Nature of the Root-Knot Disease in Florida Tobacco

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ABSTRACT

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A random survey of 74 tobacco fields in five north central Florida counties was conducted in 1981 to determine grower nematode management practices, *Meloidogyne* spp. present, and tobacco loss to these nematodes. More than 90% of all fields were treated with a nematicide and planted with cultivars resistant to *M. incognita*. A minimum of a 2-yr rotation between tobacco crops was practiced in 60% of the fields. The most common *Meloidogyne* sp., *M. javanica*, was present in 65% of the fields, whereas *M. incognita* was found in 33% of the fields. *M. arenaria* was present in one tobacco field. Moderate to high levels of nematode damage (>5%) were found in 57% of the fields. The survey confirmed the major role of *M. javanica* in Florida tobacco production.

Plant-parasitic nematodes in the genus *Meloidogyne* are the major nematodes damaging flue-cured tobacco (*Nicotiana tabacum* L.) in the United States (7). The most common and destructive species are *M. arenaria* (Neal) Chitwood, *M. incognita* (Kofoid & White) Chitwood, and *M. javanica* (Treub) Chitwood. In recent years, *M. arenaria* and *M. javanica* have increasingly displaced *M. incognita* as the most important nematodes on flue-cured tobacco (4,8,9). The use of shortened rotation regimes and *M. incognita*-resistant cultivars have been suggested as causes for the increased prevalence of *M. arenaria* and *M. javanica*. Both *M. arenaria* and *M. javanica* have proven more damaging to tobacco than *M. incognita* (1,2).

In the southeastern United States, the geographical distribution of *M. arenaria* and *M. javanica* overlap (10). In the Carolinas, *M. arenaria* is a major problem in tobacco production, whereas in Florida *M. javanica* is the major nematode parasite (4,8,9). These data are consistent with the finding that *M. javanica* has less cold tolerance than *M. arenaria* (10). In a 1977 tobacco survey (9), *M. javanica* was identified in 47% of Florida tobacco fields, but the relative presence of *M. arenaria* and *M. incognita* was not determined. This survey is an expansion of the earlier study, to determine the relative prevalence of *Meloidogyne* spp. and any change in grower practices in response to the identification of *M. javanica* as a major nematode problem in Florida tobacco.

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MATERIALS AND METHODS

The survey was conducted from 15 July to 15 August 1981 in the north central Florida counties of Columbia, Hamilton, Lafayette, Madison, and Suwannee, which produce about 70% of the state's tobacco (Table 1). The hectarage of tobacco sampled in each county was approximately proportionate to the amount of 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. Individual tobacco fields, however, were randomly selected. Each tobacco field was observed for *Meloidogyne* spp. damage, and a visual damage assessment (percent yield reduction) was made at that time. The grower completed a survey form regarding the number of hectares in each tobacco field and nematode management practices. Soil samples were collected in a manner to represent the entire field, and problem areas were not purposely selected for these samples. Ten subsamples of soil were collected 25 cm deep in the row center in a random pattern across each field, regardless of field size. Subsamples of soil from the individual fields were composited and mixed thoroughly, then a 250-cm^3 sample was processed by a sugar flotation-centrifugation technique. Three galled root systems were collected from each field and dissected to collect mature root-knot females. A minimum of 10 perineal patterns were obtained from each field for species identification, and juvenile measurements were made to substantiate perineal pattern identifications (3).

Table 1. Flue-cured tobacco fields and hectares of crop surveyed in each of five north central Florida counties in 1981[a]

	Tobacco	
County	No. of fields	No. of hectares[b]
Columbia	17	134
Hamilton	11	116
Lafayette	11	67
Madison	15	131
Suwannee	20	153
Total	74	601

[a] Survey conducted between 15 July and 15 August.
[b] Survey represented 9% of the hectarage grown in the five counties in 1981.

RESULTS AND DISCUSSION

Methods of nematode management employed by growers were similar to those reported from the earlier survey (Table 2). More than 90% of all fields and hectares were treated with a nematicide and planted with *M. incognita*-resistant cultivars. A rotation of at least 2 yr out of tobacco was practiced in 60% of the fields, and irrigation was used in 92% of them. Changes in grower practices from the 1977 survey (9) were predominately related to an increase in use of fumigant nematicides (60% in 1981 vs. 39% in 1977) and increased use of irrigation (92% in 1981 vs. 70% in 1977). Data on use of fumigant nematicides suggested a greater grower recognition of the value of these chemicals in fields heavily infested with *Meloidogyne* spp. (5).

