EFFECTS OF COVER CROPS AND FALLOWING ON POPULATIONS OF *BELONOLAIMUS LONGICAUDATUS* AND *MELOIDOGYNE INCOGNITA* AND SUBSEQUENT CROP YIELDS[1]

H. L. Rhoades

Nematologist, University of Florida, Agricultural Research and Education Center, P. O. Box 909, Sanford, Florida 32771, U.S.A.

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ABSTRACT

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High populations of the sting nematode, *Belonolaimus longicaudatus,* developed on summer cover crops of a sorghum-sudangrass hybrid (*Sorghum bicolor* x *S. sudanense*), sesbania (*Sesbania exaltata*), and weeds. Moderate populations occurred on cowpea (*Vigna unguiculata*), but populations were low after hairy indigo (*Indigofera hirsuta*) and fallowing. A root-knot nematode, *Meloidogyne incognita,* did not develop to high populations on any of the crops but was more numerous on vegetable crops following sesbania and cowpea. Yields of the first crops (snap beans and cabbage) following the cover crops that had built up populations of *B. longicaudatus* were greatly increased following in-row applications of 2.24 kg/ha of fenamiphos. Only moderate increases in yield occurred for treatment with fenamiphos following soil fallow and cover crops that did not build up this nematode. Yields of the second crop of vegetables (cucumbers) following the summer cover crops and fallowing were improved and populations of both nematode species reduced by fenamiphos in all instances.

Additional key words: Nematode control, cultural practices, crop rotation, chemical control, nonfumigant nematicides, Sorghum bicolor x *S. sudanense, Sesbania exaltata, Indigofera hirsuta, Vigna sinensis.*

RESUMEN

Rhoades, H. L. 1982. Efecto de las cosechas de covertura y barbecho limpio en las poblaciones de *Benololaimus longicaudatus* y *Meloidogyne incognita* y los subsequentes rendimientos de las cosechas, Nematrópica 13:9-16.

El nematodo de aguijón desarolló poblaciones altas en dos cosechas de covertura de verano, el híbrido millo-yerba del sudan (*Sorghum bicolor* x *S. sudanense*) y sesbania (*Sesbania exaltata*) y en las yerbas. En el frijol de vaca (*Vigna unguiculata*) ocurrieron poblaciones moderadas pero las poblaciones fueron bajas después del añil (*Indigofera hirsuta*) y el babecho limpio. Un nematodo nodulador de las raices (*Meloidogyne incognita*) no desarolló poblaciones altas en ninguna de las cosechas pero fue más numeroso en las cosechas de vegetales a continuación de la sesbania y el frijol de vaca. Los rendimientos de las primeras cosechas de los vegetales habichuela y col

a continuación de las cosechas de covertura que hicieron subir las poblaciones de *B. longicaudatus* aumentaron grandemente cuando se aplicó fenamifos en el surco a razón de 2.24 kg/ha. Solamente un aumento moderado en los rendimientos tuvo lugar por las aplicaciones de fenamifos a continuación del barbecho limpio y las cosechas de covertura que no hicieron subir las poblaciones de dicho nematodo. Los rendimientos de la segunda cosecha del vegetal pepino, mejoraron a continuación de las cosechas de covertura y el barbecho limpio y las poblaciones de los dos nematodes fueron reducidas por el fenamifos e todos los casos.

Palabras claves adicionales: Control de nematodos, prácticas culturales, rotación de cosechas, control químico, nematocidas no-volatiles, Sorghum bicolor x *S. sudanense, Sesbania exaltata, Indigofera hirsuta, Vigna sinensis.*

INTRODUCTION

Fields that are used for winter vegetable production in Florida are usually either fallowed, cover-cropped, or allowed to grow up in weeds during the summer months. Clean fallow reduces nematode populations (2,5,7) as well as other soilborne pests and is used extensively. However, this practice is considered to be destructive to soil fertility and physical properties and is not normally recommended by soil scientists. Because of the abundance and diversity of species of plant nematodes in Florida, the success of cover cropping depends largely on the host status of the cover crop to the nematodes. Since hairy indigo (*Indigofera hirsuta*) is a poor host for *Belonolaimus longicaudatus* (1,4,6) and *Meloidogyne incognita* (6), two of the most important nematode pests of vegetables in central Florida, experiments were conducted over a 4-year period to compare the effects of this and other cover crops with fallowing on nematode populations and subsequent yields of vegetable crops.

