

Further Experiments on the Chemical Control of Nematodes in Plantains (*Musa acuminata* × *M. balbisiana*, AAB)¹

J. Román, X. Rivas, D. Oramas, J. Rodríguez²

ABSTRACT

Two experiments were conducted to evaluate the effectiveness of three nematicides in the control of nematodes that affect plantain (*Musa acuminata* × *M. balbisiana*, AAB): one at the Corozal Agricultural Substation and the other at the Gurabo Substation. The results show that all of the three doses of Dasanit 15G, Mocap 10G, and Furadan 10G tested were effective in controlling nematodes, increasing yield, and extending the useful life of the plantation so that three crops were harvested without renovating the plantation.

INTRODUCTION

Plantains (*Musa acuminata* × *M. balbisiana*, AAB) are widely planted in Puerto Rico as a source of food. According to the latest information of the Department of Agriculture of Puerto Rico, plantains have become the second crop of economic importance in the Island (1). According to this agency the agricultural gross income from plantains for the year 1974-75 was \$21.56 million, a 14% increase over 1973-74. In terms of fruit-units the 1974-75 production was 30 million greater than the production for 1973-74.

This trend toward increasing production is hampered by the high incidence of nematodes which reduce yields significantly. It is assumed that a great majority of the plantain farms are affected by nematodes. Under these conditions only the plant crop is economically feasible. The ratoon crops, which would be expected to produce higher net incomes, are so affected that plants do not attain maturity. This situation is conducive to plantain shortages making it necessary to import them from abroad.

Records on the effect of nematodes on plantain yield decline are scarce. Ogier and Merry (3) and Hutton and Chung (2) related plantain yield decline to nematode attack in Trinidad and Jamacia, respectively. Román et al. (4) reported that *Radopholus similis* causes the "black head toppling disease" of plantains in Puerto Rico. They demonstrated that *R. similis* is controlled by pangolagrass and that rotation of plantains with pangola grass increased plantain yields significantly (5).

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² Nematologists and Research Assistants, respectively, Agricultural Experiment Station, College of Agricultural Sciences, Mayagüez Campus, University of Puerto Rico, Río Piedras, P.R.

Román and Medina (7) reported on the effect of Carbofuran (Furadan)³ in controlling nematodes and increasing plantain yields. Román (8) reported that Fensulfothion (Dasanit) was an effective nematicide and increased plantain yields significantly. Román et al. (6) reported that granular formulations of nematicides provided a fast, easy, and economic method of application and increased the yields of plantains significantly, especially in the ratoon crops. The research reported herein is a continuation of this latter study.

MATERIALS AND METHODS

Two experiments, one each at the Corozal (Sept. 19, 1972) and Gurabo (Aug. 22, 1972) Substations, were established to evaluate the effect of three doses of three granular nematicides: Fensulfothion (Dasanit), Ethoprop (Mocap), and Carbofuran (Furadan). At Corozal the soil was a Corozal clay with pH 4.5. At Gurabo it was a Mabi clay with pH 5.0. Both were treated similarly. Soil pH was corrected to 6.0 by adding Ca CO₃.

The Maricongo cultivar was used. Before planting, the rhizomes or "seeds" were peeled to discard necrotic tissue. Experimental plots had 10 plants at 1.37 × 2.74 m—an approximate density of 2,471 plants/ha (1,000 plants/acre). Ten treatments were replicated four times in a balanced incomplete block design (tables 1-3). The nematicides were applied at planting by mixing the material with the soil covering the "seeds," and thereafter, every 6 months on the soil surface in a 3/4-m radius around the plant. A small calibrated plastic container was used for this operation.

Two gal of Dieldrin 15 EC per 100 gal of water were applied every 6 months to control the corm weevil, *Cosmopolites sordidus*. Weeds were controlled with postemergence applications of Gramoxone at 473 cm³/ha. A 10-10-10 fertilizer was applied 1 and 5 months after planting at 227 and 454 g/plant, respectively. Thereafter, every 5 or 6 months a 10-5-20 fertilizer was applied at 454 g/plant.

