POPULATION DENSITIES OF ROOT-KNOT NEMATODES FOLLOWING CORN AND SORGHUM IN CROPPING SYSTEMS

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ABSTRACT

Densities of the root-knot nematode, *Meloidogyne incognita* (Kofoid and White) Chitwood, were compared following summer crops of tropical corn *(Zea mays* L.) and sorghum *(Sorghum bicolor* L.) at several locations in north Florida. Densities of *M. incognita* remained low ($\leq 34/100$ cm^3 soil) following the sorghum cultivars DeKalb FS25E and DeKalh BR64 and the sorghum-sudangrass *(S. sudanense* [Piper] Stapf) hybrid DeKalb SX-17, and were lower ($P \leq 0.05$) than population densities following any of the corn cultivars tested. Results were consistent, regardless of location, planting date, or tillage practices. Densities of *M. incognita* following the sorghum cultivar Asgrow Chaparral were not consistently lower than those following corn. Sorghum can be an effective rotation crop for keeping *M. incognifa* populations low, but cultivar choice is critical.

INTRODUCI'ION

Root-knot nematodes (Meloidogyne spp.) have been recognized for many years as the most serious nematode pests of many commercial crops grown in Florida and other southeastern states (Christie, 1959; Johnson, 1982; Taylor and Sasser, 1978). Recently, increased emphasis has been placed on developing crop rotations or sequences that minimize buildup of serious nematode pests, such as root-knot nematodes (Dickson and Gallaher, 1989; Johnson, 1982; McSorley et al., 1991). For example, a winter cover crop of rye *(Secale cereale* L.) was better than vetch *(Vicia villosa* Roth.) for lowering population densities of *Meloidogyne incognita* (Kofoid and White) Chitwood (McSorley et al., 1991). Densities of *M. incognita* were greatly increased following summer crops of corn *(Zea mays* L.) compared with sorghum (Sorghum *bicolor* L.) in both conventional and no-tillage plots (Dickson and Gallaher, 1989). This and other recent observations (McSorley and Gallaher, 1991a) suggest that sorghum and sorghum-sudangrass *(S. sudanense* [Piper] Stapf) hybrids may be excellent rotation crops for limiting root-knot nematode densities. The objective of the current research is to verify these results across a range of sites, tillage practices, planting dates, and cultivars of corn and sorghum.

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MATERIAIS AND METHODS

Separate experiments involving selected corn and sorghum cultivars were established at several locations in Alachua and Marion counties in north Florida. At all locations, the crop treatments were arranged in a randomized complete block design, but the number of replications varied among the sites. Winter cover crops also varied with site and included rye, vetch, wheat *(Triticum aestivum* L.), lupine *(Lupinus angustifolius* L.), or crimson clover *(Trifolium incarnatum* L.), as well as double-cropped corn or sorghum. Tillage practices also varied with location. Previous crops were mowed and removed for silage, and in conventional tillage plots, crop residues were incorporated by plowing and discing before planting. In no-tillage sites, herbicides were '.applied to kill any living plant material, and seed was planted between the old crop rows. In all cases (conventional and no-tillage), corn and sorghum seed were planted in rows 75 cm apart with a two-row Brown-Harden Super Seeder (Brown Mfg. Co. Banks, AL).

In 1990, corn and sorghum cultivars were planted at the Green Acres Agronomy Research Farm in Alachua County on 20 May. Individual plots consisted of four rows, 5 m long. The soil was an Arredondo sand (94% sand, 35% silt, 25% clay; pH 6.7; 2.0% organic matter). The site at the Dairy Research Unit in Alachua County was on Scranton fine sand (90% sand, 3.5% silt, 6.5% clay; pH 6.8; 43% organic matter), and planted on 21 July 1991. Plots consisted of 30 rows, 70 m long. Plots at the Pine Acres Research Farm in Marion County contained four rows, 9 m long. The soil type was an Arredondo sand-Gainesville loamy sand association (92% sand, 3% silt, 5% clay; pH 5.6; 2.8% organic matter). Three different plantings of corn and sorghum were made at this location in 1990 2 April, 20 May, and 20 July. The 20 July planting was a double crop following the same cultivars in the 2 April planting. In 1991, experiments comparing corn and sorghum were established at seven different locations on the Green Acres Farm. Sites differed in their previous crops, but all were planted in May, and plot size at all sites was four rows, 3 m long.

Cultural practices, fertilizers, and herbicide usage at all of these sites are described in detail elsewhere (Gallaher et al., 1991; McSorley and Gallaher, 1991b; McSorley and Gallaher, 1992). Plots were sampled for nematodes at the harvest of each corn and sorghum crop. Each soil sample consisted of six cores 2.5 cm in diameter and 20 cm deep, collected within plant rows in a systematic pattern. From this, a 100-cm^3 subsample was removed for nematode extraction, using a modified sieving and centrifugation procedure (Jenkins, 1964). Nematode count data were log-transformed ($\log_{10}\{x+1\}$) before analysis of variance, and single degree of freedom orthogonal contrasts (Freed et al., 1987; Sokal and Rohlf, 1969) were determined for corn vs. sorghum.