MATERIALS AND METHODS

Experiments were conducted during 1978-1982 on Myakka fine sand. The primary plant nematodes present were the sting nematode, *Belonolaimus longicaudatus* (Rau, 1958), and root-knot, *Meloidogyne incognita* (Kofoid and White, 1919) Chitwood, 1949. Treatments consisted of fallowing, a natural growth of weeds consisting primarily of signalgrass (*Brachiaria piligera*) and crabgrass (*Digitaria sanguinalis* (L.) Scop.), and the cover crops: sorghum-sudangrass hybrid (*Sorghum bicolor* L. x *S. sudanense* (Piper) Stapf 'Grazer A'), cowpea (*Vigna unguiculata* (L.) Walp. 'California Blackeye #5'), *Sesbania exaltata* (Raf.) Rydb., and hairy indigo (*Indigofera hirsuta* L.).

The experimental design was a randomized complete block with five replicates. Plot size was 6.1 m x 12.2 m. The cover crops were seeded in mid-June after winter vegetable production had ceased. All were

broadcast seeded except cowpea which was seeded in rows spaced at 75 cm for cultivation purposes. Fallow plots were disked periodically to prevent weed growth, whereas no tillage occurred in weed plots. The cover crops and weeds were allowed to grow until approximately September 1, then were mowed, plowed, and tilled during September in preparation for vegetable planting in early October. Two crops of vegetables were grow each year: snap beans (*Phaseolus vulgaris* L.) followed by cucumbers (*Cucumis sativus* L.) in 1978-79 and cabbage (*Brassica oleracea* L.) followed by cucumbers during the last three years. Just prior to planting each vegetable crop, half of each plot (4 rows) was treated with 2.24 kg ai/ha of fenamiphos (formulated as Nemacur®15G) applied in a 38-cm band in-row and incorporated 5-8 cm deep with rotating spiked wheels. Normal cultural and harvesting practices were followed for all crops. Soil samples were collected from all crops 8 weeks after planting for determining populations of *B. longicaudatus* by centrifugal-flotation (3). Cucumber roots were indexed for root-knot galling using an index of 1, no galling, to 5, severe galling.

RESULTS AND DISCUSSION

In 1978 *B. longicaudatus* populations were much higher on snap beans following sorghum-sudangrass, weeds, and sesbania than following hairy indigo or soil fallow (Table 1). The lowest populations occurred after fallowing. Bean yields were also much higher following hairy indigo and fallowing. Treating with fenamiphos greatly reduced *B. longicaudatus* populations and bean yields were greatly increased following all treatments but were highest following soil fallow. Populations of *B. longicaudatus* and some *M. incognita* developed on the second crop (cucumber) where no nematicide was used, and yields were low regardless of the cover crop or fallowing during the previous summer. However, yields were still highest in plots previously in hairy indigo or fallow. Treating with fenamiphos greatly reduced both nematode species and yields were essentially the same for all treatments.

In 1979 and succeeding years, cowpea was substituted for sesbania and cabbage was used as the fall vegetable crop. On cabbage, where no nematicide was applied, *B. longicaudatus* populations were high following sorghum-sudangrass, cowpea, or weeds, much lower following hairy indigo, and very low for soil fallow (Table 2). Yields of the cabbage were much higher following hairy indigo and soil fallow than for the other treatments. Applying fenamiphos prior to planting cabbage gave excellent control of *B. longicaudatus* and yields were greatly increased following sorghum-sudangrass, cowpea, and weeds. Only a very modest increase was obtained from the nematicide following hairy in-

Table 1. Effects of cover crop, nematicide, and fallowing on nematode population and yield of snap beans and cucumber (1978-79).

Treatment	First Crop (Snap beans)		Second Crop (Cucumber)		
	Belonolaimus longicaudatus[x]	Yield (quintals/ha)	*Belonolaimus longicaudatus*	Root-knot index[y]	Yield (quintals/ha)
Sorghum-sudangrass	59	16	142	2.07	46
" + fenamiphos[z]	11	64	5	1.05	240
Sesbania	44	14	85	2.32	17
" + fenamiphos	11	58	3	1.07	248
Weeds	49	16	121	2.07	19
" + fenamiphos	15	58	2	1.15	246
Hairy indigo	24	49	96	2.15	50
" + fenamiphos	2	67	0	1.10	233
Fallow	15	61	85	1.72	70
" + fenamiphos	2	78	0	1.10	222
LSD .05		21		0.45	56

[x]Average number extracted from 100 cm^3 soil.