Soil samples for nematode counts were collected immediately before and 6 weeks after each nematicide application. Root samples were collected immediately after the second harvest for each of the two experiments, but none thereafter, to prevent damage to the plant root system. Soil samples were analyzed by the routine sieving-decanting, Baermann-funnel method. Root samples were comminuted and blended

³ Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of equipment or materials by the Agricultural Experiment Station of the University of Puerto Rico or an endorsement over other equipment or materials not mentioned.

for 15 s and processed in the same way as the soil samples. Nematodes collected were identified and counted under a microscope.

Number of fruits and bunch weights were recorded at harvest-time. At the end of the third harvest of each experiment, four plants were pulled from each plot to study corm weevil infection.

RESULTS AND DISCUSSION

Tables 1 (Corozal) and 2 (Gurabo) show the fluctuations in the number of known and suspected plant parasitic nematodes in the soil throughout the experiments. In both places the populations included the following nematodes: *Radopholus similis*, *Helicotylenchus* spp., *Rotylenchulus reniformis*, *Pratylenchus* spp., *Tylenchus* spp., and *Aphelenchoides* spp. These tables show a trend toward bigger populations in control plots than in treated ones.

The populations of *R. similis* in 100 g of roots at the time of the second harvest are presented in figure 1 (Corozal and Gurabo). In both experiments the treated plots had fewer *R. similis* than the control plots. At Gurabo the root samples taken from plots with the higher doses of Dasanit, Mocap, and Furadan were free of *R. similis*. At Corozal the only roots found to be free of *R. similis* were those treated with the higher doses of Furadan. The general low population of nematodes found in the soil and roots from the treated plots was associated with overall growth and vigor of the plants throughout the experiments and with the high yields obtained.

The mean plantain yields for 3 consecutive years are presented in table 3 (Corozal and Gurabo). In both experiments yields from treated plots were higher than those from the control. These differences in yields were very pronounced in the first and second ratoons. In fact, the ratoon of the control treatment did not produce fruits in Gurabo and few in Corozal.

No direct relationship was found between dosage and yield. Although the higher doses were more effective in controlling *R. similis* during the second harvest at Gurabo, they had no effect on yields. It was apparent that any of the three doses of each material increased yields.

The three chemicals used have both insecticidal and nematicidal action, but plants in both fields were free of corm weevil. Therefore, the differences in yield are attributed to nematode control alone.

The results show that semiannual applications of granular formulations of Dasanit 15G from 17 to 66 g/plant and of Mocap 10G and Furadan 10G from 28 to 112 g/plant control nematodes, increase yields significantly, and extend productivity of the plantation. These results agree with those published by Román et al. (6).

TABLE 1. — Mean number of known and suspected plant parasitic nematodes recovered from 300 cm³ of soil from the rhizosphere of plantains treated with nematicides at Corozal, P.R.¹

Semiannual treatment/plant ²	Sept. 1972	Nov. 1972	March 1973	May 1973	Sept. 1973	Nov. 1973	March 1974	May 1974	Sept. 1974	Nov. 1974	March 1975	May 1975
1. Dasanit 15G, 17 g	180	0	480	100	0	40	1,680	80	300	820	5,180	280
2. Dasanit 15G, 33 g	80	0	860	240	20	20	2,040	160	620	200	880	420
3. Dasanit 15G, 66 g	320	80	120	20	20	20	520	0	220	160	2,640	520
4. Mocap 10G, 28 g	240	20	120	40	100	0	640	20	40	40	720	0
5. Mocap 10G, 56 g	280	80	60	40	0	0	620	60	80	40	800	60
6. Mocap 10G, 112 g	180	20	120	20	0	0	40	0	100	40	180	20
7. Furadan 10G, 28 g	300	100	100	40	0	20	80	160	40	80	1,140	240
8. Furadan 10G, 56 g	340	40	220	40	20	0	660	20	160	140	1,300	20
9. Furadan 10G, 112 g	200	60	0	0	20	0	60	0	100	0	1,760	60
10. Control	300	300	320	410	1,680	560	1,620	2,420	1,320	1,520	4,335	1,440

¹ Numbers correspond to a mixed population of *R. similis*, *Helicotylenchus* spp., *R. reniformis*, *Pratylenchus* spp., *Tylenchus* spp. and *Aphelenchoides* spp.

² Treatments (6) were made in September and March of each year after taking the soil samples.