RESULTS AND DISCUSSION

At all locations in 1990, population densities of the root-knot nematode *M. incognita* were lower ($P < 0.05$) following sorghum than following corn (Table 1). This result occurred regardless of tillage practices or whether the crop was first crop or a double crop. Across all sites, average nematode densities on sorghum were all $\leq$ 34/100 cm^3 soil, whereas the lowest nematode density observed after corn was 147/100 cm' soil. These results are consistent with previous observations (Dickson and Gallaher, 1989; McSorley and Gallaher, 1991a) that sorghum was a better rotation crop than corn for keeping population densities of *M. incognita* low.

In 1991, *M. incognita* population densities following sorghum were lower ($P \leq 0.05$) than those following corn at two sites, were not significantly different at four sites, and were higher than populations following corn at one site (Table 2). Results were different from those obtained in the previous season, but a different sorghum cultivar (Asgrow Chaparral) was used, which supported relatively high (mean densities $\geq$ 91/100 cm^3 soil) numbers of *M. incognita* at harvest.

It is evident that, while the preference of sorghum over corn as a rotation crop to limit *M. incognita* densities is not affected by tillage practices, planting date, or location, the choice of a sorghum cultivar is critical. The sorghum or sorghum-sudangrass cultivars DeKalb FS25E, DeKalb BR64, and DeKalb SX-17 were effective in keeping *M. incognita* low. However, relatively few sorghum cultivars have been tested for their effects on root-knot nematode population densities, and much research will be needed to determine the range of response of available sorghum germplasm to these nematode pests.

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Table 1. Population densities of root-hot nematodes (*Meloidogyne incognita*) following crops of corn or sorghum at several locations in 1990.

Location	Tillage[1]	Previous crop	Current crop	Cultivar	Root-knot nematodes per 100 cm^3 soil[2]
Green Acres	No	Winter rye	Corn	Pioneer X304C	152
			Sorghum	DeKalb FS25E	5*
			Sorghum	DeKalb BR64	2*
Dairy Unit	No	Spring corn	Corn	Pioneer X304C	1,872
			Corn	Florida SYN-1	950
			Corn	DeKalb XL678C	884
			Sorghum	DeKalb FS25E	34*
Pine Acres	Conv.	Winter rye	Corn	Pioneer 3320	437
			Corn	Northrup King 508	409
			Corn	Pioneer X304C	762
			Corn	Florida SYN-1	654
			Sorghum	DeKalb SX-17	6*
			Sorghum	DeKalb FS25E	10*
Pine Acres	No	Spring corn	Corn	Pioneer 3320	191
		Spring corn	Corn	Northrup King 508	162
		Spring corn	Corn	Pioneer X304C	234
		Spring corn	Corn	Florida SYN-1	249
		Spring sorghum	Sorghum	DeKalb SX-17	0*
		Spring sorghum	Sorghum	DeKalb FS25E	5*
Pine Acres	Conv.	Winter rye	Corn	Pioneer 3320	375
			Corn	Northrup King 508	147
			Corn	Pioneer X304C	437
			Corn	Florida SYN-1	306
			Sorghum	DeKalb SX-17	4*
			Sorghum	DeKalb FS25E	13*

[1] No = No tillage; Conv. = Conventional tillage.
[2] Asterisk (*) indicates nematode densities on corn and sorghum at the same location are significantly ($P \leq 0.05$) different, according to the orthogonal contrast of corn vs. sorghum. Data are means of 4-8 replications, depending on loeation.

Table 2. Population densities of root-knot nematodes *(Meloidogyne incognita)* following crops of corn or sorghum under conventional tillage during 1991 at seven sites with different winter cover crops.

Previous crop	Current crop	Cultivar	Root-knot nematodes per 100 cm^3 soil[1]
Wheat	Corn	Pioneer 3098	759
	Sorghum	Asgrow Chaparral	91*
Fallow	Corn	Pioneer 3098	265
	Sorghum	Asgrow Chaparral	318*
Rye	Corn	Pioneer 3098	1,076
	Sorghum	Asgrow Chaparral	166*
Lupine	Corn	Pioneer 3098	782
	Sorghum	Asgrow Chaparral	248
Lupine	Corn	Pioneer 3098	1,244
	Sorghum	Asgrow Chaparral	467
Clover	Corn	Pioneer 3098	706
	Sorghum	Asgrow Chaparral	541
Vetch	Corn	Pioneer 3098	1,262
	Sorghum	Asgrow Chaparral	815

[1] Asterisk (*) indicates nematode densities on corn and sorghum are significantly ($P \leq 0.05$) different, according to the orthogonal contrast of corn vs. sorghum. Data are means of 4-5 replications, depending on site.