COMPARATIVE REPRODUCTION OF *MELOIDOGYNE INCOGNITA* RACE 3 (COTTON ROOT-KNOT NEMATODE) AND *ROTYLENCHULUS RENIFORMIS* (RENIFORM NEMATODE) ON COTTON, KENAF, AND SUNN HEMP

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Abstract

Growth chamber, microplot, and field tests evaluated sun hemp (*Crotalaria juncea)* and kenaf (*Hibiscus cannabinus*) as rotational fiber crops for managing nematode pests in cotton. Each test included kenaf cv. Everglades 71, sunn hemp cv. Tropic Sun, and a cotton cultivar (Delapine 16 or Deltapine 50) susceptible to race 3 of *Meloidogyne incognita* (the cotton root-knot nematode), as the experimental control. Additional entries included the sunn hemp genotypes TX-374 and IAC 1-2 in the growth chamber test, the resistant cotton genotype Auburn 623 in the growth chamber and microplot test, and the kenaf lines SF 459 and SF 192 in the field test. In the growth chamber and microplot experiments, each genotype was tested separately against *M. incognita* and *Rotylenchulus reniformis* (the reniform nematode). In the field experiment, soil was naturally infested with a mixed population of the two nematodes. The results indicated that sunn hemp cv. Tropic Sun and probably other sunn hemp genotypes will reduce nematode problems in a cotton rotation. Everglades 71 kenaf also can be used in rotation with cotton where *R. reniformis* but not *M. incognita* is present. If used where *M. incognita* is present, Everglades 71 can increase the population density of *M. incognita* to a level that is devastating to cotton.

Introduction

Kenaf (*Hibiscus cannabinus*) and sunn hemp (*Crotalaria juncea*) are rapidly growing erect plants that are cultivated for fiber used in manufacturing paper and absorbents. Both plants have shown promise as new cash crops in the southern United States, possibly in rotation with cotton. Kenaf and sunn hemp generally suffer fewer insect and disease problems than cotton (Cook and Hickman, 1990; Cook and White, 1996). However, several kenaf genotypes support high levels of reproduction by *Meloidogyne incognita* race 3 (the cotton root-knot nematode) (Lawrence and McLean, 1992; Veech, 1992) and are hosts of *Rotylenchulus reniformis* (the reniform nematode) (Peacock, 1956; Yik and Birchfield, 1984). Sunn hemp has been reported to be a poor host of *R. reniformis* (Caswell et al., 1991; Soares da Silva et al., 1989). The following experiments were done to obtain information regarding the relative levels of reproduction by *M. incognita* and *R. reniformis* on kenaf, sunn hemp, and cotton to better understand the constraints and benefits of using these new crops in rotation with cotton in fields where nematode pests are present.

Materials and Methods

Growth Chamber Test

The experimental design was a randomized complete block with six replications of seven plant genotypes infested with either *M. incognita* or *R. reniformis*. Genotypes included the kenaf cv. Everglades 71, the sunn hemp genotypes Tropic Sun, TX 374, and IAC 1-2, the root-knot nematode-resistant cotton line Auburn 623, and the nematode-susceptible cotton cv. Deltapine 16. Plants were grown individually in 500-cm^3 pots containing a 6:1 mixture of fine sand and vermiculite supplemented with 5 g/kg pelletized limestone. Each pot was infested with 4,000 vermiform *R. reniformis* or 1,000 second-stage juveniles (J2) of *M. incognita* race 3 by injecting nematode suspension 1-5 cm deep 2-3 cm from the plant stem 10 days after planting. Plants were exposed to a 14-hour photoperiod with day and night temperatures of 30 and 26 °C, respectively, watered daily, and fertilized weekly. Seven weeks after infesting pots with nematodes, plant heights and weights were taken, nematodes were extracted from 100 g soil per pot by Baermann funnel, and nematode eggs were extracted from each entire root system with dilute NaOCl, then concentrated by sieving and centrifugal flotation (Jenkins, 1964), and counted. Nematode counts were transformed with $\log(x + 1)$ prior to analysis of variance and means were compared with means of controls using Fisher's protected least significant difference. Weights and heights of plants inoculated with *M. incognita* were compared with those of plants inoculated with *R. reniformis* by the *t*-test.

Microplot Test

The experimental design was a randomized complete block with seven replications of Everglades 71, Tropic Sun, Auburn 623, and Deltapine 16 infested with *M. incognita* and seven replications of each infested with *R. reniformis*. Seed were planted in 500-cm^3 pots in the greenhouse and transplanted individually on May 12 into microplots (40-liter pots) containing nematode-free loamy sand. Soil was infested with nematodes as in the growth chamber test. Plants were watered and fertilized as needed. Fifteen weeks after planting, plant heights were taken, and five 2-

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cm-diameter soil cores from each pot were removed, composited, and thoroughly mixed to obtain a 100-g subsample from which nematodes were extracted by Baermann funnel. All but two sunn hemp plants were eaten by rabbits during the first month and sunn hemp was excluded from the statistical analysis. Otherwise, data were analyzed as in the growth chamber test.