TABLE 2. — Mean number of known and suspected plant parasitic nematodes recovered from 300 cm³ of soil from the rhizosphere of plantains treated with nematicides at Gurabo, P.R.¹

Semiannual treatment/plant ²	Aug. 1972	Oct. 1972	Feb. 1973	April 1973	Aug. 1973	Oct. 1973	Feb. 1974	April 1974	Aug. 1974	Oct. 1974	Feb. 1975	April 1975
1. Dasanit 15G, 17 g	1,240	140	320	40	580	20	140	60	360	160	380	84
2. Dasanit 15G, 33 g	700	20	240	80	220	160	340	40	180	20	160	64
3. Dasanit 15G, 66 g	740	60	200	20	140	0	480	140	20	120	220	68
4. Mocap 10G, 28 g	1,100	100	880	200	340	80	460	80	340	40	260	100
5. Mocap 10G, 56 g	600	80	260	80	200	0	540	40	120	40	40	48
6. Mocap 10G, 112 g	1,160	40	200	60	40	80	380	100	200	40	80	64
7. Furadan 10G, 28 g	1,300	20	220	20	100	20	280	200	220	100	440	72
8. Furadan 10G, 56 g	1,260	20	180	20	60	100	120	240	140	100	120	96
9. Furadan 10G, 112 g	800	60	100	40	60	0	240	1,160	80	100	180	272
10. Control	980	380	2,280	3,060	200	1,400	2,220	1,720	720	40	1,840	1,690

¹ Numbers correspond to a mixed population of *R. similis*, *Helicotylenchus* spp., *R. reniformis*, *Pratylenchus* spp., *Tylenchus* spp., and *Aphelenchoides* spp.

² Treatments (6) were made in August and February of each year after taking the soil samples.

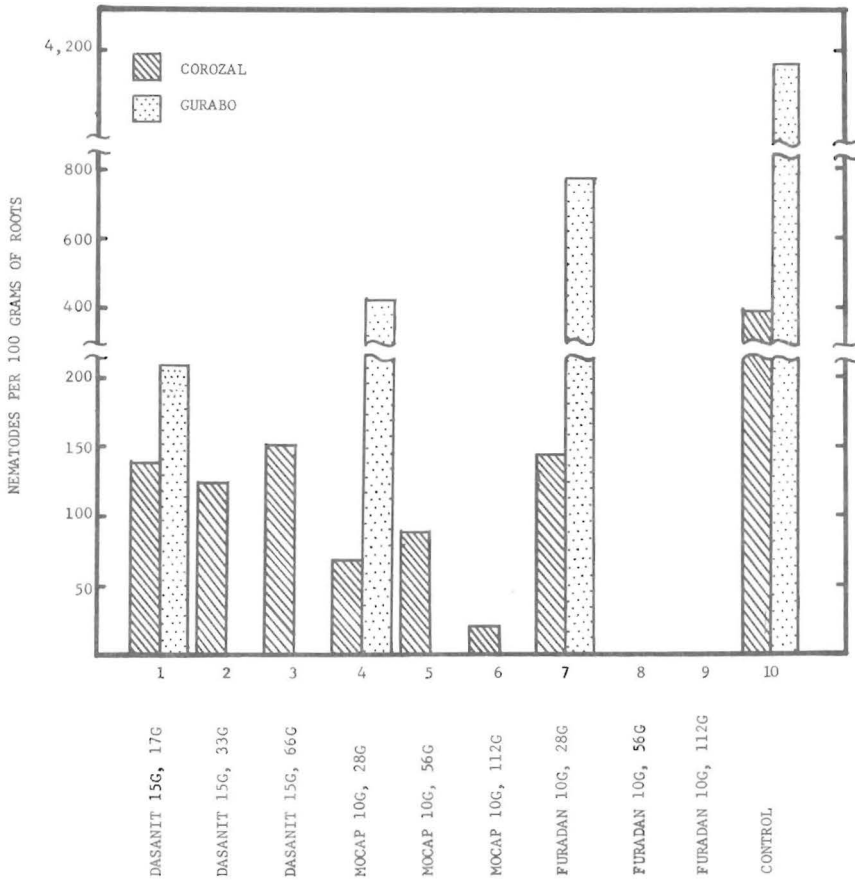


FIG. 1. — Number of *Radopholus similis* during the second harvest of plantains treated with various nematocides at two localities in Puerto Rico.

