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INFLUENCE OF NEMATICIDES AND METHODS OF THEIR APPLICATION ON GROWTH AND YIELD OF CABBAGE IN STING NEMATODE INFESTED SOIL[1]

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Abstract. **The soil fumigant, ethylene dibromide, provided excellent control of the sting nematode,** Belonolaimus longicaudatus, **and increased yields of cabbage significantly when applied overall at 72 kg/ha and in-the-row at 35.8 kg/ha. In-row applications of 2.24 kg/ha aldicarb, carbofuran, ethoprop, oxamyl, phenamiphos, and terbufos also effectively controlled this nematode and increased yields significantly. The efficacy of carbofuran, ethoprop, oxamyl, and phenamiphos was essentially the same whether applied as granules incorporated in the soil prior to planting or as liquid formulations in the transplant water.**

The sting nematode, *Belonolaimus longicaudatus* Rau 1958, is a serious pest of many vegetable crops produced in the fine sand type soils of Florida (2). Cabbage, *Brassica oleracea* var. *capitata* L., an important crop in central Florida, is particularly susceptible to the attack of this nematode and extensive yield losses frequently occur if it is not controlled. Fortunately, this nematode is relatively easy to control with soil fumigants that have been used for many years and by several of the more recently developed nonfumigant organophosphorus and carbamate nematicides (1, 7). Since previous work (4, 5, 6) has shown that several of the earlier nonfumigant nematicides were quite effective for controlling the sting nematode on cabbage, experiments were conducted for evaluating those and more recently developed ones in comparison with the soil fumigant, ethylene dibromide. This report summarizes the results of these experiments.

Materials and Methods

An experiment was conducted in each of the winters of 1978-79 and 1979-80 on Myakka fine sand at Sanford, Florida. High populations of the sting nematode were present at initiation of both experiments, whereas, only low populations of the stubby-root nematode, *Paratrichodorus christiei* (Allen, 1957) Siddiqi, 1973, were present in 1978-79 and low populations of both stubby-root and the lance nematode, *Hoplolaimus galeatus* (Cobb, 1913) Filipjev & Sch. Stekhoven, 1941, were present in 1979-80.

Both experiments were of randomized complete block design with five replicates. Plot size was 1.5 X 12.2 meters (two rows). Granular formulations of ethyl 4-(methylthio)-m-tolyl isopropylphosphoramidate (phenamiphos); O-ethyl S,S dipropyl phosphorodithioate (ethoprop); 2,3-dihydro-2, 2-dimethyl-7-benzofuranyl methylcarbamate (carbofuran); methyl N, N-dimethyl-N- [(methylcarbamoyl)oxy]-1-thiooxamimidate (oxamyl); 2-methyl-2-(methylthio) propionaldehyde O-(methylcarbamoyl) oxime (aldicarb); and S-(1,1-dimethylethyl) thiomethyl O,O-diethyl phosphorodithioate (terbufos) were applied as 38-cm bands in-the-row and incorporated 5-7-cm deep with spiked, rotary wheels just prior to transplanting 'Rio Verde' cabbage. Liquid formulations of phenamiphos, ethoprop, carbofuran, and oxamyl were also applied in the transplant water within 24 hours after planting. The transplant water was applied in 25-cm bands directly over the row with sprinkling cans at the rate of 776 ml/m of row. The application rate for all of the nonfumigant nematicides was 2.24 kg a.i./ha. The soil fumigant, ethylene dibromide (EDB), was applied overall at 72 kg/ha in 1978-79 with chisels spaced 25-cm apart and 15-cm deep. In 1979-80, it was injected in-the-row at 35.8 kg/ha with a single chisel 15 cm deep.

Normal cultural practices were followed during the growing season and two harvests were taken two weeks apart as the heads matured. Soil samples for determining nematode populations were taken just prior to the first harvest and processed by a centrifugal-flotation technique (3).

Results and Discussion

Improvement in plant growth and vigor was evident in 2-3 weeks after transplanting in all plots treated with the various nematicides, and the difference between treated and untreated plots became even more pronounced during the early growth stages (Fig. 1). The sting nematode was the primary nematode pest and all of the nematicides greatly reduced its populations and increased yields significantly over check plots in both experiments (Table 1). The soil fumigant, EDB, applied both overall and in-the-row reduced sting nematode populations more than the nonfumigant nematicides. However, yields were no higher than for many of the nonfumigant nematicides, indicating that control from these materials was sufficient to give near maximum yield. Ethoprop and carbofuran gave the poorest control of the sting nematode in the 1978-79 experiment and carbofuran again in the 1979-80 experiment. This was reflected in slightly lower yields for these materials. Although differences between the two methods of applying carbofuran, ethoprop, oxamyl, and phenamiphos varied somewhat between the two experiments, these differences

Fig. 1. Effect of a nematicide on the growth of cabbage in soil heavily infested with sting nematodes. Left two rows, 2.24 kg/ha of oxamyl applied in the transplant water; right two rows, untreated check.

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Table 1. Effect of nematicides on *nematode populations* and yield of cabbage.

Treatment	Application rate (kg/ha)	Nematode populations[z] Sting	Lance	Stubby-root	Yield kg/plot[y]
1978-79					
EDB (overall)	72	10	—	18	56.3
phenamiphos (grans.)	2.24	16	—	16	56.8
" (Tr. water)	"	16	—	12	50.4
ethoprop (grans.)	"	127	—	29	45.4
" (Tr. water)	"	131	—	24	40.4
carbofuran (grans.)	"	116	—	26	37.7
" (Tr. water)	"	167	—	29	40.9
oxamyl (grans.)	"	93	—	24	47.2
" (Tr. water)	"	51	—	28	44.9
aldicarb (grans.)	"	22	—	32	53.1
terbufos (grans.)	"	14	—	9	48.1
Check		273	—	38	15.9
LSD .05					10.9
1979-80					
EDB (in-row)	35.8	4	0	28	45.9
phenamiphos (grans.)	2.54	60	22	9	44.5
" (Tr. water)	"	69	17	7	45.4
ethoprop (grans.)	"	56	16	7	40.0
" (Tr. water)	"	58	14	13	42.7
carbofuran (grans.)	"	86	16	7	36.8
" (Tr. water)	"	76	31	11	41.3
oxamyl (grans.)	"	52	18	0	42.7
" (Tr. water)	"	38	17	3	42.2
aldicarb (grans.)	"	29	19	2	45.9
terbufos (grans.)	"	63	14	8	49.0
Check		142	20	10	20.4
LSD .05					9.5

[z]Average number of nematodes extracted from 100 cc of soil.
[y]Harvested area consisted of 8.8 m^2.

were small and there appeared to be no distinct advantage of one method over the other. Populations of stubby-root and lance nematodes were too low to affect results in either experiment but the data indicate that EDB *gave good* control of the lance nematode whereas the nonfumigants did not.

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