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Reproduction of *Meloidogyne incognita* and *M. arenaria* on Tropical Corn Hybrids[1]

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Abstract: Reproduction of *Meloidogyne incognita* and *M. arenaria* was determined on 25 commercial tropical corn hybrids in greenhouse studies. Soil around corn seedlings was infested with 3,000 eggs/plant. Reproduction was quantified from counts of egg masses on roots stained with phloxine B 60 days after soil infestation. All of the tropical hybrids were susceptible to *M. incognita* and *M. arenaria*. Egg mass indices (0–5 scale) ranged from 3.4 to 4.2 and from 3.4 to 4.1 for *M. incognita* and *M. arenaria*, respectively.

Key words: corn, maize, *Meloidogyne arenaria*, *Meloidogyne incognita*, nematode, peanut root-knot nematode, resistance, southern root-knot nematode, *Zea mays*.

Tropical corn (*Zea mays*) hybrids have received much interest in recent years due to the unique alternatives these hybrids provide to traditional cropping practices in the southeastern United States (11,18). Hectarage planted to tropical corn hybrids has increased significantly since the late 1980's. An estimated potential of 60,000 to 80,000 hectares of tropical corn exists in the Southeast (12). These hybrids are grown primarily for silage, although under favorable conditions they may be grown for grain.

Tropical corn hybrids offer several advantages over temperate hybrids. Tropical hybrids have resistance to fall army worm (*Spodoptera frugiperda*) and have better tolerance of drought and heat stress (11). These characteristics allow tropical hybrids to be double cropped after small grains, grass crops, and vegetable crops (5,12).

Tropical hybrids have been evaluated in crop rotation systems in efforts to manage root-knot nematodes (*Meloidogyne* spp.) (2, 5–9). *Meloidogyne arenaria* populations were not sufficiently suppressed by tropical corn hybrids in rotation with soybean (9). Also, population densities of *M. incognita* increased following rotations with tropical corn hybrids (2,5–8).

No information is available on the host status of recently developed commercial tropical corn hybrids for *M. incognita* and *M. arenaria*. The objective of these experiments was to determine the reproductive potential of *M. incognita* and *M. arenaria* on tropical corn hybrids.

Materials and Methods

Isolates of *M. incognita* race 4 and *M. arenaria* race 2 were cultured on tomato (*Lycopersicon esculentum* cv. Floradel) in the greenhouse at ca. 28 C. After 8–10 weeks, tomato roots were washed free of soil, and eggs and second-stage juveniles (J2) were collected by the NaOCl method (4).

Twenty-five commercial tropical hybrids were selected for this study. Two root-knot resistant lines from the open-pollinated varieties Tebeau and Old Raccoon (1,17) and a root-knot susceptible temperate hybrid (15), Pioneer 3110, were included in the tests as checks. A mixture of methyl bromide-treated sandy loam and river sand (80% sand, 14% silt, 6% clay) was added to Todd planter flats (Model 300, Speedling, Sun City, FL). Each flat contained 32 7.6-cm^2 × 7.6-cm-deep inverted, pyramid-shaped cells. Seeds of each hybrid were planted in separate cells, and 7-day-old seedlings were thinned to one plant per cell. When the seedlings were 7 to 10 days old, the soil was infested with 3,000 eggs

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and J2 of the appropriate *Meloidogyne* isolate suspended in 1 ml water. Plants were grown in the greenhouse at an average temperature of ca. 28 C.

Treatments were arranged in a completely randomized design with 10 replications. Sixty days after soil infestation, roots were washed free of soil and stained with phloxine B (3). Nematode reproduction was quantified with an egg mass index (EMI) on a 0–5 scale, with 0 = 0, 1 = 1 or 2, 2 = 3–10, 3 = 11–30, 4 = 31–100, and 5 = >100 egg masses (10). The experiment for each *Meloidogyne* isolate was repeated once. Data from both experiments for each nematode were combined for analyses, and EMI means for hybrids were compared by least significant differences (LSD) at $P = 0.05$.

Results

Tropical corn hybrids differed ($P = 0.05$) in their abilities to support *M. incognita* (Table 1); however, all of the hybrids had EMI (≥3.0) that indicated susceptibility. DeKalb XL599, DeKalb XL510, DeKalb DK888, and Pioneer 3098 had the highest EMI at 4.2. The hybrid with the lowest EMI (3.4) for *M. incognita* was DeKalb B844. The susceptible control had an EMI of 3.6, and the resistant lines from Tebeau and Old Raccoon had EMI of 0.6 and 1.3, respectively.

