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COMPARISON OF VARIOUS TREATMENTS FOR THE CONTROL OF *PRATYLENCHUS COFFEAE* IN YAM [COMPARACION DE VARIOS TRATAMIENTOS PARA CONTROL DE *PRATYLENCHUS COFFEAE* EN TUBERCULOS DE ÑAME]

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ABSTRACT

Negro yam *(Dioscorea rotundata)* tubers were dipped for 30 min. in hot water (51C) and then in solutions of the nematicides oxamyl, phenamiphos, and diazinon or in solutions of the nematicides only. Tubers, treated with hot water and nematicides developed soft and wet roots whether planted or kept in storage. Root production was good in treatments with hot water, oxamyl alone, phenamiphos alone and the control. Populations of *Pratylenchus coffeae* were significantly reduced by the hot water dip, but this treatment had adverse physiological effects on distal portions of tubers. Treatment with oxamyl at 1200 or 2400 ppm was the most effective since nematode populations were significantly lowered and plant growth was unaffected; phenamiphos and diazinon were ineffective treatments.

INTRODUCTION

In Jamaica, yam *(Dioscorea spp.)* tubers are affected by a condition known locally as "burn" and universally as "dry rot". Disease symptoms readily observable in mature tubers are cracking of the skin and dark necrotic lesions which are corky in texture due to disintegration of the cortex. Tubers stored at ambient temperatures to be used either as food or planting material may show severe disease symptoms a few weeks after being harvested.

Dry rot of yams was first associated with nematodes by Steiner and LeHew who found *Scutellonema bradys* (Steiner and LeHew) Andrassy in yams from Jamaica. Species of the nematode genera *Pratylenchus* Filipjev, *Scutellonema* Andrassy and *Hoplolaimus* Daday are reported to be associated with the disease in various countries including Jamaica (2, 4, 5, 6, 7, 9, 10, 11, 12, 14). Ekundayo and Haqui (8) showed that in Nigeria the disease is caused by a bacterium *(Corynebacterium* sp.) in association with *S. bradys* which acts as the wounding agent. Negro yam *(D. rontundata* Poir) is widely grown in Jamaica. We believe that use of planting material with a high proportion of dry rot results in nonsprouting of tubers and the subsequent poor stands observed in some fields. Experiments were therefore set up with Negro yam to compare the effectiveness of various treatments for control of nematodes in tubers.

MATERIAL AND METHODS

Five tubers from a consignment of negro yams were reserved for estimating the initial nematode population level. Remaining tubers were divided into 14 groups, each of 17 tubers. The groups were allocated various treatments (Table 1) which consisted of dipping tubers for 30 min. in hot water and/or the nematicides oxamyl (Vydate), phenamiphos (Nemacur) and diazinon (Sarolex). Each tuber was then cut into a proximal and a distal portion weighing an average 335 g and 310 g respectively. Calcium carbonate slurry was applied to the dry cut surface to form a protective coat and the tubers were allowed to dry in the sun.

Three proximal and 3 distal portions from each treatment were placed in moist coir in 14-cm diam plastic bags and arranged on the greenhouse bench in a 14 x 6 randomized complete block design. The portions were removed three weeks after planting and records made of bud and root production, presence of soft or wet rot, degree of dry rot and nematode population increase. The remaining tubers were stored in cardboard boxes at laboratory temperatures. After 3 weeks 1 proximal and 1 distal portion per treatment were processed to obtain an indication of the nematode population increase in storage and the degree of dry rot was recorded from 4 portions. Observations of soft, wet and dry rots were made from the remaining 10 portions for each treatment, and the nematode population estimated from 4 of these after 9 weeks storage.

Nematode populations were estimated by paring tubers to a depth of 15 mm, cutting the parings into 3 mm sections and extracting the nematodes from a 20 g sample by the Young's incubation technique for 24 hr. (15). The resulting nematode suspension was made up to 100 ml and a 10 ml aliquot removed for nematode count. Dry rot was assessed by cutting each portion longitudinally into four quarters and measuring the maximum depth of rot.

RESULTS

Tubers sampled before treatment yielded only 1 plant parasitic nematode species, *P. coffeae*. Populations averaged 720 and 610/20 g for proximal and distal portions respectively.

In the greenhouse trial, roots were produced by tubers in all treatments but a higher number occurred in portions treated with hot water, oxamyl and phenamiphos (Table 1). Buds were just sprouting at the termination of the trial. Tubers dipped in both hot water and nematicide (Treatments 2 to 7) decayed to produce a foul-smelling mass due to soft and wet rots. Due to the missing replicates, data from these treatments could not be included in the statistical analyses. Maxium depth of dry rot generally tended to be

TABLE 1: BUD AND ROOT PRODUCTION, NUMBER OF PORTIONS WITH SOFT OR WET ROT, DEPTH OF DRY ROT, AND MEAN *Pratylenchus coffeae* POPULATIONS RECOVERED FROM 20 G PARINGS OF TUBERS OF *Dioscorea rotundata* 'NEGRO' RECEIVING VARIOUS TREATMENTS AND GROWN UNDER GREENHOUSE CONDITIONS FOR THREE WEEKS.

