Population Dynamics of Plant Nematodes as Affected by Combinations of Fallow and Cropping Sequence[1]

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The obligate parasitism of plant nematodes makes them particularly responsive to manipulation of their environment through soil management practices. The suitability of the host plant for nematode reproduction is perhaps the major determinant of population densities (1, 2, 4, 8). Although fallowing drastically influences nematode population densities, it has received little attention as a means of nematode control because of its unfavorable effect on organic matter and structure of soil (3, 6, 7). We studied the effects of combinations of cover crops and short-term (6 weeks) fallow on population densities of *Pratylenchus brachyurus* (Godfrey) Filipjev & Schuur.-Stek., *Trichodorus christiei,* Allen, and *Meloidogyne incognita* (Kofoid & White) Chitwood.

Land recently cleared of pine trees and underbrush was used. Plots were 1.8 m wide and 15 m long. Crops were planted in four rows per plot. Eight treatments involving crotalaria (*Crotalaria mucronata* Dev.), millet (*Panicum ramosum* L.), corn (*Zea mays* L.), okra (*Hibiscus esculentus* L.), and fallow; and combinations of each crop with fallow, except okra, were arranged in a randomized complete-block design, replicated four times.

The plots were seeded to tomato (*Lycopersicon esculentum* Mill) in March of each year. Tomato transplants were harvested late in April or early in May. Those plots that received only a cover crop treatment (crotalaria, millet, corn or okra) were planted to the cover crops within a week after tomato transplant harvest. Those plots that received both fallow and cover crops were fallowed six weeks between tomato transplant harvest and planting of cover crops. Those plots with only fallow treatment were fallowed from tomato transplant harvest to tomato seeding (May to March). Fallowing was accomplished by keeping the land tilled and free of weeds.

Soil samples for nematode assay were collected in October of each year. Twenty 5 × 5-cm cores were collected randomly from each plot. These were mixed thoroughly and a 150-cc aliquant was wet-seived on a 44-μm screen (325-mesh) and the sieve residue placed on a Baermann pan for 48 hours. Tomato transplants were hand-pulled and measured for height to determine yield/hectare of marketable plants.

Population densities of *P. brachyurus* and *T. christiei* were extremely low, and *M. incognita* was not detectable during the first year. After 3 years, population densities of *P. brachyurus* had increased considerably on crotalaria and on corn and to a lesser extent on okra and on millet when these crops were planted within a week after tomato transplant harvest (Table 1). When six weeks of fallow intervened between transplant harvest and planting of crotalaria, corn, or millet, *P. brachyurus* was not detectable after 2 years.

The greatest increase in the population density of *T. christiei* occurred on corn the second year when corn was planted within a week after tomato transplant harvest (Table 1). A low density of *T. christiei* was maintained where millet was planted within a week after tomato transplant harvest. In both cases, six weeks of fallow (in the period 1 May to 30 June) between transplant harvest and planting of corn or millet suppressed the increase in population density of *T. christiei.*

M. incognita was not detectable when the experiment was established. It was detected the second year in plots where crotalaria, corn, or okra were planted within 1 week after transplant harvest. The population density of *M. incognita* further increased the 3rd year in the okra and corn plots. When 6 weeks of fallow intervened between tomato transplant harvest and planting of corn, the population density of *M. incognita* was considerably less than when corn was planted within 1 week after tomato transplant harvest.

None of the treatments significantly affected yield of tomato transplants; however, certain trends were evident after 3 years. Highest yields were obtained where corn or

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TABLE 1. Influence of fallow and summer cover crops on population densities of *Pratylenchus brachyurus*, *Trichodorus christiei*, and *Meloidogyne incognita*.

	Nematodes per 150 ml of Soil								
	P. brachyurus			*T. christiei*			*M. incognita*		
Treatment	1966	1967	1968	1966	1967	1968	1966	1967	1968
okra	8	24	19	1	5	1	0	2	25
millet	1	11	1	3	4	1	0	0	0
crotalaria	1	8	75	0	1	0	0	2	0
corn	54	17	145	4	94	4	0	7	22
fallow - millet[a]	1	0	0	1	0	0	0	0	0
fallow - crotalaria[a]	0	0	0	0	0	0	0	2	0
fallow - corn[a]	2	0	0	0	3	0	0	1	9
fallow[b]	2	1	0	0	4	0	0	0	0

[a]Land fallowed for six weeks between tomato transplant harvest and planting of cover crop.
[b]Land fallowed nine months between tomato transplant harvest and planting of tomato.

crotalaria was planted immediately after transplant harvest. Lowest yields were obtained in plots that were fallowed without a cover crop, fallowed 6 weeks then planted to corn, or where okra was the cover crop. There was an increase in yield where 6 weeks of fallow preceded millet. In no case did nematode population densities reach economic threshold levels, which usually occurs 4-5 years after woodlands are cleared for agricultural use in South Georgia. However, root-knot nematodes can develop to levels that make transplants unsuitable for certification as "nematode free" sooner than 4-5 years (5).

Six weeks of fallow between tomato-transplant harvest and cover crop was as effective as continuous fallow in preventing an increase in the population density of *P. brachyurus* and *T. christiei*. Continuous fallow was more effective than 6 weeks of fallow in preventing an increase in the population density of *M. incognita*.

Our results emphasize the importance of preplant population density on nematode population dynamics. Since plant parasitic nematodes must survive a very long period in an active metabolic condition in the south, population densities are extremely low in the spring. Apparently our 6-week fallow occurred prior to the nematode populations entering the logarithmic stage of development, thus, severely limiting development. Also, since the 6-week fallow was used when the average soil temperature (10 cm deep) was 32-36 C and average rainfall was less than 15 cm, desiccation could have been a factor in limiting population increase. Short-term fallow such as this, during periods of stress on nematodes, may be more practical and less damaging to soil structure and organic matter content than longer periods of fallow. This needs further investigation.

Our data further emphasize the importance of an integrated approach to nematode control. Two means of controlling nematodes, fallow and nonhost crops, each with its own limitations, resulted in somewhat greater nematode control and crop yields when they were used in combination than when used alone.

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