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POTATO SEED-PIECE TREATMENT WITH THE SYSTEMIC NEMATICIDE PHENAMIPHOS FOR CONTROL OF PLANT PARASITIC NEMATODES [TRATAMIENTO DE SEMILLA DE PAPA CON EL NEMATICIDA SISTEMICO PHENAMIPHOS PARA EL CONTROL DE NEMATODOS FITOPARASITOS].

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ABSTRACT

Potato seed-pieces were immersed in emulsions containing the systemic nematicide phenamiphos at concentrations of 0, 1.8, 3.6, 8.9, 17.9, or 35.9 g/L. When treated seed-pieces were planted in soil infested with a variety of plant-parasitic nematodes, there was a reduction in number of pathogens in the soil and in roots of plants produced as compared to controls. Concentrations of nematicide higher than 1.8 g/L were toxic to plants. No plants were produced from seed-pieces immersed in the 2 most concentrated emulsions. The degree of control obtained with the 1.8 g/L emulsion ranged from 67 - 100% depending on the nematode species.

INTRODUCTION

Control of nematodes affecting potatoes has been traditionally accomplished with preplant applications of halogenated hydrocarbons, or more recently, with in-furrow or banded applications of contact or systemic nematicides at planting time (4, 6). Because of the extreme phytotoxicity of halogenated hydrocarbons and some of the contact nematicides (4), the treatment of potato seed-pieces with nematicides has not been considered practical. However, with the introduction of new systemic nematicides, we thought it possible to treat seed-pieces for control of nematodes without injury to the crop. This paper presents results of a study on the feasibility of using phenamiphos for treatment of potato seed-pieces.

MATERIALS AND METHODS

Soil used in the experiment was a Norfolk sandy loam taken from a field that had been under cotton monoculture. The soil was infested with lance (*Hoplolaimus galeatus*), root-knot (*Meloidogyne incognita*), stunt (*Tylenchorhynchus*

claytoni), and lesion (*Pratylenchus brachyurus*) nematodes. The soil was sieved (2 mm) and weighed in 1-kg amounts into 11-cm diam plastic pots. Eight 50 g potato seed-pieces (cultivar + FL 96) were immersed for 5 min in 1 L of emulsions containing either 0, 5, 10, 25, 50, or 100 ml of the Nemacur 3 EC formulation (Chemagro Corporation) of phenamiphos; the emulsions contained 0, 1.8, 3.6, 8.9, 17.9 and 35.9 g/L of phenamiphos. After treatment, seed-pieces were shaken to remove excess emulsion and planted, one to a pot, giving 8 replications per nematicide concentration. Pots were arranged in a randomized complete block design and maintained under greenhouse conditions. After 6 weeks soil samples were taken from each pot and the number of nematodes was determined using the molasses flotation sieving technique (2, 3). Potato plants were carefully removed from the pots and soil was washed from the roots. Fresh root and shoot weights were determined after removal of the seed-piece, and the degree of phytotoxicity was recorded using a scale of 0 (no damage) to 5 (extreme toxicity). Ten-gram fresh weight of root tissue from each plant was incubated for 72 hrs on a 2 mm screen over 500 ml of water in 1-L beakers to isolate nematodes from the roots. After incubation, the water in each beaker was passed through a 38-mm sieve and nematodes retained were washed into a counting dish.

All data were analyzed using standard procedures for analysis of variance. Differences between means were evaluated for significance following the modified Duncan's multiple range test (5). Least significant differences were also calculated and are included on the graphs to aid interpretation.

RESULTS AND DISCUSSION

No potato plants emerged from pots containing seed-pieces treated with phenamiphos at concentrations of 17.9 and 35.9 g/L; emergence was 75% for the 8.9 g/L level and 100% for lower concentrations. Phytotoxicity and fresh root weight (Fig. 1A) for the lowest concentration of phenamiphos were not significantly different from control values; however, a significant increase in phytotoxicity, and reduction in root weight, was observed with the 2 higher concentrations. Phytotoxicity was characterized by smaller leaves with marginal necrosis and occasionally black necrotic spots. Shoot weight differences were not statistically significant.

Stunt nematode was the only parasitic species found in significant ($>10/50$ cm^3) numbers in soil from the pots (Fig. 1B). Treatment of seed-pieces with phenamiphos resulted in marked reductions in numbers of stunt, tylenchoid (*Ditylenchus + Tylenchus*), dorylaimoid and saprophagous nematodes in the soil. Maximal decrease in numbers was obtained with the lowest concentration of phenamiphos; higher concentrations resulted in no significant additional control. Changes observed for numbers of lance nematodes in soil were not significant. This is attributed to their relatively low number at sampling time.

Root-knot larvae, lesion, stunt and lance nematodes were extracted from roots (Fig. 1C). Changes in nematode numbers in the roots followed the same pattern as described for soil. The greatest reduction in numbers occurring with the lowest concentration of nematicide; use of more concentrated emulsions gave little additional control. The most susceptible were the larvae of *M. incognita* which were eliminated at the lowest concentration. Lance nematodes were the most tolerant, showing only a 67% maximal reduction in contrast to a 93% decline for lesion and 99% for stunt nematodes.

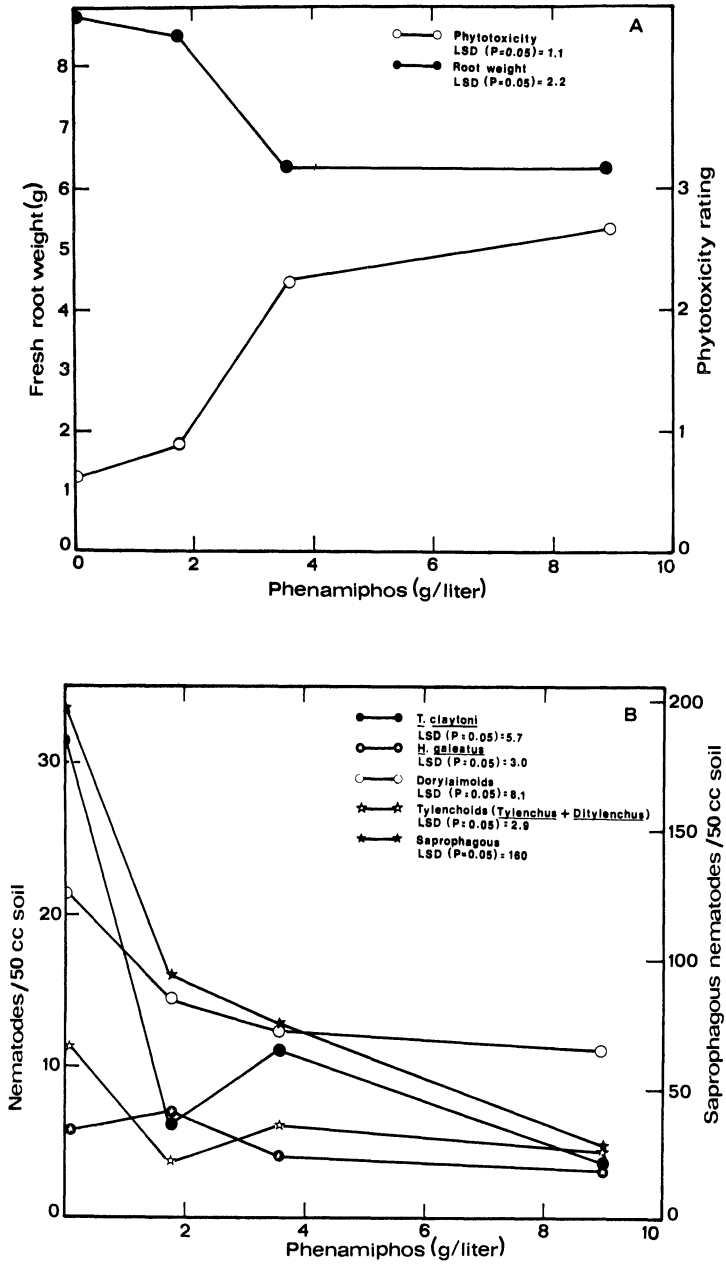

Fig. 1. Effect of immersion of potato seed-pieces in phenamiphos on growth of plants (A) and on the numbers of nematodes in soil (B).

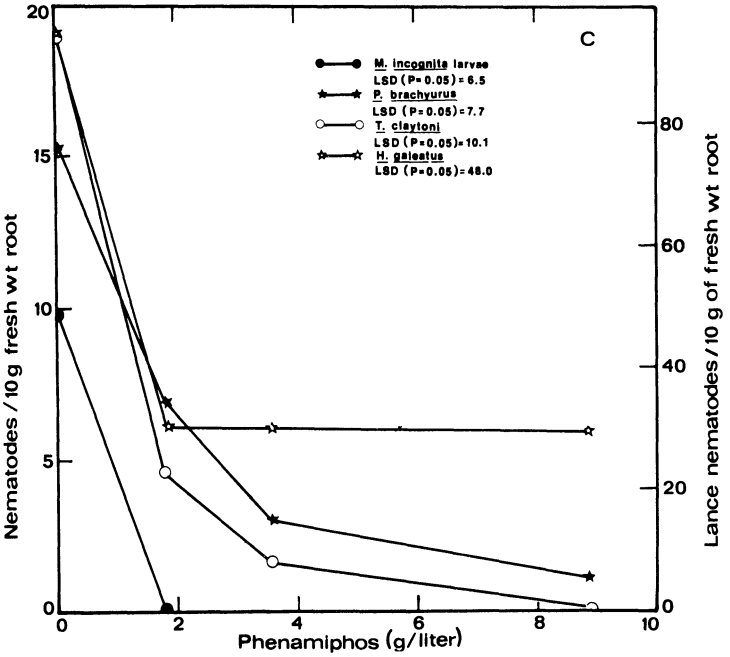

Fig. 1. (cont.) Effect of immersion on potato seed-pieces in phenamiphos on number of nematodes in roots (C).

In contrast to the degree of tolerance obtained with other systemic nematicides in similar seed-piece treatment experiments (1), these results indicate that potato seed-pieces have a small threshold of tolerance to phenamiphos supplied as the Nemacur 3 EC formulation. It is possible that with other formulations of phenamiphos a greater degree of crop tolerance may be obtained. Tolerance to the nematicide possibly varies with potato variety and it would be necessary to determine the level of tolerance before treatment of other cultivars. The results show that soaking of Cultivar FL-96 seed-pieces in concentrations of 1.8 g/L of phenamiphos produces adequate nematode control without significant toxic effects on the plants produced. Our results indicate that seed-piece treatment could be an efficient and simple method for applying nematicide to obtain early season control without the need for special equipment. The method could be particularly advantageous if systemic nematicides with strong insecticidal properties, such as oxamyl, were used for the treatment. Whether or not additional applications of nematicide are required after emergence of potatoes to maintain low pathogen numbers will be determined by local conditions and the level of soil infestation.

RESUMEN

Peadazos de papa de semilla fueron sumergidos en emulsiones que contenían: 0, 1.8, 3.6, 8.9, 17.9, or 35.9 g/L de nematicida sistémico fenamifos. La siembra de la semilla así tratada en un suelo infestado con gran número de nemátodos fitoparásitos resultó en reducciones significativas en el número de estos patógenos, tanto en el suelo como en las raices de las plantas resultantes. Se observaron efectos

pronunciados de fitotoxicidad en plantas derivadas de semilla tratada con concentraciones más altas que 1.8 g/L del nematicida. Las semillas tratadas con las dos concentraciones más altas no dieron plantas. El grado de control obtenido con la concentración más atenuada varió entre 67 y 100% dependiendo de la espécie de nemátodo.

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EFFECT OF OXAMYL ON HATCHING AND LARVAL DEVELOPMENT OF *ROTYLENCHULUS RENIFORMIS* [EFECTO DEL OXAMYL EN LA ECLOSION Y DESARROLLO LARVAL DE *ROTYLENCHULUS RENIFORMIS*]

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ABSTRACT

In vitro studies proved that oxamyl suppressed the hatching of *Rotylenchulus reniformis* eggs at concentrations varying from 5 to 500 ppm. Limited hatching took place at concentrations of 5, 10, 25 and 50 ppm while complete inhibition occurred at 500 ppm. The action was reversible but hatching potential was significantly reduced at concentrations of 10 ppm and above. Larval development was delayed in oxamyl. The development period in 0, 5, 10, 25, 50 and 500 ppm was 11, 14, 14, 17, 20 and 27 days for males and 13, 17, 17, 19, 22 and 29 days for juvenile females respectively, at 25 C.

Foliar application of oxamyl (methyl N' - N' - dimethyl - N - ((methylcarbamoyl) oxy) - 1 -thiooxamimidate) has been reported to be effective in preventing invasion of cotton and tomato roots by *Rotylenchulus reniformis* (4). Results of studies conducted *in vitro* on the hatching and larval development of the nematode are presented in this paper.

MATERIALS AND METHODS

Ten egg masses of the nematode from a culture maintained on castor bean were transferred to 5 ml solutions containing 0, 5, 10, 25, 50 and 500 ppm oxamyl in glass vials and incubated at 25 C. Each treatment was replicated 4 times. The hatched larvae were counted every 48 hr and fresh chemical solution was added. When hatching ceased after a week, the eggs were transferred to water to again induce hatching and further observations made until hatching again ceased.

The eggs were incubated in water at 25 C and the larvae which hatched on the first day were discarded. Larvae hatching the second day were transferred to