Development of Meloidogyne incognita **Inhibited by** Digitaria decumbens **cv. Pangola**[1]

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Abstract: Population densities of the root-knot nematode, *Meloidogyne incognita,* were lower after 90 days in soil planted to digitgrass (*Digitaria decumbens* cv. Pangola) than in soil left fallow or planted to tomato. Roots of tomato seedlings interplanted with Pangola digitgrass were less galled than were roots of tomato seedlings planted alone. Fewer second stage larvae invaded roots of Pangola digitgrass than tomato and those that entered the grass roots failed to develop beyond the late second stage. *Key words:* antagonistic plant, biological control, digitgrass, root-knot nematode.

Journal of Nematology 15(1):102-105. 1983.

Digitgrass (*Digitaria decumbens* Stent. cv. Pangola) is a forage grass which originated in Africa and was released to Florida livestock producers in 1945 (2). The grass can be used for grazing, for hay, or for silage (4).Winchester and Hayslip (9) reported a rapid reduction of established populations of *Meloidogyne incognita acrita* by Pangola digitgrass; when pure stands of the grass were maintained in plots, no *M. incognita acrita* were found in the soil 2 months after establishment. However, since stands usually are infested with weeds, Winchester (8) indicated that it may take up to 2 years to eliminate *M. incognita acrita* with Pangola digitgrass.

Overman (7) sampled 74 pastures of Pangola digitgrass ranging in age from 1 to 17 years and reported that *Meloidogyne (M. incognita)* was detected in only one pasture; that pasture was in tomato production the previous year.

Hayslip et al. (3) suggested that Pangola digitgrass could be used in rotation with tomato production in Florida because it controlled *M. incognita acrita,* reduced weeds, reduced fruit rot caused by *Rhizoctonia solani* Kuehn, and had other beneficial effects. Ayala et al. (1) suggested that Pangola digitgrass could be included in a rotation with pineapple because it controlled *M. incognita* as well as species of *Criconemoides* and *Helicotylenchus.*

The objective of the research reported here was to investigate further the effects of Pangola digitgrass on *M. incognita.*

MATERIALS AND METHODS

The population of the root-knot nematode, *Meloidogyne incognita,* used in these investigations was designated *M. incognita*-118 collected from potato (*Solanum tuberosum L.*) in St. John's County, Florida (6). The population was increased on tomato (*Lycopersicon esculentum* Mill. cv. Manalucie). The following were common to all experiments: 5-week-old Manalucie tomato seedlings and 5-week-old rooted cuttings of Pangola digitgrass; egg masses of *M. incognita* picked from the root surface of the stock plants; Arredondo fine sand, steam sterilized for 15 min under pressure of 1.41 kg/cm^2 (15 psi); all experiments conducted in a greenhouse with temperatures at approximately 25 C (78 F); seedlings watered as needed and once a week each received about 100 ml of a solution made up with 1 g/liter of Nutrisol fertilizer 12-10-12 analysis.

Effect of Pangola digitgrass on a population of M. incognita. Eighteen pots (15-cm d) were filled with soil and each was infested with eight egg masses. Six of the pots were planted with one Pangola digitgrass cutting each, six with one Manalucie tomato seedling, and six were left fallow as controls. After 3 months, a 100-cm^3 soil sample was processed from each pot using a centrifugation-sugar flotation method (5) and the number of larvae counted. The plant roots were washed and observed for galls and egg masses.

Effect of Pangola digitgrass interplanted with tomato on populations of M. incognita. Twelve pots were filled with soil and each was infested with eight egg masses of *M. incognita.* One Pangola digitgrass cutting and one tomato seedling were interplanted

Received for publication 8 March 1982.

[1]Florida Agricultural Experiment Stations Journal Series No. 3689. Portion of a thesis submitted by the senior author in partial fulfillment of the requirements for the M.S. degree in Nematology.

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in each of six pots. One tomato seedling was planted in each of the six control pots. After 3 months, data were taken as for the previous experiment.

Recovery of second-stage larvae of M. incognita from roots of tomato plants versus Pangola digitgrass. Eighteen pots were planted with one tomato seedling each and 18 with one Pangola digitgrass cutting; each was infested with 20 egg masses. After 1, 2, and 3 months, roots of six Pangola digitgrass and six tomato plants were washed, comminuted in a food blender for 30 sec, and placed in a modified Baermann funnel. After 24 hours, the larvae were collected on a 500 mesh sieve and washed into a Syracuse watch glass for counting.

Larval penetration and development in Pangola digitgrass.

Experiment A: Each of 44 pots was infested with eight egg masses of *M. incognita.* Twenty-two pots were planted with one Pangola digitgrass cutting and 22 with one tomato seedling.

Every 2 days for 22 days, plants from two pots of Pangola digitgrass and two pots of tomato were harvested. Roots were washed, stained with acid fuchsin in lactophenol, cleared in lactophenol, mounted on slides, and examined for the presence of larvae.

Experiment B: The procedures were similar to those in Experiment A except that 60 pots were used, 30 of which were infested with 20 egg masses per pot, and observations were made over a 30-day period.

Experiment C: This experiment was conducted to study the development of *M. incognita* in roots of Pangola digitgrass over an extended period of time. Sixty 15-cm pots of soil were planted each with one Pangola digitgrass cutting and each was infested with 50 egg masses. Roots of plants from three pots were examined every 3 days for 90 days using the method in Experiment A. Larvae in the roots were counted and the life stage determined.

