CONTROL OF *HELICOTYLENCHUS MULTICINCTUS* AND *MELOIDOGYNE JAVANICA* IN ESTABLISHED PLANTAIN AND NEMATODE SURVIVAL AS INFLUENCED BY RAINFALL [COMBATE DE *HELICOTYLENCHUS MULTICINCTUS* Y *MELOIDOGYNE JAVANICA* EN PLATANO Y EL EFECTO DE LA LLUVIA SOBRE LA SUPERVIVENCIA DE NEMATODOS].

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ABSTRACT

Soil treatment with oxamyl and carbofuran at 3 g followed by 1.2 g a.i./plant after 4 months reduced damage caused by *Helicotylenchus multicinctus* and *Meloidogyne javanica* to established plantain *(Musa* AAB). Treatment appreciably reduced nematode populations and significantly increased vigor and yield of plantain. Oxamyl gave the best response followed by carbofuran increasing yields by 98 and 61% respectively. One liquid formulation of oxamyl applied to foliage gave less nematode control and less yield than the granular formulation. In nontreated soils both *H. multicinctus* and *M. javanica* juveniles increased or decreased with rainfall. Population densities of both pathogens were significantly correlated with average and/or total rainfall but not correlated with number of rain days. Drought conditions adversely affected *M. javanica* juveniles populations more than populations of *H. multicinctus.*
Key Words: Vydate, Furadan, systemic nematicides, root knot nematodes

INTRODUCTION

Nematode parasitism is the cause of serious damage to *Musa* spp. throughout the tropics (1). Control efforts have demonstrated the effectiveness of fumigant, contact and systemic nematicides in reducing nematode damage to banana and plantain cultivation (4, 10, 11, 14). The efficacy of nematicides on *Musa* spp. is influenced by soil type (9), nematode species involved (6, 7), plant age (7) and timing and methods of application (2, 3, 15). Various ecological factors also influence population survival (12, 13).

This paper reports on the use of 3 formulations of systemic nematicides and their potential use on *Musa* spp. in West Africa. The effect of rainfall on nematode population level is also reported.

MATERIALS AND METHODS

An established field of one-year-old plantain, *Musa* AAB cv Agbagba on a sandy loam soil (pH 6.5) heavily infested with *Helicotylenchus multicinctus* (Cobb, 1893) Golden, 1956 and *Meloidogyne javanica* (Treub, 1885) Chitwood, 1949 was used in the trial. Treatments were carbofuran 10G (Furadan ®), oxamyl 10G (Vydate ®), oxamyl 24L and nontreated control. A completely randomized design with eight replications of one tree each was used.

Granular formulations of carbofuran and oxamyl were incorporated into the soil in a 0.75 m radius around each plant at the rate of 3 g a.i./plant. Liquid oxamyl was sprayed on the foliage in one liter per plant at the rate of 3 g a.i./plant. The first

treatment was made early in the rainy season. Four months later a second application of each nematicide was made at the rate of 1.2 g a.i./plant. The field was left to grow under natural conditions without supplemental irrigation and the harvest was made after 8 months during the dry season.

Nematode populations were monitored monthly. Nematodes were isolated from soil samples using the modified Baerman technique (16) and concentrated by the settling-siphon method (5).

Data on trunk circumference 1 m above the soil surface and plant height were taken at the beginning of the trial and at harvest. The number of fruits and bunch weight per plant were also recorded.

RESULTS

Nematode control: Population fluctuations of *H. multicinctus* and *M. javanica* juveniles for the 8 month trial period are shown in Fig. 1. In general terms the nematicides significantly reduced the plant-parasitic nematode soil populations compared to the control treatment. An exception was the treatment using oxamyl liquid where higher population densities of *M. javanica* juveniles were recovered during the second rainy season. Against *H. multicinctus,* oxamyl 10G, carbofuran 10G and oxamyl liquid gave the best control respectively according to the regression b values (Fig. 1A). Against *M. javanica,* carbofuran 10G, oxamyl 10G and oxamyl liquid respectively gave the best control (Fig. 1B).

Growth and yield: Oxamyl 10G produced the best response, increasing pseudostem height and circumference by 30 and 56%, and fruit numbers and weights by 48 and 98% respectively, as compared with control treatments. Yield after oxamyl 10G treatment was significantly higher than those of all other treatments (Table 1).

Carbofuran 10G treatment increased fruit numbers and weights by 27 and 61%, respectively. Oxamyl liquid was the least effective compound tested though the yield was significantly greater than the control yield.

Rainfall: Soil population densities of *H. multicinctus* and *M. javanica* juveniles were affected by rainfall and average daily rainfall (Fig. 2). *M. javanica* juveniles showed the greatest sensitivity to drought conditions. There were significant negative correlations between *H. multicinctus* population levels and total and average daily rainfall, and with *M. javanica* juveniles a positive correlation with average daily rainfall. Neither nematode soil population had a significant correlation with number of raindays.