TABLE 3.—Estimated mean number and weight of marketable fruits per hectare of plantain plants treated with nematicides at two localities in Puerto Rico

Semiannual treatment/plant	Plant crop		First ratoon		Second ratoon		Total 3 harvests	
	Fruits	Weight	Fruits	Weight	Fruits	Weight	Fruits	Weight
	No.	Metric tons	No.	Metric tons	No.	Metric tons	No.	Metric tons
<i>Corozal</i>								
1. Dasanit 15G, 17 g	98,593 ¹	22.87 ^{**2}	78,257 ^{**}	16.79 ^{**}	44,651 ^{**}	8.89 [*]	221,501	48.55
2. Dasanit 15G, 33 g	97,852 [*]	24.10 ^{**}	73,216 ^{**}	17.89 ^{**}	37,312 [*]	8.95 [*]	208,380	50.94
3. Dasanit 15G, 66 g	97,605 [*]	22.65 ^{**}	91,798 ^{**}	22.41 ^{**}	49,791 ^{**}	9.53 [*]	239,194	54.59
4. Mocap 10G, 28 g	90,192	20.18 [*]	80,357 ^{**}	19.79 ^{**}	63,579 ^{**}	13.31 ^{**}	234,128	53.28
5. Mocap 10G, 56 g	106,994 [*]	20.58 ^{**}	78,874 ^{**}	19.95 ^{**}	57,994 ^{**}	12.06 ^{**}	243,862	52.59
6. Mocap 10G, 112 g	100,570 [*]	24.77 ^{**}	87,869 ^{**}	22.68 ^{**}	60,045 ^{**}	10.28 ^{**}	248,484	57.73
7. Furadan 10G, 28 g	94,886	23.77 ^{**}	87,721 ^{**}	22.96 ^{**}	54,041 ^{**}	12.51 ^{**}	236,648	59.24
8. Furadan 10G, 56 g	84,014	21.30	87,226 ^{**}	22.67 ^{**}	61,281 ^{**}	14.93 ^{**}	232,521	58.90
9. Furadan 10G, 112 g	81,790	18.61	70,078 ^{**}	19.31 ^{**}	56,018 ^{**}	13.89 ^{**}	207,886	51.81
10. Control	69,929	13.56	6,919	1.20	5,115	1.01	81,963	15.77
<i>Gurabo</i>								
1. Dasanit 15G, 17 g	86,979	³	70,424	11.88	49,914	10.20	210,317	22.08 ⁴
2. Dasanit 15G, 33 g	91,427		70,424	13.56	56,092	10.65	217,943	24.21
3. Dasanit 15G, 66 g	84,508		70,671	12.89	55,350	12.67	210,529	25.56
4. Mocap 10G, 28 g	83,520		58,069	9.98	45,466	10.86	187,055	20.84
5. Mocap 10G, 56 g	73,636		69,929	11.99	51,891	12.33	195,456	24.32
6. Mocap 10G, 112 g	70,176		69,929	12.89	61,281	13.79	201,387	26.68
7. Furadan 10G, 28 g	72,400		66,964	13.00	48,926	11.10	188,290	24.10
8. Furadan 10G, 56 g	89,944		70,918	13.34	60,540	12.11	221,402	25.45
9. Furadan 10G, 112 g	71,659		63,998	12.78	46,702	12.89	182,359	25.67
10. Control	68,447		0	0	0	0	68,447	0

¹ Significant value (5%) over control.² Significant value (1%) over control.³ Crop destroyed by storm; weight not taken.⁴ Weight of plant crop not included.

RESUMEN

Para evaluar la eficacia de tres nematocidas en el platanero (*Musa acuminata* × *M. balbisiana* AAB), se efectuaron dos ensayos: uno en la Subestación Experimental de Corozal y otro en la Subestación de Gurabo. Los resultados indican que aplicaciones semi-anales de formulaciones granuladas de Dasanit 15G de entre 17 y 66 g por planta, de Mocap 10G entre 28 y 112 g por planta y de Furadan 10G también entre 28 y 112 g por planta, son eficaces para controlar los nematodos, aumentar significativamente los rendimientos y alargar la vida útil de la plantación hasta producir tres cosechas sin necesidad de resembrar.

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