EDB and 1,3-D were the most widely used nematicides in Florida tobacco (Table 3). Other nematicides used in descending order of preference were fensulfothion, fenamiphos, and ethoprop. The multipurpose chemicals, 1-3-D-Pic and EDB-Pic, were used in only 4% of the fields, perhaps reflecting the low incidence of black shank and Granville wilt disease in Florida (6). Cultivars most used by growers were Speight G-28 (66%) and Speight G-70 (18%). In 25% of the fields, more than one cultivar was

Table 2. Nematode management practices used by Florida tobacco growers in 1981[a]

Management practice	Fields (%)	Hectares (%)
Nematicide		
Fumigant	60	62
Nonfumigant	33	34
Total	93	96
Resistant cultivar	94	95
2-Yr rotation[b]	60	59
Irrigation	92	95

[a] Results of a random survey of 74 tobacco fields containing 601 ha.
[b] Indicates at least 2 yr out of tobacco without regard to rotation crop.

Table 3. Cultivars and nematicides used by tobacco growers in 1981

Nematicide	Fields[a] (%)
1,3-D	30
EDB	26
Fensulfothion	13
Fenamiphos	8
Ethoprop	6
Carbofuran	5
1,3-D-Pic	3
Fenamiphos-fensulfothion	3
EDB-Pic	1
None	7
Tobacco cultivar	
Speight G-28	66[b]
Speight G-70	18
NC 2512	7
McNair 944	2
NC 82	2
NC 79	2
Hicks	2
NC 2326	2

[a] Data do not total 100% due to rounding to the nearest whole percentage point.
[b] Mixed cultivars not calculated in these data but represented 25% of fields; predominant mixture was Speight G-28 and Speight G-70, which accounted for 64% of mixed cultivars.

Table 4. Presence of *Meloidogyne* spp. and estimated damage in Florida tobacco fields in 1981[a]

Species	Fields (%)
M. javanica	55
M. incognita	33
Mixed[b,c]	10
Damage level (% loss)	
Low (0–5)	43
Moderate (5–10)	33
High (10[+])	24

[a] Survey of 74 tobacco fields in five north central Florida counties.
[b] Indicates mixed *M. incognita* and *M. javanica* fields.
[c] One field contained a mixture of *M. javanica* and *M. arenaria* but data not included in table.

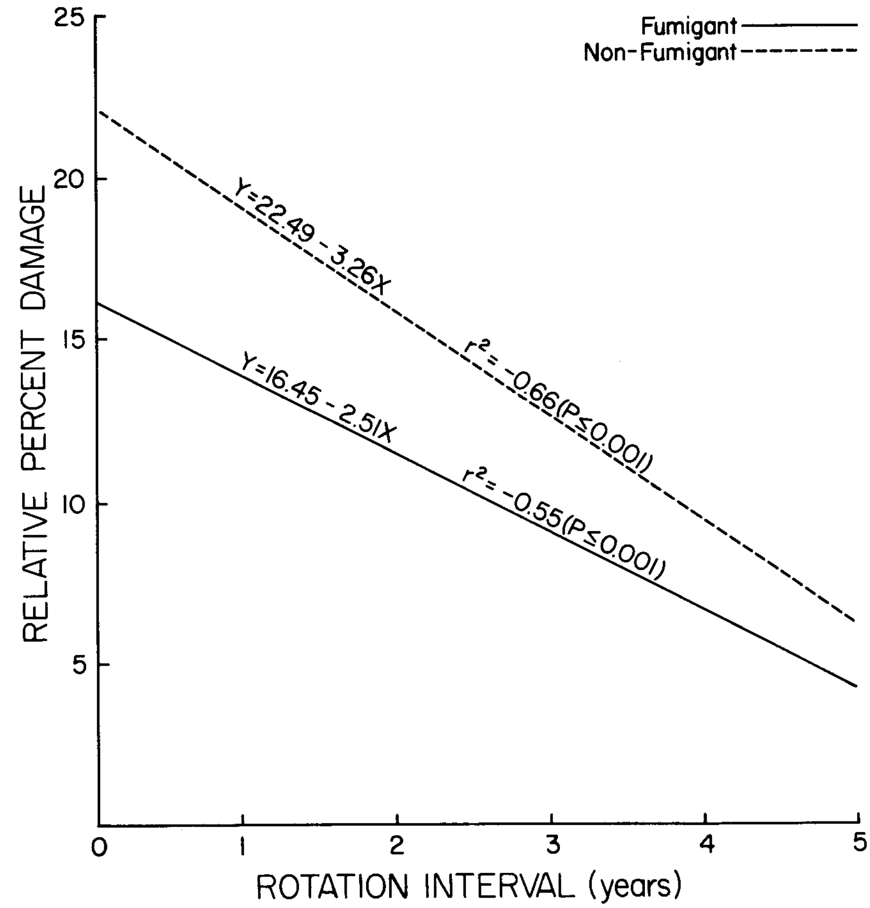

Fig. 1. Relationship between relative nematode damage to tobacco and length of rotation interval.

planted. The two cultivars most widely planted together in the same field were Speight G-28 and Speight G-70. These data indicated a grower trend of switching from the older Speight G-28 to the newer Speight G-70.