Number	Treatment[1]	Rate (ppm)	No portions with buds	No. portions with roots	Mean no. roots per portion	No. portions[2] with soft or wet rot	Mean maximum[3] depth of dry rot (mm) P	D	Mean no. nematodes
1	Hot water at 51 C	-	2	4	31	2	4.8	1.5	38
2	Treatment 1 plus oxamyl immediately	600	2	2	3	6	-	-	-
3	Treatment 1 plus oxamyl after 4 days	600	1	2	23	5	-	-	-
4	Treatment 1 plus phenamiphos immediately	600	0	2	3	6	-	-	-
5	Treatment 1 plus phenamiphos after 4 days	600	1	2	8	6	-	-	-
6	Treatment 1 plus diazinon immediately	600	0	1	37	5	-	-	-
7	Treatment 1 plus diazinon after 4 days	600	2	2	16	4	-	-	-
8	Oxamyl	1200	3	5	22	2	2.3	1.5	78
9	Oxamyl	2400	4	6	27	0	3.3	0.8	43
10	Phenamiphos	1200	5	6	15	11	3.3	1.3	258
11	Phenamiphos	2400	4	4	14	2	4.0	1.5	288
12	Diazinon	1200	3	3	41	3	3.0	1.8	173
13	Diazinon	2400	3	3	14	3	5.0	2.0	1,347
14	No treatment (control)		3	5	38	1	2.3	2.2	320

[1]Tubers immersed for 30 min in each liquid; [2]Maximum number of portions=6; [3]P - proximal; D=distal

TABLE 2: Depth of dry rot and *Pratylenchus coffeae* populations recovered from 20 g parings of tubers of *Dioscorea rotundata* receiving various treatments and stored at laboratory temperatures for 3 weeks.

Treatment	Mean maximum depth of dry rot (mm)			Nematode population
	P	D	T	
1	3.3 aby	0.5 a	1.9 a	43
2-7	-	-	-	-
8	5.6 bc	1.6 ab	3.6 ab	68
9	7.0 bc	0.6 a	3.8 abc	85
10	1.5 a	2.1 abc	1.8 a	660
11	3.9 abc	1.9 ab	2.9 ab	1,890
12	7.8 c	4.4 bc	6.1 c	-
13	4.4 abc	4.8 c	4.6 bc	3,214
14	7.0 bc	3.3 abc	4.1 bc	2,085

P =proximal; D=distal; T= P + D/2

Column means followed by the same letter are not significantly different (P = 0.05) according to Duncan's Multiple Range Test.

greater in proximal than in distal portions. Nematode populations were reduced in treatments of hot water only and both rates of oxamyl.

Three weeks after treatment and storage of tubers, depth of dry rot was significantly greater in the proximal than in the distal portions (P .05). There were significant differences between treatments (Table 2). However, the relative performance of treatments was not the same in proximal as in distal portions. After 9 weeks storage, there was no significant difference in depth of rot between proximal and distal portions. Treatments differed significantly among distal but not among proximal portions (Table 3). Unlike results obtained after 3 weeks, treatment by portion interaction was not significant.

As in the greenhouse test, tubers treated with both hot water and nematicide disintegrated from soft and wet rots after 9 weeks storage (Table 3). In the remaining treatments, a greater percentage loss occurred in distal than in proximal portions. Treatments of hot water only and diazinon (1200 ppm) suffered higher losses than the control.

Comparison of results for maximum depth of rot 3 and 9 weeks after storage, shows that the relative ranking of the treatments is not exactly the same in both instances, but there is some indication that less rot is obtained with treatments of hot water only and oxamyl at 1200 and 2400 ppm.

TABLE 3: The occurrence of soft rot, depth of dry rot and mean *P. coffeae* populations recovered from 20 g parings of tubers of *D. rotundata* receiving various treatments and stored at laboratory temperatures for 9 weeks.

Treatments	Portions with soft or wet rots (%)		Mean maximum depth of dry rot (mm)			Nematode population		
	P	D	P	D	T	P	D	T
1	7	29	3.8 a	2.5 a	3.1 a	90 a	15 a	120 a
2-7	100	100		-	-	-	-	-
8	0	7	4.8 a	1.8 a	3.3 a	1,450 b	1,060 ab	1,255 bc
9	0	7	2.8 a	2.8 ab	2.8 a	650 b	610	630 b
10	0	0	5.0 a	5.5 ab	5.3 a	7,210 c	10,320 b	8, 765 d
11	0	0	5.5 a	6.5 abc	6.0 ab	18, 240 c	11,900 b	15,070 d
12	29	29	5.5 a	3.0 a	4.3 a	11,500 c	6,240 ab	8,895 cd
13	0	0	3.3 a	7.5 bc	5.4 a	23,900 c	28,290 b	26,095 d
14	7	14	6.8 a	10.8 c	8.8 b	16,160 c	15,800 b	15,980 d

P = proximal; D = distal; T = P + D/2

Column means followed by the same letter are not significantly different (P = 0.05) according to Duncan's Multiple Range Test.