DISCUSSION

Soil incorporation of oxamyl and carbofuran granules at the onset of the rains and 4 months later was effective in reducing soil populations of *H. multicinctus* and *M. javanica* juveniles. Significant growth and yield responses were made in established plantain under growth conditions of western Nigeria. Periodic sampling of nematode soil population levels showed that oxamyl 10G and carbofuran 10G had a high nematicidal activity which persisted for at least 3 months following application. Oxamyl liquid was less effective in controlling the nematode soil populations than the granular formulation. The use of an adequate sticker-spreader may be necessary to increase the effectiveness of the liquid formulation when used on above ground plant parts (8).

The population dynamics of the plant-parasitic nematodes during the wet and dry months of the growth period show a decline in the recovery of nematodes correlated

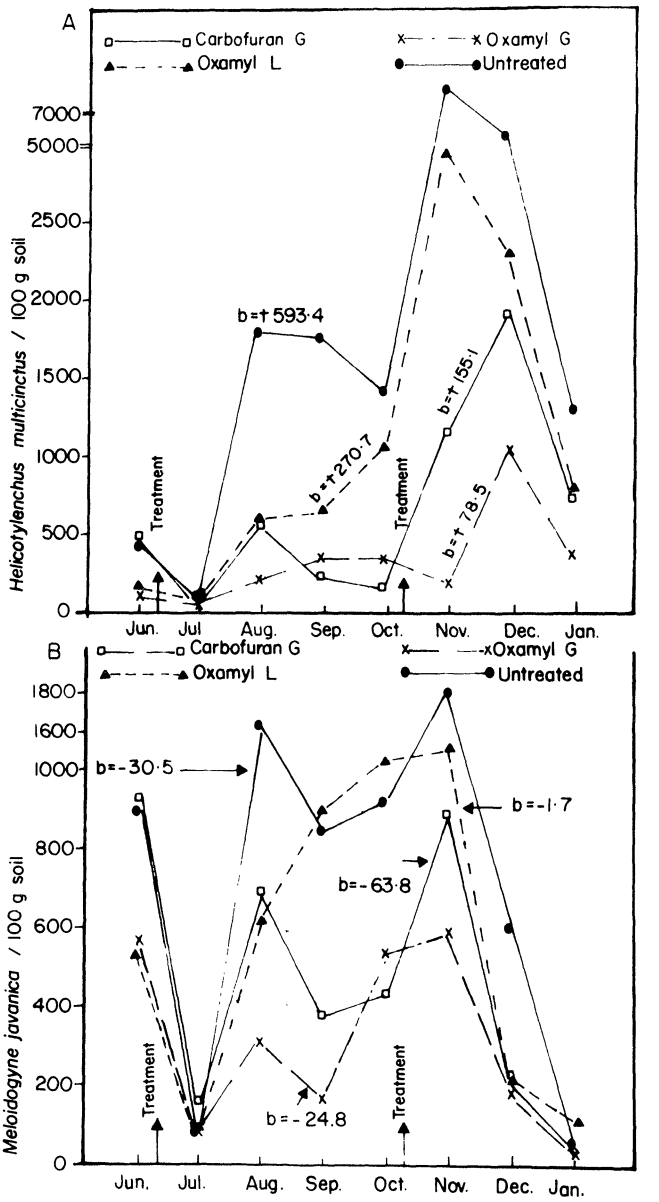

Fig. 1. Population density changes of plant-parasitic nematodes on established plantain in western Nigeria. A Effect of nematicide treatment on *Helicotylenchus multicinctus* population levels. B. Effect of nematicide treatment on *Meloidogyne javanica* population levels.

