ROOT-KNOT NEMATODES IN NORTH-CENTRAL FLORIDA SOYBEAN FIELDS

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ABSTRACT

Garcia M., R., and J. R. Rich. 1985. Root-knot nematodes in north-central Florida soybean fields. Nematropica 15:43-48.

A survey of 103 soybean fields in five north-central Florida counties was conducted to determine the incidence of *Meloidogyne* species and grower practices used to manage these nematodes. All fields sampled were infested with *Meloidogyne* spp. The most prevalent species was *M. incognita* (Kofoid and White) Chitwood found in 70% of the soybean fields, followed by *M. javanica* (Trueb) Chitwood in 24% and *M. arenaria* (Neal) Chitwood in 6%. Management practices for the *Meloidogyne* spp. in descending order of usage were resistant cultivars, crop rotation, and nematicides. The survey confirmed the potential threat of *M. javanica* and *M. arenaria* to this relatively new soybean production area of Florida.
Additional key words: Glycine max, Meloidogyne arenaria, M. javanica, M. incognita, nematode survey.

RESUMEN

Garcia M., R., y J. R. Rich. 1985. Los nematodos noduladores de las raices en los campos de frijol de soya del norte central de la Florida. Nematropica 15:43-48.

Se condujo un inventario en 103 campos de frijol de soya en 5 condados del norte central de la Florida para determinar la incidencia de las especies de *Meloidogyne* y las prácticas usadas por los agricultores para manejar esos nematodos. Todos los campos muestreados estaban infestados con *Meloidogyne* spp. Las especies más prevalescientes fueron *M. incognita* (Kofoid y White) Chitwood que se encontró en el 70% de los campos de soya, seguido por *M. javanica* (Trueb) Chitwood en el 24% y *M. arenaria* (Neal) Chitwood en el 6%. Las prácticas de manejo para el *Meloidogyne* spp. en orden descendente, fueron el uso de cultivares resistentes, la rotación de cosechas y la aplicación de nematicidas. El inventario confirmó la amenaza potencial de *M. javanica* y *M. arenaria* para la relativamente nueva producción de frijol de soya en la Florida.
Palabras claves adicionales: Gylcine max, Meloidogyne arenaria, M. javanica, M. incognita. inventario de nematodos.

INTRODUCTION

Soybean (*Glycine max* [L.] Merr.) production in Florida increased from 93,000 ha in 1972 to 249,000 ha in 1982 (1). As soybean hectarage

expanded, so did the recognition of plant-parasitic nematode damage to the crop (8). Estimated losses to nematodes in Florida soybeans exceed 13% annually with *M. arenaria* (Neal) Chitwood, *M. incognita* (Kofoid and White) Chitwood, and *M. javanica* (Treub) Chitwood causing most damage (R.A. Dunn, personal communication).

The commonly used methods for managing the *Meloidogyne* complex are resistant cultivars, crop rotation, and nematicides (4). Soybean cultivars adapted to the southeastern United States currently possess good resistance to *M. incognita,* but only moderate resistance to *M. arenaria* and slight resistance to *M. javanica.* Crop rotation has been practiced, but the usefulness of this technique is limited by the lack of alternative high-value crops. Nematicides have been shown to control the three *Meloidogyne* species, but due to their relatively high cost are generally not economical for soybean production.

Methods of managing *Meloidogyne* spp. vary with the species or species mixture in a field. The first step in devising a nematode management scheme is to correctly determine the species present. However, little is known regarding the relative abundance of the three *Meloidogyne* species in the soybean production area of north-central Florida. Earlier surveys indicated that *M. javanica* was the most prevalent and most damaging species on tobacco (5, 6). In the southeastern U.S., *M. arenaria* has been reported to be increasing in importance on soybeans (7). This study was conducted to determine the relative incidence of *M. arenaria, M. incognita,* and *M. javanica* infestation in soybean fields in north-central Florida and grower utilization of nematode management practices.

MATERIALS AND METHODS

The survey was conducted between 15 August and 15 October, 1982 in five north-central Florida counties (Columbia, Hamilton, Lafayette, Madison, and Suwannee). A total of 103 fields comprising 1956 ha were surveyed in the five counties (Table 1). The sampled soybean hectarage in each county represented approximately 11% the crop grown in that county. Sampling was conducted according to a modified stratified pattern to obtain information from widely distributed areas in each county. Soybean fields within each area, however, were selected randomly. Ten 25-cm-deep cores of soil were taken in the row in each field. Soil samples were spaced to represent the entire field. The soil cores from individual fields were composited, mixed thoroughly, and a 250 cm^3 subsample was processed by a sugar flotation-centrifugation technique (3). Five galled soybean root systems were collected from each field. Galls were dissected to collect mature females from which a minimum of 10 perineal patterns were obtained for species identification. Juveniles obtained from egg

Table 1. Incidence of *Meloidogyne* species in soybean fields in five north-central Florida counties.[z]

County	Number of fields	Number of hectares	Percent of fields infested with: *M. incognita*	*M. javanica*	*M. arenaria*
Columbia	23	443	87	9	4
Hamilton	22	407	86	9	5
Lafayette	3	36	66	0	34
Madison	26	557	54	42	4
Suwannee	29	513	58	34	8
Total	103	1,956	70	24	6

[z]The survey represented 11% of the soybean hectarage grown in the five counties.

masses on the soybean roots were measured and examined for other characters to supplement observations of perineal patterns (2). A survey form, requesting information on numbers of hectares in each field and nematode management practices, was completed by each grower.

