EFFECT OF FOSTHIAZATE ON CONTROL OF *RADOPHOLUS SIMILIS* IN BANANA

Guzmán-González,[1] S., M. Orozco-Santos,[2] and J. Farías-Larios[1]

Universidad de Colima, Facultad de Ciencias Biológicas y Agropecuarias, Apdo. Postal 36, 28100 Tecomán, Colima, México,[1] and INIFAP, Campo Experimental, Tecoman, Mexico.[2]

RESUMEN

Guzmán-González, S., M. Orozco-Santos y J. Farías-Larios. 1994. Efecto del fosthiazate sobre el control de *Radopholus similis* en plátano. Nematrópica 24:165-168.

El nemátodo barrenador *Radopholus similis*, afecta negativamente la producción de plátano (*Musa* AAA) en Colima, México. La eficacia de diferentes dosis (1, 2, 3 y 4 g de i.a./matero) de fosthiazate fue evaluado y comparado con fenamiphos y carbofurán (3 g de i.a./matero) para su control. El experimento fue realizado durante el verano-otoño de 1993 sobre el cv. Enano Gigante con altas poblaciones de *R. similis* (23 700/100 g de raíces frescas). El número de nemátodos e índice de daño en raíces, fue cuantificado después de 25, 50, 75 y 115 días de la aplicación de los nematicidas. Las dosis de fosthiazate redujeron igualmente el número de nemátodos en todos los períodos de muestreo. Fenamiphos tuvo un efecto similar que fosthiazate a los 50 o más días después de la aplicación. Carbofurán, fue el nematicida menos efectivo. Los tres compuestos redujeron similarmente el índice de daño de raíces durante los primeros 50 días. Sin embargo, después de este período, fosthiazate en su dosis más alta fue mejor. Fosthiazate es una alternativa de productos químicos para el control de *R. similis* en plátano.

Palabras clave: carbofurán, control químico, índice de daño, fenamiphos, fosthiazate, nematicida, *Radopholus similis.*

Research on nematode control in banana has been focused mainly on the burrowing nematode, *Radopholus similis* (Cobb) Thorne, on cultivars of the Cavendish group grown in intensive cropping systems (10). This parasite is distributed in the principal banana producing regions of Central America, West Africa, and the Caribbean Islands (8). Under natural conditions, lesions caused by *R. similis* are often associated with numerous fungi that are early colonizers of the wounded tissue (2,6,12). The nematode and fungi can reduce the conduction of solutes, elongation and branching of the primary roots, and in extreme cases, disrupt the anchorage systems.

The control of *R. similis* is based mainly on the use of non-fumigant formulations of chemical nematicides such as carbofuran, fenamiphos, izazophos, aldicarb and others (11,13,14). Introduction of new materials will increase the number of registered products and reduce potential problems with accelerated biodegradation (1). In this study, a new organophosphate compound, fosthiazate, was evaluated and compared with fenamiphos and carbofuran for the control of *R. similis.*

The present study was conducted during the summer-autumn period in 1993, at Boca de Apiza, Tecomán, Colima, Mexico, 20 m above sea level with an average annual precipitation of 830 mm and a mean average temperature of 27°C. The experiment was conducted in the field on a 15-year-old crop system of banana cv. Enano Gigante (Grande Naine, subgroup Cavendish, *Musa* AAA) with significant *R. similis* infestation (23 700 nematodes/100 g of fresh root weight) and moderate root damage. The soil was sandy loam with a pH of 6.8 and irrigated by sprinkling.

Granular formulations of fosthiazate (IKI-1145, [R,S,]-S-sec-butyl-O-ethyl-2-oxo-1,3-thiazolidine-3-yl phosphonothioate),

carbofuran, and fenamiphos were applied directly to soil around each plant. Fosthiazate was applied in doses of 1, 2, 3, and 4 g a.i./plant, and the latter 2 materials were applied in recommended doses for the region (3 g a.i./plant). The 7 treatments (including a control) were arranged in randomized complete block design with 4 replications and 6 plants in each experimental unit.

