted of four rows of cotton (40" centers), 35 feet in length, separated by a fallow alley. Treatment combinations consisted of either seed or in-furrow nematicide products in combination with three cotton lines (list the lines here) developed with reniform nematode tolerance and one susceptible commercial check (DeltaPine 1646B3XF). Seed treatments consisted of a base treatment (prothioconazole + penflufen + metalaxyl + myclobutanil + imidacloprid) or the base treatment + one of several treatments applied to the seed or applied in-furrow to manage the reniform nematode: toxazfen (as Nemastrike), fluopyram (as COPeO), aldicarb (as Temik), or fluopyram + imidacloprid (as Velum Total). Stand counts and vigor were assessed shortly after emergence. Soil samples were collected pre-plant, mid-season and approximately at harvest to assess the reniform nematode population present and determine the effects of treatments on nematode populations. Reniform nematodes were extracted from 200 cc of soil representing a composite sample from each plot by elutriation followed by sucrose centrifugation. Reniform nematode numbers are presented on a per pint of soil basis. Yield was collected by machine-harvesting the center two rows of each plot post-defoliation with a two row Case IH cotton picker outfitted with a harvest weigh cell system. All data were analyzed in PROC GLIMMIX at the 95% confidence interval.

Results

In most cases spring reniform nematode populations were above the economic threshold (1,000/pint) at the first sampling regardless of year. Nematode populations fluctuated throughout each season, but remained above threshold by the harvest sampling regardless of treatment combination. Reniform nematode numbers were significantly different between cultivar and seed treatment combinations during 2020 (**Fig. 1A)**. Up to a 32% numerical difference was observed in nematode numbers from planting to harvest when all reniform tolerant cotton lines and treatment combinations were compared to the commercial susceptible check and all treatment combinations. During 2020 up to an 8% increase in seed cotton was observed with all reniform tolerant cotton lines with the base seed treatment when compared to the commercial check with the base treatment, albeit not significant (**Fig. 1B**).



Panel A stats	*p*=0.8923	*p*=0.3978	*p*=0.9213	*p*=0.0646
Panel B stats	*p*=0.5410	*p*=0.0311	*p*=0.0029	*p*=0.0320
Figure legend	Seed Cotton lb/A	At-planting	Mid-season	End of season

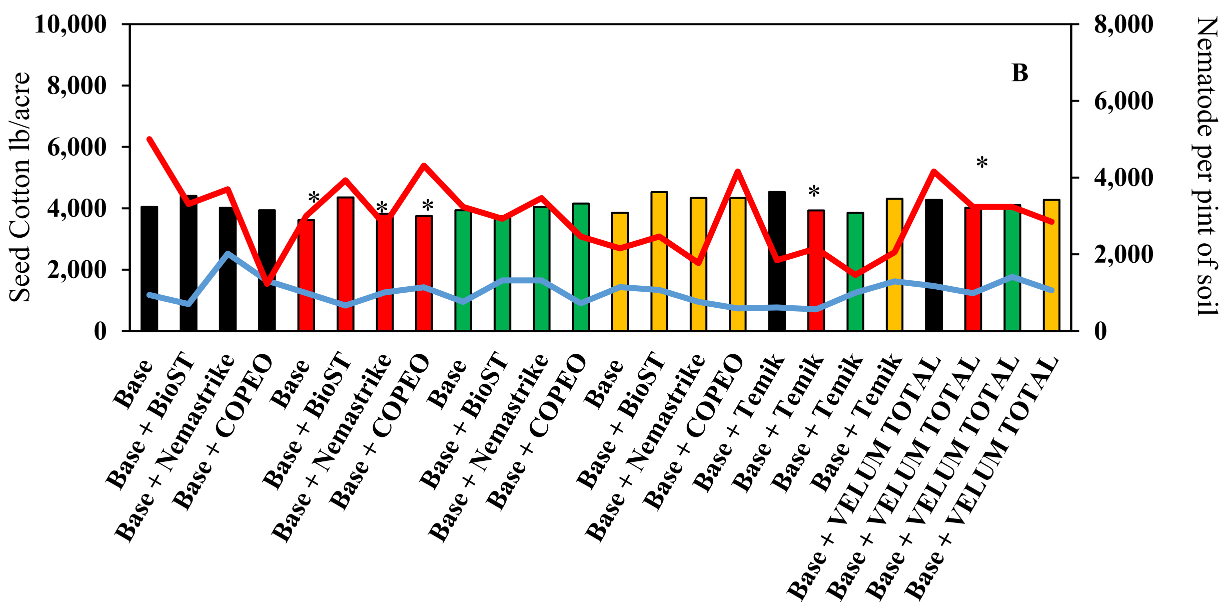


Figure 1**.** Reniform nematode numbers at three sample timings during 2019 and 2020 and the associated yield (seed cotton/A) from 1 field site located in Stoneville, MS. Colored bars represent each cotton line/cultivar used in the study and are as follows: black =M123-1337; red =DP1646; green =08SS100; and yellow =08SS110. An asterisk (*) denotes the commercial susceptible check **A)** 2019 and **B)** 2020.

Discussion

Treatment combinations may be beneficial in managing reniform nematode populations and reducing subsequent yield losses. Seed-applied nematicides alone did not provide significant increases in seed cotton; however, seed/in-furrow treatment and reniform nematode-tolerant cotton line combinations did provide numerical differences when compared to the commercial check.

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