RESULTS

All fields sampled were infested with *Meloidogyne* spp. *Meloidogyne incognita* was found in 70% of the fields, while *M. javanica* and *M. arenaria* were detected in 24% and 6% of the fields, respectively (Table 1). No polyspecific *Meloidogyne* populations were detected. The other plant-parasitic nematode genera commonly found in soil samples were (in descending order of occurrence): *Pratylenchus, Criconemella, Trichodorus, Belonolaimus, Helicotylenchus, Xiphinema,* and *Hoplolaimus.*

Nematode management practices used in soybean fields included *M. incognita* resistant cultivars, crop rotation, and nematicides (Table 2). Cultivars resistant to *M. incognita* were utilized in 70% of the fields and on 75% of the hectarage. Crop rotation for at least two years out of soybeans was practiced in 35% of the fields and 35% of the hectarage. Nematicides were used in 9% of the fields and 9% of the hectarage.

Growers planted 13 different soybean cultivars, including mixtures of two or more in the same field. The most prominent cultivars in order

Table 2. Nematode management procedures used by growers in north-central Florida soybean fields in 1982.

	Resistant Cultivar[z]	Rotation	Nematicide
% Fields	70	35	9
% Hectares	75	35	9

[z]Data represent resistance to *M. incognita* only, although some cultivars possessed partial resistance to *M. arenaria.*

Table 3. Soybean cultivars used by growers in five north-central Florida counties in 1982.

Soybean Cultivars	% Frequency[z]	Soybean Cultivars	% Frequency[z]
Bragg	39	Wright	2
Coker 237	16	Centennial	2
Hutton	14	Ransom	2
Davis	9	Ring Around 800	1
Foster	4	Asgrow 4647	1
Braxton	4	UFV1	1
Cobb	3	Jupiter	1

[z]Data rounded to nearest whole percentage point.

of usage were Bragg, Coker 237, Hutton, and Davis (Table 3). Among the nematicides applied in descending order of usage were carbofuran, aldicarb, and phenamiphos.

Soil samples from only 5% of the fields in the survey had been submitted for nematode analysis prior to planting.

DISCUSSION

The relative incidence of the three *Meloidogyne* spp. varied among counties, but the survey indicated that *M. incognita* was the prominent species on soybean. These data agree with a previous report that *M. incognita* was the most prevalent species of *Meloidogyne* spp. in west Florida (8). In a 1981 survey of tobacco, however, *M. javanica* was found in 65% of the fields from the present survey area (6). The discrepancies

concerning relative prevalence of *Meloidogyne* species in north-central Florida may be explained by the different cultural practices utilized by growers of soybean and tobacco. Over 95% of the tobacco fields were planted to *M. incognita* resistant cultivars, and these have been in use for over two decades in Florida. Soybean is a relatively new crop in north-central Florida, and utilization of resistant cultivars has only taken place in recent years. In this study, 6 of 10 soybean fields that were previously cropped to tobacco contained *M. javanica.*

The incidence and population levels of *M. javanica* and *M. arenaria* may increase with continued emphasis on planting *M. incognita* resistant soybean cultivars (6, 7). The current survey, however, agrees with earlier findings on the low incidence of *M. arenaria* in north-central Florida (5, 6). Mixed populations of the three *Meloidogyne* spp. were not found in this survey. It is suspected that the limited sampling techniques were responsible for these data.

Other grower practices for management of *Meloidogyne* species, particularly the use of nematicides and crop rotation, were minimal. These results indicate a reluctance of growers to add further costs such as nematicide applications to a lower value type crop like soybeans, and the lack of acceptance of alternative crops available for rotating with soybeans.

The survey confirmed the presence of *M. javanica* and *M. arenaria* as potential threats to soybeans in north-central Florida. Since cultivars that are available to growers have good resistance only to *M. incognita,* further efforts in breeding soybeans for resistance to *M. javanica* and *M. arenaria* are important. In the interim, greater use of crop rotation and nematicides may be necessary.

LITERATURE CITED

1. ANONYMOUS. 1982. Florida Agricultural Statistics. Field Crops Summary. Florida Crop and Livestock Reporting Service, Orlando. 20 pp.
2. ESSER, R.P., V.G. PERRY, and A.L. TAYLOR. 1976. A diagnostic compendium of the genus *Meloidogyne* (Nematoda: Heteroderidae). Proc. Helminthol. Soc. Wash. 43:138-150.
3. JENKINS, W.R. 1964. A rapid centrifugal-flotation technique for separating nematodes from soil. Plant Dis. Reptr. 48:303-306.
4. KINLOCH, R.A. 1980. The control of nematodes injurious to soybean. Nematropica 10:141-153.
5. RICH, J.R., and N.C. SCHENCK. 1979. Survey of North Florida flue-cured tobacco fields for root-knot nematodes and vesicular-arbuscular mycorrhizal fungi. Plant Dis. Reptr. 63:952-955.

6. RICH, J.R. and R. GARCIA M. 1985. Nature of the root knot disease in Florida tobacco. Plant Disease 69:(In Press).
7. RODRIGUEZ-KABANA, R. 1980. Nematode problems in the Southeast. Proc. Southern Soybean Disease Workers. 7th Annual Meeting. Ft. Walton Beach, Florida. 113 pp.
8. SCHENCK, N.C., and R.A. KINLOCH. 1974. Pathogenic fungi, parasitic nematodes, and endomycorrhizal fungi associated with soybean roots in Florida. Plant Dis. Reptr. 58:169-173.

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