More than 55% of the tobacco fields were infested with *M. javanica* and 33% with *M. incognita* (Table 4). A mixture of *M. incognita* and *M. javanica* was found in 10% of the fields, whereas *M. arenaria* was recovered from only one field, which contained a mixture of *M. javanica* and *M. arenaria*. A larger percentage of the fields (65 vs. 47%) were found infested with *M. javanica* in 1981 than in 1977 (9). Other plant-parasitic nematodes present were *Criconemella, Helicotylenchus, Scutellonema, Pratylenchus, Trichodorus, Hoplolaimus*, and *Xiphinema*.

Moderate to high damage levels (>5%) caused by *Meloidogyne* spp. were observed in 57% of the fields, whereas slight to no damage was found in 43% of the fields (Table 4). The selection of nematicide by growers influenced damage observed in the fields. When fumigants were used, 24% showed high damage levels (>10%) and 36% of the fields showed moderate (5–10%) damage. With nonfumigants, 56 and 23% of the fields had high and moderate damage levels, respectively. Of the six farms that did not use nematicides, four had high damage levels and two showed no damage. The latter two growers had used a bahiagrass rotation for at least 4 yr. In 23% of the survey fields, tobacco had been grown for at least two successive years, and only one field was in good condition regardless of nematicide treatment.

Regressions relating rotation intervals and estimates of tobacco losses caused by nematodes for two nematicide types indicated the importance of rotation in tobacco production schemes in Florida (Fig. 1). In shortened rotations, losses caused by nematodes occurred when fields were treated with either fumigant or nonfumigant nematicides. As rotation intervals lengthened, *Meloidogyne* losses in tobacco decreased.

The survey confirmed and extended the earlier, more limited survey of Florida tobacco (9). These data verified the major and minor role of *M. javanica* and *M. arenaria*, respectively, in Florida tobacco production. This is unlike reports from the Carolinas, where *M. arenaria* is a growing problem (4,8). Apparently, Florida growers responded to yield losses caused by *M. javanica* and increased their use of fumigant nematicides. Rotation intervals, however, were not lengthened. Since plant resistance to *M. javanica* is not available, rotation could be further used to reduce losses caused by *Meloidogyne* spp.

LITERATURE CITED

1. Arens, M. L., and Rich, J. R. 1981. Yield response and injury levels of *Meloidogyne incognita* and *M. javanica* on the susceptible tobacco "McNair 944." J. Nematol. 13:196-201.
2. Barker, K. R., Todd, F. A., Shane, W. W., and Nelson, L. A. 1981. Interrelationships of *Meloidogyne* species with flue-cured tobacco. J. Nematol. 12:67-79.
3. Esser, R. P., Perry, V. G., and Taylor, A. L. 1976. A diagnostic compendium of the genus *Meloidogyne* (Nematoda: Heteroderidae). Proc. Helminol. Soc. Wash. 43:138-150.
4. Fortnum, B. A., Krauz, J. P., and Conrad, N. G. 1984. Increasing incidence of *Meloidogyne arenaria* on flue-cured tobacco in South Carolina. Plant Dis. 68:244-245.
5. Garcia M., R., and Rich, J. R. 1983. Efficacy of selected fumigant and nonfumigant nematicides to control *Meloidogyne javanica* in Florida tobacco. Nematropica 13:125-134.
6. Kucharek, T. A. 1980. Tobacco disease loss estimates for Florida. Page 11 in: Report of the Tobacco Disease Loss Evaluation Committee,

Tobacco Worker's Conference, 29th. 38 pp.
7. Lucas, G. B. 1975. Diseases of Tobacco. 3rd ed. Harold E. Parker & Sons, Fuquay-Varina, NC. 621 pp.
8. Powell, N. T. 1983. Root-knot nematodes in North Carolina's flue-cured tobacco fields. Tob. Pathol. Ext. Newsbrief 3(12).
9. Rich, J. R., and Schenck, N. C. 1979. Survey of North Florida flue-cured tobacco fields for root-knot nematodes and vesicular-arbuscular mycorrhizal fungi. Plant Dis. Rep. 63:952-955.
10. Sasser, J. N., and Carter, C. C. 1982. Root-knot nematodes (*Meloidogyne* spp.): Identification, morphological and physiological variation, host range, ecology, and control. Pages 21-32 in: Nematology in the Southern Region of the United States. South. Coop. Ser. Bull. 276. 206 pp.