Research Note

NEMATICIDES AND PAECILOMYCES LILACINUS *IN NEMATODE CONTROL IN WATERMELON*[1]

Plant parasitic nematodes such as *Meloidogyne, Pratylenchus, Rotylenchulus, Helicotylenchus, Tylenchorhynchus* and *Trichodorus* are closely associated with certain vegetable crops including cucurbits[2]. Non-fumigant granular nematicides (oxime carbamates and organophosphates) are promising in the control of plant parasitic nematodes because of their low phytotoxicity[3]. Nematicides such as phenamiphos and carbofuran have been studied extensively and have proved effective for controlling plant parasitic nematodes in the field and in the greenhouse[2,4,5,6,7]. Johnson and Harmon[8] controlled nematodes in cucurbits with soil applications of phenamiphos and fensulfothion. Johnson et al.[9] found highest yields and lower *M. incognita* populations and gall indices with phenamiphos-sprinkler irrigation in squash and cucumber. In watermelon, yield increased by 33% with applications of 16.8 kg/ha of phenamiphos 15G[2].

In addition to nematicides, biological agents can be effective for nematode control. Organisms such as *Paecilomyces lilacinus*, a parasite of nematode eggs, have been effective for controlling the nematodes *Meloidogyne incognita* and *Globodera pallida.*[10,11,12]

The objective of this study was to compare the effect of two nematicides (phenamiphos 15G and carbofuran 10G) and the fungus *P. lilacinus* in controlling plant

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[4]Acosta, N., 1984. Evaluation of granular nematicides for the control of root-knot nematodes in watermelon. 1979, *Fungicide and Nematicide Test* 39: 100 (188).

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[6]Greco, N. and I. J. Thomason, 1980. Effect of phenamiphos on *Heterodera schachtii* and *Meloidogyne javanica, J. Nematol.* 12 (2): 91-96.

[7]Rhoades, H. L., 1982. Effect of phenamiphos on populations of *Heterodera schachtii* and subsequent plant injury in a cabbage-cucumber rotation, *Nematropica* 12 (2): 289-93.

[8]Johnson, A. W. and S. A. Harmon, 1974. Cantaloup yield and grade increased by chemical control of *Meloidogyne incognita, Plant Dis. Rep.* 58: 746-49.

[9]Johnson, A. W., W. A. Rhode and W. C. Wright, 1982. Soil distribution of phenamiphos applied by overhead sprinkler irrigation to control *Meloidogyne incognita* on vegetables, *Plant Dis.* 66: 489-91.

[10]Jatala, P., R. Kaltenbach and M. Bocangel, 1979. Biological control of *Meloidogyne incognita acrita* and *Globodera pallida* on potatoes, *J. Nematol.* 11 (4): 303 (Abstr.)

[11]Jatala, P., R. Kaltenbach, M. Bocangel, A. J. Devaux and R. Campos, 1980. Field application of *Paecilomyces lilacinus* for controlling *Meloidogyne incognita* on potatoes, *J. Nematol.* 12 (4): 226-27 (Abstr.)

[12]Román, J. and A. Rodríguez, 1985. Effect of the fungus *Paecilomyces lilacinus* on the larval population and root-knot formation of *Meloidogyne incognita* in tomato, *J. Univ. P. R.* 69 (2): 159-67.

parasitic nematodes associated with watermelon under field conditions at Isabela, Puerto Rico.

The experiment was established in a Coto clay infested with *Meloidogyne incognita* (root-knot) and *Rotylenchulus reniformis* (reniform). Seven treatments were included: fungus added to soil 2 weeks before planting, fungus added to soil at planting, carbofuran (Furadan^R 10G)[13] at 2.24 kg ai/ha and 4.48 kg ai/ha, phenamiphos (Nemacur^R 15G) at 6.73 kg ai/ha and 13.46 kg ai/ha, and nontreated control plots were included for comparison.

Plots measured 5.54 m × 3.69 m and included six microplots, each measuring 1.85 m × 1.85 m. The first application of *P. lilacinus* was made 2 weeks before planting. Approximately 150 g of *P. lilacinus*-colonized rice was added to each microplot and incorporated with a hoe to a depth of 8-12 cm.

Inoculum from rice was obtained in accordance with methodology suggested by Dr. Parviz Jatala, International Potato Center, Lima, Peru. Commercial rice was soaked in water and left overnight, then washed in tap water and autoclaved for 50 minutes. The autoclaved rice was then transferred to 48 polyethylene bags (150 g rice/bag), each inoculated with 10 ml of a fungal suspension (*P. lilacinus*), and incubated at 28-30°C for 10 days or more. *Paecilomyces lilacinus* inoculum was obtained from an original Peruvian isolate provided by Dr. P. Jatala.