Field Test

The field was located in Weslaco, Texas and was infested throughout with *M. incognita* and *R. reniformis* at population densities, respectively, of 8 and 176 vermiform nematodes/kg soil at planting. The experimental design was a randomized complete block with six replications. Each plot was 4 rows wide and 6.7 m long. The entries were Tropic Sun and the kenaf genotypes Everglades 71, SF 459, and SF 192. All were planted on April 28, 1997, and harvested on September 17, 1997. Cotton cv. Deltapine 50 was planted at the same time as other entries in a 2-row × 6.7-m block in the same field but was not part of the experimental design. Several soil cores from each plot and from the cotton block were collected and composited to provide 100-g subsamples for nematode analysis at planting and 2 weeks after harvest. Nematodes were extracted from at-plant samples by both the Baermann funnel and the sieving-centrifugal flotation method (Jenkins, 1964), and were extracted from samples taken at harvest by Baermann funnel. Data were analyzed as in the growth chamber test, except that the *t*-test was not done.

Results and Discussion

In the growth chamber test, sunn hemp plants on average were 91 cm tall and weighed 38 g. Sunn hemp plants infested with *M. incognita* were 7-12% shorter than those infested with *R. reniformis* and weighed 10-15% less. Kenaf plants in the growth chamber were 73 cm tall on average and weighed 46 g; plants infested with *M. incognita* were 24% shorter and 26% lighter than those infested with *R. reniformis.* In the microplots, Everglades 71 plants averaged 220 cm in height and nematode treatments did not differ. In the field test, the sunn hemp cv. Tropic Sun yielded 18,698 kg/ha and the kenaf genotypes SF 459, SF 192, and Everglades 71 yielded 7,486, 6,890, and 3,809 kg/ha, respectively. Everglades 71 normally yields comparably to SF 459 and SF 192 in the absence of nematode pressure.

The nematode-susceptible cotton cultivar in each test supported a seven- to 2,000-fold increase in nematode populations, with final densities of *R. reniformis* about 10 times those of *M. incognita.* On Auburn 623, reproduction by *M. incognita* was 1-2% of that on Deltapine 16 and reproduction by *R. reniformis* was 25-40% of that on Delapine 16 (Table 1). On kenaf Everglades 71, reproduction by *M. incognita* was 1.5 to 37-fold greater than on susceptible cotton. In contrast, population increases by *R. reniformis* on Everglades 71 were similar to those on susceptible cotton in the field test and only 1-8% of that on susceptible cotton in the growth chamber and microplot tests. Lawrence and McLean (1992) similarly found the reproductive factor of *R. reniformis* on kenaf cv. Tainung 1 to be only 14% of that measured for *M. incognita*. Although plots were kept weed free during most of the growing season, *R. reniformis* in the field experiment could have reproduced on weeds (primarily *Amaranthus* spp.) during the last few weeks. Sunn hemp cv. Tropic Sun supported measurable reproduction only by *M. incognita* and then only in the growth chamber test, where the final population on Tropic Sun was 20% of that measured on Deltapine 16 (Table 2). Results obtained for additional genotypes of kenaf in the field test and of sunn hemp in the growth chamber test were similar to those obtained for Everglades 71 and Tropic Sun.

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Table 1. Reproduction (final population/initial population) of *Rotylenchulus reniformis* and *Meloidogyne incognita* on kenaf cv. Everglades 71 compared with susceptible (Deltapine 16) and resistant (Auburn 623) cotton in three experiments.

Experiment	*R. reniformis*	*M. incognita*
Growth Chamber		
Everglades 71	5 ***	478 ***
Auburn 623	52	1 ***
Deltapine 16	66 *	49 (control)
Microplots		
Everglades 71	0.05 ***	487
Auburn 623	847 *	2 ***
Deltapine 16	2,228 **	198 (control)
Field Test		
Everglades 71	10 ***	258 (control)

***, **, * indicate significantly different from the control at the 0.001, 0.01, and 0.05 levels, respectively.

Table 2. Final Population Density (number per gram soil) of *Rotylenchulus reniformis* and *Meloidogyne incognita* Race 3 on Selected Genotypes of Cotton, Kenaf, and Sunn Hemp in Growth Chamber, Microplot, and Field Experiments.

Nematode and Experiment	Cotton (DP 16 or DP 50)	Cotton (Auburn 623)	Kenaf (Ever-glades 71)	Sunn Hemp (Tropic Sun)
R. reniformis				
Growth chamber	378	264	25	2
Microplots	47	18	0.001	NA
Field Test	2	NA	2	0.02
M. incognita				
Growth chamber	66	1	647	13
Microplots	4	0.04	l0	NA
Field Test	0.04	NA	2	0