RESULTS

Effect of Pangola digitgrass on a population of M. incognita. Within 3 months of planting, fewer than 50 *M. incognita* larvae per pot were recovered from soil under Pangola digitgrass; more than 150 per pot were recovered from fallow soil and more than 700 per pot from soil under tomato. No galls, females, or egg masses were observed on Pangola digitgrass roots.

Effect of Pangola digitgrass interplanted with tomato on populations of M. incognita. Root systems of tomato interplanted with Pangola digitgrass contained an average of eight galls compared with an average of 93 on tomato planted alone. An average of 192 larvae per pot was extracted from soil interplanted with tomato and Pangola digitgrass compared with 912 for tomato planted alone. The roots of tomato planted alone weighed an average of 2.3 g, while those interplanted with Pangola digitgrass weighed an average of 16.1 g. All of these comparisons were significantly different.

Recovery of second-stage larvae of *M. incognita from roots of tomato versus Pangola digitgrass.* The numbers of larvae extracted from Pangola digitgrass roots in months 1, 2, and 3 were an average of 2, 15, and 5, respectively, compared with an average of 62, 102, and 140, respectively, from tomato roots.

Larval penetration and development in Pangola digitrass.

Experiment A: Second-stage larvae of *M. incognita* were observed inside tomato roots 6 days after inoculation. Third- or fourth-stage larvae were found after 12 days and mature females after 22 days. No attempt was made to distinguish between third- and fourth-stage larvae. No larvae or adults were observed in Pangola digitgrass roots (Fig 1).

Experiment B: Four days after inoculation, second-stage larvae were present; 22 days after, females were present; and 24 days after, eggs were present in tomato roots. Second-stage larvae were found inside Pangola digitgrass roots 16 days after inoculation, but none developed beyond the second stage (Fig 1).

Experiment C: Second-stage larvae were first found in roots of Pangola digitgrass 12 days after inoculation. The number of larvae inside the roots reached a peak of 70 at 42 days after inoculation and declined thereafter, with only two detected at day 90. As observed in Experiments A and B, larvae did not develop beyond the late sec-

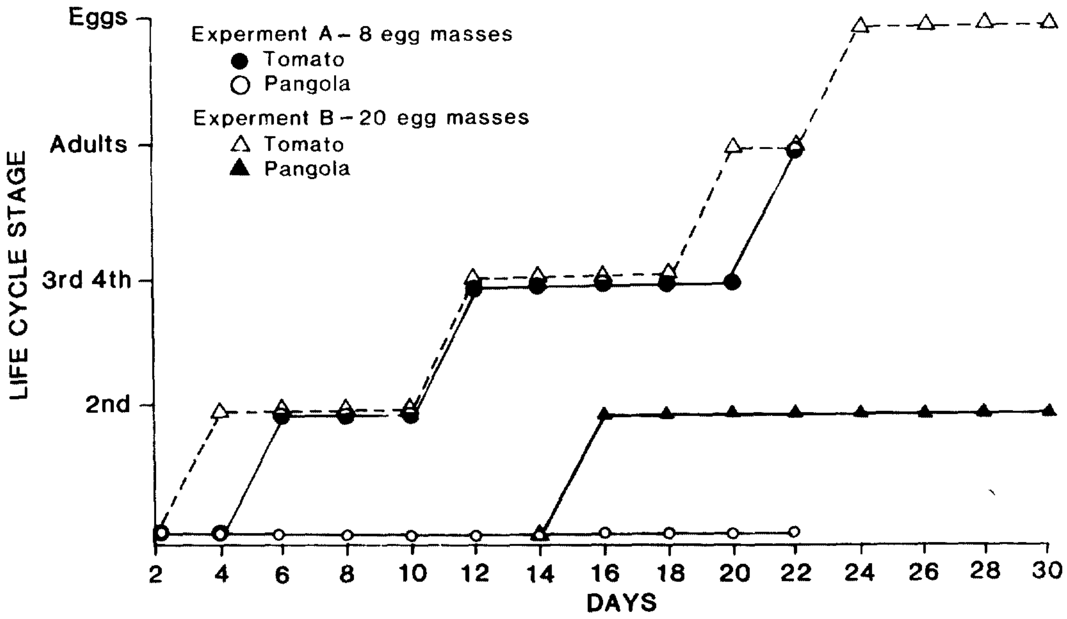

Fig. 1. Penetration and development of *Meloidogyne incognita* in roots of tomato (*Lycopersicon esculentum* cv. Manalucie) and digitgrass (*Digitaria decumbens* cv. Pangola) in soil infested with 8 or 20 egg masses.

ond stage. Giant cell formation was not detected and no hypersensitive reaction was noted in the plant tissues around the larvae. The larvae were found usually near root tips, but some were observed in mature root tissues.

DISCUSSION

These experiments confirmed the reports of Winchester (8) and observations of Overman (7) that Pangola digitgrass adversely affects populations of at least certain species of root-knot nematodes. Further tests showed that interplanting Pangola digitgrass and tomato provided some protection of tomato from root-knot nematode damage. Thus, the protective property of Pangola digitgrass must have been transferred to the soil or to the tomato plant roots.

Although second-stage larvae enter roots of Pangola digitgrass, considerably fewer do so than enter tomato roots, and those that do enter do not develop beyond the late second stage.

We do not know why relatively few larvae enter roots of Pangola digitgrass or why they do not develop beyond the second stage. However, preliminary data indicate that giant cells are not formed by the plant. Since these are the "nurse" cells on which the sedentary larvae and adult females feed, development of the larvae would not be possible without the formation of such specialized cells. It is possible, too, that the plant does not provide an essential element for growth of the nematode, that it produces a substance which prevents growth and development, or that it produces a toxic substance.

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