Nematicides were applied to each microplot by hand, from glass jars, and incorporated to depths of 5-8 cm with a hoe, immediately before planting. After application, five seeds of Charleston Gray watermelon were planted in the center of each of the microplots. After emergence, plants were thinned to two per microplot.

Treatments were replicated four times in a complete randomized design. Soil samples for nematode assays were taken from 15 cm depths before planting and six weeks after. Data on number of fruits, fruit weight, total yield and final nematode population were recorded 90 days after planting.

Data were analyzed following standard procedures for analysis of variance. Percentage reduction (PR) in nematode popula-

TABLE 1.—*Effect of fungus and nematicide application on fruit yield on watermelon cv. Charleston Gray, Isabela, 1987*

Treatment	Dosage (kg ai/ha)	Fruit yield/plot[2] (kg) Number	Weight[3]	Weight/fruit
			kg	
Fungus 2 weeks before planting	[1]	5.50	38.17 ab	6.20 ab
Fungus at planting	[1]	7.00	31.75 a	5.30 ac
Carbofuran 10G	2.24	4.25	48.00 b	6.46 ab
Carbofuran 10G	4.48	7.25	44.58 bc	7.43 b
Phenamiphos 15G	6.73	6.75	33.41 ac	5.59 abc
Phenamiphos 15G	13.46	6.75	28.28 a	4.68 ac
Check		5.75	26.29 a	3.95 c

[1]*150 g Paecilomyces lilacinus colonized rice/microplot.*

[2]Values in columns followed by the same letters do not differ at the 5% probability level.

[3]Values within this column are adjusted means of yield (weight) with covariance of number of fruits.

[13]Trade names in this publication are used only to provide specific information. Mention of a trade name does not constitute a warranty of equipment or materials by the Agricultural Experiment Station of the University of Puerto Rico, nor is this mention a statement of preference over other equipment or materials.

TABLE 2.—*Effect of fungus and nematicide applications on % nematode reduction on watermelon, cv Charleston Gray, Isabela, P. R. 1987*

Treatment	Dosage (kg ai/ha)	% Nematode reduction: Ecto and[1] endoparasites	% Nematode reduction: Sedentary[2] endoparasites
Fungus 2 weeks before planting	[3]	60.50 a	80.00 a
Fungus at planting	[3]	66.50 a	75.50 a
Carbofuran 10G	2.24	61.75 a	84.00 a
Carbofuran 10G	4.48	85.25 a	79.50 a
Phenamiphos 15G	6.73	58.33 a	58.50 a
Phenamiphos 15G	13.46	61.67 a	80.33 a
Check	——	−42.33 b	−27.00 a

[1]Values followed by the same letters do not differ at the 5% probability level.
[2]*M. incognita* and *Rotylenchulus reniformis*.
[3]150 g *Paecilomyces lilacinus* colonized rice/microplot.

tions was calculated for each plot by comparing the initial population of nematodes (Pi) with the final population (Pf), where PR = Pi − Pf/Pi × 100.

No significant differences in number of fruits were obtained in spite of large differences among treatments (table 1). Yield from the carbofuran-treated plots was significantly higher from those receiving fungus added at planting, the penamiphos 15G and nontreated control. There were no significant differences (in terms of yield) between carbofuran 10G at 2.24 and 4.48 kg/ha, nor between phenamiphos at the two rates tested. Fruit weight was significantly higher in carbofuran-treated plots than in the control. Even though no differences in yield were found between the control and fungus or phenamiphos-treated plots, a tendency was observed toward greater yield in plots treated with the fungus 2 weeks before planting. Yield increases of 30% and 50% were obtained with phenamiphos 15G (the lower dose—6.73 kg ai/ha and with the fungus added 2 weeks before planting.

Johnson et al.[9] and Román et al.[2] obtained highest yields in squash, cucumber and watermelon in phenamiphos 15G-treated plots. Our findings are consistent with those of Acosta[4] and Acosta et al.[5], who found significantly higher yield increases in cucurbits and watermelon in plots treated with carbofuran 10G at 1.12 kg ai/ha.

All fungus and nematicide treatments proved effective in reducing ecto- and endoparasitic nematodes (table 2). No significant differences were observed on reduction of root-knot and reniform nematodes. Nevertheless, a higher percentage reduction of nematode numbers was observed in plots treated with fungus 2 weeks before planting, as well as with both dosages of carbofuran 10G and with higher dosage of phenamiphos 15G.

Similar findings were obtained in cucurbits by Acosta[4], by Acosta et al.[5] and by Johnson & Harmon[8] with soil applications of carbofuran 10G and phenamiphos 15G. Román, et al., who conducted greenhouse studies with *M. incognita* and *P. lilacinus* in tomato, cv. Floradel, found reduced numbers of nematodes in soil and root-gall formation as the time of inoculation of the fungus previous to inoculation with the nematode was increased.

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