INFLUENCE OF *MELOIDOGYNE JAVANICA* ON GROWTH AND YIELD OF OILSEED SUNFLOWER

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ABSTRACT

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One microplot test and two field tests were conducted to study the reproduction, pathogenicity and control of *Meloidogyne javanica* (Treub.) Chitwood on sunflower *(Helianthus annuus* L.) In the microplot test, inoculum levels of 5, 25, and 125 eggs and/or second stage larvae of *M. javanica* per 100 cm^3 soil increased 3-5 fold after 60 days. Plant dry weights at harvest, however, were not significantly different. In the field tests, phenamiphos, aldicarb, carbofuran, BAS 263-04-I, and fensulfothion in 20 cm bands increased sunflower growth and reduced populations of *M. javanica.* Phenamiphos at 3.0 kg a.i./ha was phytotoxic to the sunflower plants but not at 1.2 kg a.i./ha.

Additional key words: root knot nematodes, crop rotations, Nemacur, Temik, Furadan, Dasanit, pest management.

RESUMEN

Rich, J.R., y V.E. Green, Jr. 1981. Influencia de *Meloidogyne javanica* en el crecimiento y producción de semilla de girasol.
Nematropica 11: 11-16,

La reproducción, patogenicidad y el grado de combate de *Meloidogyne javanica* (Treub.) Chitwood en girasol *(Helianthus annuus* L.) fueron estudiados en un ensayo con microparcelas y en dos experimentos de campo. En las microparcelas niveles de inóculo de 5, 25, y 125 huevecillos y/o larvas en segundo estadio por 100 cm^3 de suelo se multiplicaron de 3-5 veces en 60 días, aunque no se observaron diferencias en peso seco de las plantas. En los

experimentos de campo, las aplicaciones de fenamifos, aldicarb, carbofurán, BAS 263-04-I, y fensulfotión en franjas de 20 cms resultaron en aumentos en el desarrollo del girasol y disminuciones en las poblaciones de *M. javanica.* Fenamifos a 3 Kg i.a./ha resultó ser fitotóxico en las plantas de girasol pero no en dosis de 1.2 Kg i.a./ha.

Palabras claves adicionales: nematodos noduladores, rotación de cultivos, Nemacur, Temik, Furadan, Dasanit, manejo de plagas.

INTRODUCTION

In recent years interest in the production of oilseed sunflower *(Helianthus annuus* L.) has increased in north central Florida (4). The crop may be planted during February-August, and therefore may serve in multiple cropping systems. However, limited information on sunflower pests and their control is available in the Southeastern U.S.A. (2, 3). Plant parasitic nematodes are potentially major pests of this crop (4, 7, 10). Three species of the root-knot nematodes, *M. incognita, M. arenaria,* and *M. javanica,* are important parasites on agronomic crops in Florida. Three experiments were conducted to define reproduction, pathogenicity, and control of *M. javanica* on sunflower.

MATERIALS AND METHODS

Thirty-two microplots made from fiberglass were placed into a Lakeland fine sand soil (93% sand, 4.0% silt, and 3.0% clay) previously treated with 673 kg/ha methyl bromide (9). On April 25, 1978, three levels of *M. javanica* were added to the microplots: 5, 25, and 125 nematode eggs and/or second stage larvae/100 cm^3 of soil. Initial inoculum levels were based on the soil volume in the 76-cm-diam microplots to a depth of 23-cm. Eggs and second stage larvae were extracted from tomato roots with a 1% sodium hypochlorite solution (5). Nematodes were added in 20 ml of water to each of 55 evenly spaced holes (8, 15, and 23-cm deep) per microplot (1). Seeds of sunflower 'Sungro 372A' were planted the following day and upon emergence were thinned to 6 plants per microplot. Treatments were replicated eight times in a randomized complete block design. Plants were grown following recommended cultural practices and were irrigated as needed. Soil and root samples were collected 60 days after planting by removing five soil cores (2.8 x 30 cm) from each microplot. Soil cores were composited, and a 250 cm^3 subsample was screened to remove roots. Soil was processed by a modified centrifugal sugar flotation technique (6). Eggs and larvae were recovered from the roots by the sodium hypochlorite technique. For comparison with initial inoculum levels, the sum of eggs and larvae recovered from roots and soil were converted to

nematodes per 100 cm^3 of soil. At harvest, six whole mature sunflower plants per microplot were oven-dried and weighed.

Field tests were conducted in 1978 and 1979 in a Lakeland fine sand (93% sand, 5% silt, and 2% clay) soil infested with *M. javanica.* In the 1978 test, sunflowers were double-cropped on a tobacco nematicide test site. The site was treated in early spring with broadcast applications of DD at 100.9 kg a.i./ha, and ethoprop at 9.0 and 26.9 kg a.i./ha. On August 11, phenamiphos was applied at 3.0 kg a.i./ha in a 20 cm band over the row, and seeds of Sungro 380 were planted in the same operation. Phenamiphos was applied with a Gandy^R electric granular applicator and was lightly incorporated by the action of the planter shoes. Treatments were arranged in a split plot design with the previous tobacco nematicide treatments serving as main plots and phenamiphos and control treatments as subplots. The treatments were replicated six times, and each plot consisted of two rows 0.9 m apart and 9.1 m long. Plant emergence was recorded 14 days after planting. Soil samples for nematode analysis were taken at planting and 63 days after planting by removing eight soil cores 30 cm deep in each plot. Soil cores were composited and 250 cm^3 subsamples were wet-sieved and the contents placed on Baermann funnels for three days. Sunflower heads were harvested from 4.6 m of row in each plot 103 days after planting. Seed heads were oven-dried and seeds removed by threshing. Seed yields are reported on the basis of 10% moisture.