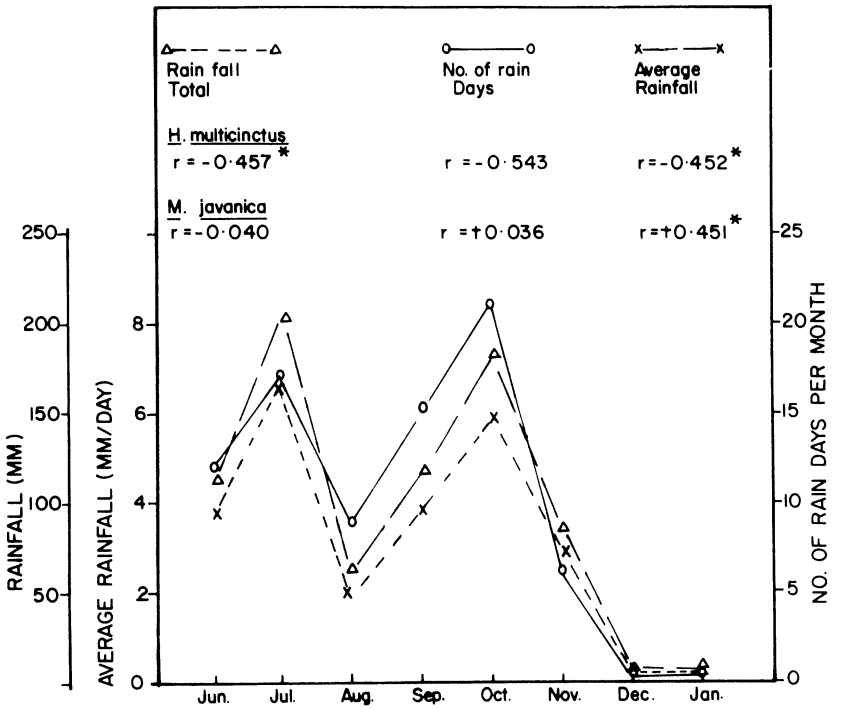

Fig. 2. Correlations of *Helicotylenchus multicinctus* and *Meloidogyne javanica* soil population levels with total rainfall, average daily rainfall and number of raindays per month. An * indicates a significant correlation.

Table 1. The effect of plant-parasitic nematode control by nematicides on plantain growth and marketable fruits.[x]

Treatment	Height Increase[y] (cm)	Sucker Height (cm)	Circumference Increase[y] (cm)	Fingers/ Bunch[z] (No.)	Bunch Weight[z] (kg)
Oxamyl 10G	145	118	15	29.8 c	15.5 d
Carbofuran 10G	133	102	13	25.6 b	12.6 c
Oxamyl liquid	115	75	12	24.9 b	10.4 b
Control	112	68	10	20.1 a	7.8 a

[x] Means of eight replications of one tree each.

[y] Height or circumference increase represents the difference in the measurements taken at the beginning of the trial and at harvest.

[z] Means followed by the same letters are not significantly different according to Duncan's Multiple Range Test (P = 0.01).

with drought conditions. The combination of nematode attack and drought stress curtailed plant growth in nontreated soils. As shown in this study, the average and total rainfall were more important than the frequency of raindays.

RESUMEN

Tratamientos del suelo con oxamil y carbofurán a dosis de 3 g seguida de 1.2 g i.a./ planta después de 4 meses, redujeron el daño causado por *Helicotylenchus multicinctus* y *Meloidogyne javanica* en plátanos *(Musa* AAB). Los tratamientos redujeron apreciablemente las poblaciones de nematodos y aumentaron significativamente el vigor y los rendimientos de los platanos. Oxamil dió los mejores resultados seguido de cabofurán ambos aumentando los rendimientos en un 98 y 61 % respectivamente. Una preparación liquida de oxamil aplicada al follage resultó en menor grado de combate de nematodos y menos rendimiento. El número de formas juveniles de *H. multicinctus* y *M. javanica* aumentó o disminuyó en relación a la precipitación. Las densidades de poblaciones para ambos patógenos estuvieron correlacionadas con el promedio y o con la cantidad total de precipitación pero no con el número total de días lluviosos. La seca afectó más adversamente a las poblaciones juveniles de *M. javanica* que a las de *H. multicinctus.*

Claves: Vydate, Furadan, nematicidas sistémicos, nematodos noduladores.

LITERATURE CITED

1. Blake, C. D. 1969. In: J. E. Peachey (ed.). Nematodes of tropical crops. CAB, Farnham Royal, Bucks., England. pp 109-132; *2.* Broadley, R. A. 1976. Aust. Pl. Path. Soc. Newsletter 5 (1 Suppl.) Abs. 101; *3.* Burnett, W.M., R.M. Burnett and I.M. Inglis. 1974. Pflanzenschutz-Nachrichten Bayer 27: 233-266; *4.* Canderon, O.P. 1974. Fitopatologia 9: 41-42; *5.* Caveness, F. E. 1975. Nematropica 5: 30-32; *6.* Figueroa, A. 1975. Fitopatologia 10:67; *7.* Gowen, S. R. 1975. Nematropica 5:22; *8.* Gowen, S. R. 1977. J. Nematol. 9: 158-161; *9.* Guerout, R., A. Lassoudiere and A. Vilarbedo. 1976. Fruits 31: 427-436; *10.* Gupta, J. C. 1975. Haryana, J. Horticul. Sci. 4: 152-156; *11.* Hasing-Lama, M., M. K. France and J. Escobar-Goyes. 1976. Acta Horticul. 57: 213-221; *12.* Hutton, D. G. 1978. Nematropica 8: 34-39; *13.* Salas, J.A., R. Oyuela and R.H. Stover. 1976. Pl. Dis. Reptr. 60: 863-866; *14.* Shafiee, M.F. and S. Gutierrez Valliciergo. 1975. Ciencias, Univ. Havana, Serie II, Sanidad Vegetal No. 9, 14 pp; *15.* Vilardebo, A. and R. Guerout. 1976. Nematropica 6: 51-53; *16.* Whitehead, A.G. and J.R. Hemming. 1965. Ann. appl. Biol. 55: 25-38.

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