Root samples were collected from all plants 25, 50, 75, and 115 days after treatment, and nematode population and root damage index were determined. The nematodes were extracted from a 100 g subsample from each root sample by milling the roots in water with a blender for one minute and then using the sieving-centrifugation technique (5). The number of *R. similis* was determined directly from the extract by placing 5 subsamples (1 ml each) in 1-cm^3 polystyrene boxes and observing them under a stereo microscope with 45× magnification. The damage index was determined by the length of roots with lesions (9). Fifteen root segments of variable length (15-20 cm) were cut longitudinally, and cortical tissue with lesions was measured upon a visual scale of percentage of root length with lesions (0 = 0%, 1 = 20%, 2 = 40%, 3 = 60%, 4 = 80%, and 5 = 100%).

All data obtained were subjected to analysis of variance to determine whether significant ($P \leq 0.05$) differences occurred among the nematicide treatments. Separation of means was done by the Waller-Duncan *k*-ratio test.

The effects of fosthiazate on *R. similis* was similar ($P \leq 0.05$) at all doses tested (Table 1). However, the lowest nematode numbers (1 800 to 7 500 in 100g of fresh roots) were observed with doses of 3 and 4 g a.i./plant at 50 or more days after application. The doses of fosthiazate (X) and number of nematodes in roots 115 days after application (Y) showed an inverse relationship (r = - 0.97, $P \leq 0.05$, n = 5), represented by the linear regression equation $Y = 7678 - 1406X$.

Fosthiazate and fenamiphos reduced nematode numbers equally well at 50 days and beyond. The rate of reduction was from 50% to 92%. Carbofuran at 25 days after application had a similar effect to that of fenamiphos; however, in later sampling periods, it had significantly lower effectiveness. Nevertheless, *R. similis* num-

Table 1. Number of *R. similis* in 100 g roots of banana cv. Enano Gigante at four time periods after nematicide application.

		Days after application			
Treatment	Dose (a.i./plant)	25	50	75	115
Fosthiazate	(1 g)	11 800a[z]	11 100a	9 500a	5 800a
Fosthiazate	(2 g)	11 500a	11 700a	6 000a	5 500a
Fosthiazate	(3 g)	12 900ab	7 500a	4 900a	3 500a
Fosthiazate	(4 g)	14 100ab	6 000a	2 900a	1 800a
Fenamiphos	(3 g)	21 500b	10 500a	5 300a	2 800a
Carbofuran	(3 g)	18 400b	18 300b	21 500b	22 700b
Control		28 800c	27 900c	28 800c	29 500c

[z]Means followed by different letters within column are significantly different ($P \leq 0.05$).

Table 2. Index of *R. similis* root damage in banana cv. Enano Gigante at four time periods after nematicide application.[y]

Treatment	Dose (a.i./plant)	Days after application			
		25	50	75	115
Fosthiazate	(1 g)	1.68a[z]	1.73a	0.98ab	0.70ab
Fosthiazate	(2 g)	1.53a	1.45a	0.95ab	0.78ab
Fosthiazate	(3 g)	1.90a	1.45a	0.78ab	0.65ab
Fosthiazate	(4 g)	1.63a	1.30a	0.40a	0.40a
Fenamiphos	(3 g)	1.50a	1.30a	1.10b	1.00ab
Carbofuran	(3 g)	2.05a	1.58a	1.43b	1.15b
Control		2.80b	2.65b	2.68c	2.80c

[y]Percentage root length with lesions (0 = 0%, 1 = 20%, 2 = 40%, 3 = 60%, 4 = 80%, and 5 = 100%).
[z]Means followed by different letters within column are significantly different ($P \leq 0.05$).

bers in plants treated with carbofuran were lower than those in the control. The low efficacy of this nematicide might be due to microbial degradation or other factors.

The root damage index was statistically the same at 25 and 50 days in plants treated with the nematicides for all doses applied. However after this period, the fosthiazate dose of 4 g a.i./plant showed the lowest damage index (0.4) and was significantly better than carbofuran (Table 2). In control plant roots, the damage index varied from 2.65 to 2.80 and was always greater than those observed in plants treated with nematicide.