The 1979 field test was adjacent to the 1978 test on a site previously cropped to soybeans. Procedures were similar to those used in 1978 except as described below. Treatments replicated six times in a randomized complete block were as follows: aldicarb (15G) 1.1. kg and 2.5 kg a.i./ha, carbofuran (10G) 2.5 kg a.i./ha, fensulfothion (15G) 2.5 kg a.i./ha applied at planting on August 25 (Table 3). BAS 263-04-I WP at 2.5 kg a.i./ha was sprayed in 187 L/ha of water immediately after planting. Soil samples were taken at planting and 103 days after planting, and nematodes were extracted by a modified centrifugal sugar flotation technique. Four plants from each plot were rated for galling (0-4 scale) (8) after 100 days, and seed head diam from 10 plants was recorded from every third plant in each plot. Frost killed the plants before seed maturity, and no yield data were obtained.

RESULTS AND DISCUSSION

Sixty days after inoculation, numbers of *M. javanica* had increased on sunflower in the microplot test (Table 1). Reproductive rates were slightly higher at the lower inoculum levels, but significantly more eggs and larvae were recovered from the highest inoculum level. Yields were inversely correlated with nematode inoculum level but differences among treatments were not significant.

Table 1. Influence of three inoculum levels of *M. javanica* on nematode reproduction and sunflower growth in microplots.

Inoculum level per 100 cm³ soil	Level after 60 days	Dry weight of plants (g)
0	1 B[z]	421 A
5	18 B	386 A
25	137 B	368 A
125	349 A	346 A

[z]Column means followed by the same letter are not significantly different (P=0.05) according to Duncan's Multiple Range Test.

Table 2. Efficacy of phenamiphos for control of *M. javanica* on sunflower.

Treatment	Rate in kg a.i./ha	Stand/ 18 m row	Number in 100 cm³ soil	Yield kg/ha
Phenamiphos	3.0	53 B[z]	81 B	1077 A
Control	--	82 A	494 A	604 B

[y]Initial population density in control plots was 419/100 cm³ soil.

[z]Column means followed by the same letter are not significantly different (P=0.05) according to the Analysis of Variance Test.

In the 1978 test, residual effects of the DD treatment were observed in sunflower. Yields in plots treated with DD were significantly better (P=0.10) than those from control plots, but no differences were found in numbers of *M. javanica*. No differences in sunflower yields or numbers of *M. javanica* were found in the ethoprop treatments. Phenamiphos-treated plots produced significantly higher seed yields and contained fewer *M. javanica* than the control plots (Table 2). Phenamiphos reduced sunflower emergence and produced slight plant stunting early in the season. The young plants exhibited marginal necrosis on the first 2-4 true leaves, but these symptoms disappeared as the season progressed.

In 1979, all treatments significantly increased sunflower seed head diam, reduced gall index, and reduced nematode numbers (Table 3). Fensulfothion produced a higher gall index than other nematicide treatments except the low

Table 3. Effect of five nematicides on sunflower seed head diameter, gall index and number of *M. javanica* in soil.

Treatment	Rate in kg a.i./ha	Seedhead Diam (cm)	Gall Index	No. nematodes/ 100 cm³ soil[y]
aldicarb	2.5	15.4 A[z]	1.1 C	22 C
carbofuran	2.5	15.4 A	1.3 C	34 C
aldicarb	1.1	14.8 A	1.7 BC	71 C
BAS 263-04-I	2.5	14.7 A	1.4 C	28 C
phenamiphos	1.2	14.4 A	1.3 C	79 C
fensulfothion	2.5	13.9 A	2.1 B	288 B
control	--	12.2 B	2.9 A	316 A

[y]Initial population density in control plots was 20/100 cm³ of soil.

[z]Column means followed by the same letter are not significantly different (P=0.05) according to Duncan's Multiple Range Test.

rate of aldicarb. More *M. javanica* were recovered in the fensulfothion treatments than from other nematicide treatments. Phytotoxicity was not observed in any plots. Although phenamiphos was phytotoxic at 3.0 kg a.i./ha in 1978, 1.2 kg a.i./ha had no deleterious effects on plant stand or growth in 1979.

M. javanica populations increase on sunflower, and the nematode may cause significant reductions in plant growth (7, 10). Damage, however, was less than expected with population levels of *M. javanica* present in this study. The plant appeared somewhat tolerant to parasitism by this nematode, possibly due to its extensive root system that makes it quite drought tolerant (3). Under conditions of lower *M. javanica* levels (ca <10/100 cm³ soil) and late planting, control procedures may not be essential in sunflower plantings. Further studies are needed to verify this hypothesis, and to provide additional information on optimum rates, application methods, and nematicides to control of *M. javanica* in sunflower.

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