There were no significant differences in *P. coffeae* populations between the proximal and distal portions 9 weeks after treatment. There was no treatment by portion interaction, but there was significant treatment effect. Tubers treated with hot water only had significantly lower nematode populations than the remaining treatments (Table 3).

Treatments with oxamyl at 2400 ppm had a significantly lower mean population than the remaining treatments except oxamyl at 1200 ppm. The relative ranking of treatments was very similar for proximal and distal portions.

The linear correlation coefficient (r), calculated between the values for depth of rot and transformed nematode counts, was 0.392 and was significant at the 1% level inferring that depth of rot increases as nematode population increases.

DISCUSSION

P. coffeae appears to be the major cause of dry rot of *D. rontundata* in Jamaica as is the case in Puerto Rico. (2). Acosta (1) recovered more nematodes from proximal than from distal portions of tubers. However, in the present study, significant differences in depth of dry rot and nematode populations between portions occurred at 3 weeks but not at 9 weeks after treatment.

Treatments in which tubers were immersed in both hot water and nematicide severely damaged the tubers or made them more susceptible to attack by soft and wet rot organisms. Ekundayo and Naqvi (8) have shown that organisms causing these rots may be present in tubers before harvest.

Hot water treatment has been reported to control nematodes in *Dioscorea* spp. (3, 4, 6, 9, 10). Acosta and Ayala (3) found that immersion of *D. rotundata* tubers in hot water at 35, 36, 48, 50, 52, and 54 C effectively controlled nematodes causing dry rot, regardless of the period of exposture, from 15 to 60 min. However, tuber tissue was damaged by immersion in water at 65 C. In Jamaica, Thompson, Been and Perkins (13) obtained reduction in nematode populations by immersing *D. rotundata* tubers in water at 50 C for 30 to 120 min, but distal portions which consisted of younger tissue, were damaged. In the present trial immersion of tubers in water at 51 C for 30 min was the most effective treatment for control of nematodes, but loss of distal portions was 15% above the control. The results obtained in Jamaica suggested that the cultivar of yam used in the tests may be more susceptible to damage by heat than that used by Acosta and Ayala in Puerto Rico. Immersion of tubers at lower temperatures of 35 and 46 C reportedly control nematodes in yam tubers (3). However, Coates-Beckford (unpublished data) did not obtain control of *P. coffeae* when *D. cayenensis* L. tubers were immersed in water at 45 C for 30 min although control occured at 51 C for 15 min. In the present trial, oxamyl at 1200 and 2400 ppm were the most successful treatments for controlling nematodes as well as obtaining viable planting material.

RESUMEN

Tubérculos de ñame Negro, *Dioscorea rotundata* Poir, fueron sumergidos en agua caliente a 51 C por 30 min y/o en los nematicidas oxamyl (Vydate), phenamiphos (Nemacur), y Sarolex (diazinon). Hubo un buen desarrollo de raíces en tubérculos tratados con agua caliente, oxamyl, phenamiphos y en los no tratados. Los tubérculos tratados con agua caliente y nematicida mostraron podredumbre blanda y mojada en almacenamiento o cuando se sembraron. El tratamiento de agua caliente redujo las poblaciones de *Pratylenchus coffeae* significativamente pero afectó adversamente las partes de los tubérculos distantes del centro. Oxamyl a 1200 y 2400 ppm dió los mejores

tratamientos en el control del nematodo en el material de propagación sin afectar su germinación. No hubo diferencias significativas entre tratamientos de phenamiphos, diazinon y el control.

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EFECTOS DE NEMATICIDAS EN LAS POBLACIONES DE NEMATODOS Y EN LA PRODUCCION DEL BANANO [EFFECTS OF NEMATICIDES ON NEMATODE POPULATIONS AND YIELDS OF BANANAS]. A. Figueroa y R. Mora, Sección Nematología, Ministerio de Agricultura y Ganadería y Depto. Investigaciones Cobal. San José, Costa Rica.

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RESUMEN

En un experimento de campo se evaluó el uso manual de los nematicidas aldicarb, sulfocarb y DBCP en el control de los nematodos parásitos y la producción de banano. El análisis mensual e individual de muestras de raíces obtenidas en el área experimental demostró en un período de un año, que los tratamientos nematicidas habían reducido significativamente las poblaciones naturales de *Radopholus* y *Helicotylenchus.* Sobresalieron al respecto el DBCP y el aldicarb en las dosis de 30 y 60 g por unidad de producción. Este último fué el más efectivo en el aumento del número de racimos y la producción, en el incremento del vigor de las plantas y en la reducción del lapso de