Reproduction by *M. arenaria* on the tropical hybrids was also high. Differences were observed between the hybrids, but all of the hybrids had EMI that indicated susceptibility. Pioneer X304C, DeKalb XL678C, DeKalb D717A, and DeKalb B844 had the highest EMI (4.1). The tropical hybrid with the lowest EMI (3.4) was DeKalb B555. The susceptible control had an EMI of 3.7, and the resistant lines from Tebeau and Old Raccoon had EMI of 1.3 and 1.9, respectively.

TABLE 1. Reproduction of *Meloidogyne incognita* and *M. arenaria* on tropical corn hybrids after 60 days.

		Egg mass index†	
Brand	Hybrid	*M. incognita*	*M. arenaria*
DeKalb	XL599	4.2	3.9
DeKalb	XL510	4.2	3.9
Pioneer	3098	4.2	4.0
DeKalb	DK888	4.2	3.9
Pioneer	X304C	4.1	4.1
Pioneer	3078	4.1	3.7
DeKalb	XL561	4.1	3.9
DeKalb	XL678C	4.1	4.1
DeKalb	D801B	4.0	4.0
Pioneer	3086	4.0	3.9
Cargill	C901	4.0	3.9
DeKalb	B833	3.9	3.5
DeKalb	DK4F-91	3.9	3.7
Pioneer	P3072	3.8	4.0
DeKalb	XL370	3.8	3.9
Oro	375T	3.8	3.8
DeKalb	DK3-S-41	3.8	3.5
DeKalb	D717A	3.8	4.1
DeKalb	B850	3.8	3.8
DeKalb	DK4F-37	3.8	3.8
Cargill	701	3.7	3.7
Pioneer	3110‡	3.6	3.7
DeKalb	XL604	3.6	3.8
DeKalb	B555	3.5	3.4
Cargill	X9255	3.5	4.0
DeKalb	B844	3.4	4.1
Old Raccoon§		1.3	1.9
Tebeau§		0.6	1.3
LSD ($P = 0.05$)		0.4	0.4

Data are means of 20 replications.
† Egg mass index: 0 = no egg masses, 1 = 1–2, 2 = 3–10, 3 = 11–30, 4 = 31–100, 5 = >100 egg masses.
‡ Root-knot nematode susceptible hybrid.
§ Root-knot nematode resistant lines.

Discussion

Tropical corn hybrids have been included in crop rotations in efforts to suppress *Meloidogyne* populations. In Alabama, a tropical hybrid (Pioneer X304C) in rotation with soybean was not effective in reducing numbers of *M. arenaria* (9). In Florida, the same tropical hybrid was compared with sorghum in crop rotations in an effort to reduce numbers of *M. incognita* (2). Final population densities of *M. incognita* were 10 times higher than initial population densities on the tropical hybrid. Nematode numbers following sorghum were significantly lower than those on corn. In other studies in Florida, tropical corn hybrids were ineffective in suppressing *M. incognita* (5–8). *Meloidogyne incognita* reproduced readily on Pioneer 3098 and Pioneer X304C in those experiments. The susceptibility of Pioneer 3098 and Pioneer X304C was confirmed in our experiments. These hybrids had EMI of 4.0 or higher for *M. incognita* and *M. arenaria.*

The susceptibility of the commercial tropical hybrids to *M. incognita* and *M. arenaria* in our study is comparable to the level of susceptibility in commercial temperate hybrids. Many temperate corn hybrids are excellent hosts for *M. incognita* (15). Initial populations of *M. incognita* race 4 increased 20 to 40-fold on commercial temperate hybrids. Most temperate hybrids are also highly susceptible to *M. arenaria;* however, several with resistance have been identified (15). Northrup King 508 and Pioneer 3147 were poor hosts for *M. arenaria* race 2. Final populations (60 days after soil infestation) did not increase over the initial populations.

Although no commercial corn hybrids, temperate or tropical, with resistance to *M. incognita* have been reported, progress has been made in identifying root-knot-nematode resistant lines (13,14). An inbred line, Mp307, and two open-pollinated varieties, Tebeau and Old Raccoon, were poor hosts for *M. incognita* (1,16). The resistant lines used as checks in our study were selected from Tebeau and Old Raccoon. These lines were highly resistant (EMI < 2.0) to *M. incognita* and *M. arenaria* compared with the tropical hybrids. Limited *M. incognita* reproduction on these resistant lines is due to slower nematode development (17).

Tropical corn hybrids are attractive alternatives for inclusion in double cropping systems because of their insect resistance and heat and drought tolerance. These hybrids, however, are excellent hosts for *M. incognita* and *M. arenaria.* The incorporation of root-knot nematode resistance into tropical corn hybrids would make them useful in managing *Meloidogyne* spp. in the southeastern United States.

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