The results obtained, as also reported on the control phytoparasitic nematodes in bermuda grass (4), suggest that fosthiazate shows promise as a nematicide. However, it is necessary to evaluate crop yield during several production cycles to determine fosthiazate effectiveness not only in diminishing parasite population but in improving banana yield and quality. In other studies (3,7), some granular nematicides have been very effective in decreasing *R. similis* infestation without affecting yield.

LITERATURE CITED

1. ANDERSON, J. P., and A. P. WYBOU. 1987. How do we cope with the biodegradation of non-fumigant nematicides in the soil?. Proceedings VIIIth Meeting ACORBAT. ACORBAT, Panama City, Panama, (abstract).
2. BRUN, J., and E. LAVILLE. 1965. Etude de la mycoflore des racines du bananier "Poyo". 2. Cote d'Ivoire, Guadeloupe, Mali. Fruits 20:123-128.
3. CHAVARRIA, J. A., and H. IRIZARRY. 1991. Evaluación de dosis, intervalos de aplicación y rotación de cuatro plaguicidas granulados, registrados para el control de nemátodos y el picudo negro (*Cosmopolites sordidus* Germar), en plátanos. P. 201 *en* Memorias de la X Reunión ACORBAT. ACORBAT, Panama City, Panama (abstract).
4. GIBLIN-DAVIS, R. B., J. L. CISAR, AND F. G. BILZ. 1993. Evaluation of fosthiazate for the suppression of phytoparasitic nematodes in turfgrass. Nematrópica 23:167-175.
5. JENKINS, W. R. 1964. A rapid centrifugal flotation technique for separating nematodes from soil. Plant Disease Reporter 48:692.
6. MATEILLE, T., and S. FOLKERSTMA. 1991. A survey of nematodes and fungi in roots of banana cv. Poyo in the Ivory Coast. Revue Nématologie 14:3-8.
7. PATEL, H. R., D. J. PATEL, C. C. PATEL, and N. A. THAKAR. 1991. Field testing of four granular nematicides for checking infection of plant-parasitic nematodes in banana (*Musa paradisiaca*).

Indian Journal of Agricultural Sciences 61:350-352.

8. PINOCHET, J. 1987. La variabilidad de *Radopholus similis* en banano en las diferentes regiones productoras del mundo. Pp. 175-182 *en* Memorias VII Reunión ACORBAT, ACORBAT, Panama City, Panama.
9. PINOCHET, J. 1987. A method for screening bananas and plantains to lesion forming nematodes. Pp. 62-65 *in* Nematodes and the Borer Weevil in Bananas. INIBAP. Proceedings of a workshop held in Bujumbura, Burundi, Montpellier, France.
10. QUENEHERVE, P. 1993. Nematode management in intensive banana agrosystems: comments and outlook from the Cote d'Ivoire experience. Crop Protection 12:164-172.
11. SARAH, J. L., A. LASSOUDIERE, and R. GUEROUT. 1988. Expérimentation avec l'aldicarbe pour lutter contre *Radopholus similis* Cobb (Nematoda, Pratylenchidae) et *Cosmopolites sordidus* Germar (Cole-optera, Curculionidae) en Bananeraie. 2. Expérimentations réalisées en Cote d'Ivoire. Fruits 43:475-484.
12. STOVER, R. H. 1966. Fungi associated with nematodes and non-nematode lesions on banana roots. Canadian Journal of Botany 44:1703-1710.
13. VILARDEBO, A., and J. ROBIN. 1969. Nematicidal treatment of banana planting material. Pp. 133-141 *in* J. E. Peachey, ed. Nematodes of Tropical Crops. Commonwealth Agricultural Bureaux: Slough, UK.
14. VILARDEBO, A., R. GUEROUT, A. PINON, and P. MELIN. 1972. La lutte contre les nématodes du bananier. Synthèse des études avec les nématicides Nemacur et Mocap. Fruits 27:777-787.

Received: *21.III.1994*
Recibido:

Accepted for publication: *26.VII.1994*
Aceptado para publicación: