Increasing Incidence of *Meloidogyne arenaria* on Flue-Cured Tobacco in South Carolina

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ABSTRACT

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Disease loss in flue-cured tobacco caused by the root-knot nematode increased fourfold over the previous year during an epiphytotic in South Carolina. Nematode morphological characteristics and a host range differential test confirmed the widespread occurrence of *Meloidogyne arenaria* and *M. incognita*. Previously, *M. arenaria* was rarely isolated from flue-cured tobacco in South Carolina. Increased losses caused by the root-knot nematode are expected in the future.

The southern root-knot nematode, *M. incognita*, is frequently associated with field crops in the Pee Dee region of South Carolina (9). Widespread use of resistant cultivars and nonfumigant nematicides has greatly reduced the severe losses that were typical on tobacco during the early 1950s (6). Before 1982, Clemson University plant-problem clinic reports of *M. arenaria* and *M. javanica* in the Pee Dee region of South Carolina were restricted to several fields; they caused minimal losses in the state tobacco crop.

During 1982, severe stunting was observed in many fields throughout South Carolina's flue-cured tobacco production areas. Affected fields were treated with contact nematicides and often planted in cultivars resistant to *M. incognita* races 1 and 3. Affected plants were chlorotic and stunted and possessed severely galled root systems. Microscopic examination yielded mature root-knot nematode females and egg masses. The widespread damage observed on *M. incognita*-resistant cultivars prompted this study. This paper reports on disease loss caused by root-knot nematode and the species and race identification of *Meloidogyne* spp. responsible for the epiphytotic observed on flue-cured tobacco.

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MATERIALS AND METHODS

Losses reported in flue-cured tobacco by root-knot nematode were estimates based on the county extension agent's assessment of acreage affected within his county and average losses occurring among these problem sites. Estimates of disease losses were made in 1978, and comparisons were based on losses

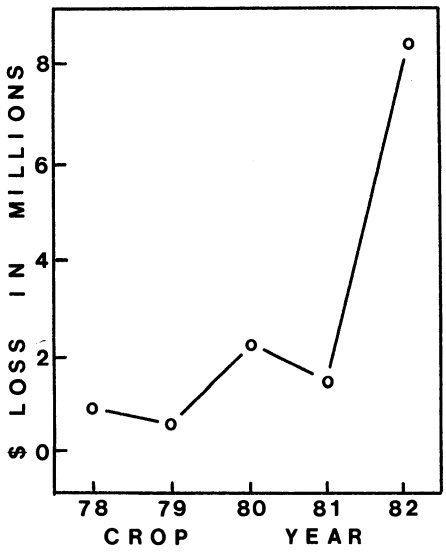

Fig. 1. Loss of flue-cured tobacco crop value caused by root-knot nematodes in South Carolina.

occurring in that year. Disease loss was calculated with the following formula:

$$\text{Loss estimate} = \left[\frac{\sum_{}^{n} (AXLY)}{Ya + \sum_{}^{n} (AXLY)} \right] Z,$$

where n = number of counties surveyed, A = acreage of tobacco within a county, X = percentage of tobacco acreage affected, L = average loss in an affected field, Y = statewide average yield per acre, Ya = actual reported yield within the state, and Z = state average price per pound.

Root samples were collected from 96 root-knot nematode problem tobacco fields diagnosed by the presence of root galls and juveniles of the nematode extracted from soil. Galled root tissue was placed in hot lactophenol-acid fuchsin for 2 min and cleared in lactophenol for 24 hr (1). Mature females were excised from the galled tissue and their perineal pattern examined by cutting the posterior end of the nematode (close to the vulva) and mounting the excised portion in glycerin on a microscope slide. Ten perineal patterns from each field were examined. Species determination was made based on features of the perineal patterns and by measurement of juveniles collected from soil, as described by Taylor and Sasser (9).

Species identification and distribution of root-knot nematode races was confirmed by standard host range bioassay (9). Soil samples collected from 18 root-knot nematode problem fields previously planted to tobacco were examined. Root-knot nematode populations were cultured on tomato (*Lycopersicon esculentum* 'Rutgers') for 54 days. *Meloidogyne* spp. eggs were obtained by washing infected roots with 0.5% sodium hypochlorite for 3 min (4). The resulting egg suspension was immediately rinsed with tap water. Bioassay plants were inoculated with 10,000 eggs per root system by pipetting the egg suspension into a 3-cm hole next to the plant hypocotyl. Species determination was confirmed using morphological criteria described previously (9).

RESULTS AND DISCUSSION

Disease-loss estimates indicated a fourfold increase in root-knot nematode damage on flue-cured tobacco in South Carolina during 1982 over losses observed the previous year (Fig. 1). This dramatic increase in nematode damage on tobacco apparently coincides with a shift in the populations of root-knot nematode species present within the South Carolina tobacco production area. *M. arenaria* was identified in 64 of 96 root samples collected from root-knot nematode problem tobacco fields. Concomitant populations of *M. arenaria* and *M. incognita* occurred in 56 of the 96 root samples assayed. *M. javanica* was rarely isolated from tobacco and occurred in only four of the samples. The sudden increase in loss caused by root-knot nematodes during 1982 appeared to be environmentally triggered because a gradual increase in the incidence of *M. arenaria* or *M. incognita* was not observed. Root-knot nematode damage and reproduction on cultivars resistant to *M. incognita* was rarely observed in preceding years. Threshold populations on tobacco are lower for *M. arenaria* than for *M. incognita*, and the former has shown a much greater capacity to cause root damage (2,6). Barker et al (2) suggest tobacco infected with *M. arenaria* may be more susceptible to secondary root-rotting organisms than similar plants infected with *M. incognita*. In addition, *M. arenaria* may be more tolerant of some nonfumigant nematicides than other root-knot nematode species (7).

In South Carolina tobacco production, several disturbing trends have occurred. Adequate crop rotations are practiced on fewer farms each year. Root-knot nematode problem sites during 1982 were frequently planted to tobacco the preceding year and about 60% of all tobacco cultivars grown in South Carolina are resistant to *M. incognita* races 1 and 3 (5). Rich and Schenck (8) suggest that shortening of rotation intervals and continued use of cultivars resistant to *M. incognita* will increase problems caused by *M. arenaria*, *M. javanica*, and biotypes of *M. incognita* capable of parasitizing cultivars resistant to *M. incognita* races 1 and 3. The observed widespread occurrence of *M. arenaria* will require reevaluation of the nematode control recommendations within the Pee Dee region of the state, with greater emphasis on rotation and alternate chemical controls (5).

The differential host test identified *M. arenaria* in 11 of 18 soils sampled. All *M. arenaria*-positive samples contained the race 2 biotype. No adapted soybean cultivar grown in South Carolina is resistant to *M. arenaria* race 2, and other potential nonhost rotation crops such as cotton and peanuts are rarely grown in rotation with tobacco in the Pee Dee region of the state. Tobacco cultivars resistant to *M. arenaria* are not available (3). Increased losses caused by *M. arenaria* in the flue-cured tobacco production areas are expected.

M. javanica, a common root-knot nematode in Florida and Georgia, was isolated from only four of the tobacco roots sampled and did not appear to play a significant role in the epidemic of root-knot observed during 1982.

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