[y]Based on a root galling index of 1, no galling, to 5, severe galling.

[z]The nematicide fenamiphos was applied at 2.24 kg ai/ha in-row on both crops.

Table 2. Effects of cover crop, nematicide, and fallowing on nematode populations and yield of cabbage and cucumber (1979-80 & 1980-81).

Treatment	1979-80					1980-81			
	First Crop (cabbage)		Second Crop (cucumber)			First Crop (cabbage)		Second Crop (cucumber)	
	Belonolaimus longicaudatus[x]	Yield (quintals/ ha)	*Belonolaimus longicaudatus*	*Root-knot index*[y]	Yield (quintals/ ha)	*Belonolaimus longicaudatus*	Yield (quintals/ ha)	*Belonolaimus longicaudatus*	Yield (quintals/ ha)
Sorghum-sudangrass	151	139	143	2.20	136	113	303	72	28
" + fenamiphos[z]	2	554	0	1.04	332	12	569	1	62
Cowpeas	108	257	162	3.30	154	27	549	34	49
" + fenamiphos	2	569	0	1.34	344	2	528	8	62
Weeds	173	113	100	2.06	193	79	441	41	36
" + fenamiphos	11	575	2	1.04	332	3	616	0	67
Hairy indigo	56	446	52	1.90	236	22	549	39	44
" + fenamiphos	6	528	0	1.06	350	9	605	0	85
Fallow	4	431	83	1.44	213	6	534	10	57
" + fenamiphos	1	503	2	1.00	316	0	508	0	72
LSD .05		118		0.51	110		180		44

[x]Average number extracted from 100 cm^3 soil.

[y]Based on a root galling index of 1, no galling, to 5, severe galling.

[z]The nematicide fenamiphos was applied at 2.24 kg ai/ha on both crops.

digo and soil fallow. As a result, yields were essentially the same for all treatments with the use of the nematicide. On the spring cucumber crop, nematode populations were again highest in plots previously planted to sorghum-sudangrass, cowpea, or weeds and yields were lower. Use of fenamiphos again gave good control of both of these nematodes and yield increases were again essentially the same for all treatments.

In 1980, populations of *B. longicaudatus* were higher and yields lower for the fall crop of cabbage following sorghum-sudan grass or weeds than for cowpea, hairy indigo, and soil fallow without the use of the nematicide; with the nematicide, the nematodes were controlled and yields were essentially the same for all treatments (Table 2). Yields of the spring crop of cucumbers were low for all treatments because of very dry weather but again fenamiphos controlled the *B. longicaudatus* in all plots and some yield increase occurred. *M. incognita* populations were too low to obtain meaningful data during this experiment.

In 1981, *B. longicaudatus* again built up highest populations on sorghum-sudangrass, cowpea, or weeds which resulted in lower yields on the subsequent crop of cabbage (Table 3). Fenamiphos again gave excellent control of the nematodes but yields were only slightly increased due to poor growing conditions for cabbage. The spring crop of cucumbers was destroyed by a severe hail storm and no data were collected for this crop.

The results of these experiments demonstrate that summer cover crops of sorghum-sudangrass, sesbania, or natural weed populations of signalgrass and crabgrass maintain or build up population of *B. longicaudatus* and *M. incognita* that are injurious to subsequent vegetable crops. The results from cowpea were inconclusive but *B. longicaudatus* increased in population in one of three years and *M. incognita* in one of two. Populations of both nematodes were consistently low on hairy indigo, but lowest populations occurred after soil fallow. Fenamiphos greatly increased yields of snap bean, cabbage, and cucumbers following the cover crops that increased nematode populations. Some increase in yield also occurred with use of this nematicide following hairy indigo and soil fallow where nematode populations remained low. This may have been due to the insecticidal as well as nematicidal properties of this material.

Table 3. Effects of cover crop, nematicide, and fallowing on populations of *Belonolaimus longicaudatus* and yield of cabbage (1981).

Treatment	*Belonolaimus longicaudatus*[x]	Yield (quintals/ha)
Sorghum-sudangrass	200	231
" + fenamiphos[y]	1	354
Cowpea	41	369
" + fenamiphos	0	369
Weeds	61	333
" + fenamiphos	0	354
Hairy indigo	18	380
" + fenamiphos	0	390
Fallow	12	344
" + fenamiphos	0	369
LSD .05		63

[x]Average number extracted from 100 cm^3 soil.
[y]The nematicide fenamiphos was applied at 2.24 kg ai/ha in-row.

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