# THE EMPLOYMENT OF A NON-FUMIGANT NEMATICIDE FOR CONTROL OF THE ROOT-KNOT AND LESION NEMATODES ON YAMS AND CROP PRESERVATION IN STORAGE [USO DE UN NEMATICIDA NO FUMIGANTE PARA COMBATIR LOS NEMATODOS NODULADORES Y LESIONADORES EN ÑAME Y PARA LA PRESERVACION DE LA COSECHA EN ALMACENAJE]

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*Accepted:*
*14.X.1980*
*Aceptado:*

## ABSTRACT

The nematicidal efficacy of oxamyl as a non-fumigant nematicide in controlling damage caused by the root-knot nematode *(Meloidogyne javanica)* and the lesion nematode *(Pratylenchus brachyurus)* to the white yam *(Dioscorea rotundata)* was investigated under field and storage conditions. Infection of yams by these nematodes in the field affects the survival of tubers in storage and threatens the maintenance of yams as vegetatively propagated clones. Populations of *M. javanica* and *P. brachyurus* in the yam root and tuber rhizoshere increased markedly during the growing season in untreated controls. Oxamyl 10G applied at the rate of 6 kg a.i./ha as row treatment was most effective in the control of *M. javanica,* whereas oxamyl 24L applied at the rate of 6 kg a.i./ha as a foliar spray was most effective in the control of *P. brachyurus* (b= -7.1 and -5.3, respectively). Tuber yields were increased by 49 and 42 percent over untreated controls when granular oxamyl at 3 kg a.i./ha was combined with calcium nitrate or ammonium sulphate at 180 kg N/ha, respectively (P = 0.01).

In 4-month storage after harvest 53 percent of tubers from untreated control plots rotted compared with 39 percent from the best nematicide treatment. The nematicide slightly increased sprouting in storage as compared with untreated tubers and did not reduce emergence of tubers when planted the following growing season. The plants grown from treated tubers were normal.

*Key Words: Meloidogyne javanica, Pratylenchus brachyurus, Dioscorea rotundata, oxamyl, nitrogenous fertilizer.*

## INTRODUCTION

Yams *(Dioscorea* spp.) are an important and preferred food in the tropics. Root-knot and lesion nematodes are important field and post-harvest pests of yam tubers reducing market value and increasing tuber decay complexes (2, 4, 5, 10). Investigators showed that non-fumigant nematicides have been successful in controlling destructive nematodes on other root tuber crops such as potatoes ( 1, 9, 11), carrots (7), sweet potatoes (3) and sugarbeets (8, 12). Similar studies on yams remained, however, unexplored. This paper presents results of an investigation on the use of a non-fumigant nematicide to control the root-knot and lesion nematodes on yams in an attempt to improve yields in the field and to conserve tubers in storage.

## MATERIALS AND METHODS

A field of loamy sand soil (pH 6.2; sand 80%; silt 9.6%; clay 10.4%; organic matter 1.1.%) infested with *Meloidogyne javanica* (Treub, 1885) Chitwood, 1949 and *Praty-*

*lenchus brachyurus* (Godfrey, 1929) Goodey, 1951, was selected for the experiment. Equal size sets of the white guinea yam *(Dioscorea rotundata* Poir) cv "Egbe" were planted as to 20 sets in 20 $m^2$ replicates in a completely randomized design with four replicates per treatment. At planting and subsequently at 4-wk intervals, oxamyl 10G (Vydate®) and oxamyl 24L were individually applied at the rates of 3 and 6 kg a.i./ha as row- and foliar-treatments, respectively. Granular oxamyl was also investigated at 3 kg a.i./ha at planting followed by calcium nitrate or ammonium sulphate at 180 kg N/ha incorporated at three 4-wk intervals, each 60 kg N. In another treatment, sets were steeped in liquid oxamyl at 2 kg a.i./ha for 30 min at planting, and then granular and liquid oxamyl followed at 2 kg a.i./ha each after 4 and 8 wks, respectively (Table 1). The plots were irrigated immediately after each application. The trial was terminated 24 wks after planting and data were obtained with regard to: 1) determination of nematode populations (6, 13) every six wks, 2) tuber yield at harvest, 3) degree of rotting and sprouting of tubers after 16 wks in storage, and 4) sprouting of sets in the field in the following growing season.

## RESULTS

Populations of *M. javanica* juveniles and *P. brachyurus* decreased steadily in treated soils and increased in plots left untreated throughout the growing season. This was expressed in negative regression b values with most chemical treatments, in contrast to positive b's produced by both nematodes in the untreated soils (Fig. 1). The numerical b values show that granular oxamyl was the most effective treatment in controlling *M. javanica,* and the liquid oxamyl was the most effective treatment for controlling *P. brachyurus* (b= -7.07 and -5.33, respectively). Data also show that the incorporation of either of the nitrogenous fertilizers with oxamyl was equally efficient in suppressing *M. javanica* but was less detrimental to *P. brachyurus* populations than the nematicide alone.

Results in Table 1 show that the highest yields were from granular oxamyl with calcium nitrate or ammonium sulphate which significantly increased the tuber yield by 49 and 42 percent over untreated controls, respectively. Plants receiving the preceeding treatments made an abundant and vigorous vegetative growth in the field and were remarkably greener than those in all other plots regardless of treatment. Liquid oxamyl at 3 kg a.i./ha significantly improved yields by 27 percent ($P = 0.05$) over controls. Yields from plots treated with 6 kg a.i./ha of liquid oxamyl, or the combined liquid and granular formulations of oxamyl were not significant. The plants given the preceeding combination exhibited severe yellowing and leaf drop and recovered slowly.

Data on the keeping quality of harvest yams in storage after four months are given in Table 1. Rot incidence decreased after treatments with the 6 kg rate of liquid and granular oxamyl as well as the nematicide combined with ammonium sulphate. Tubers treated with granular and liquid formulations combined suffered the highest degree of rotting. Tuber sprouting after most treatments was slightly higher than in untreated controls. Liquid oxamyl at 6 kg a.i./ha had, however, significantly depressed sprouting in storage, while granular oxamyl at 3 kg a.i./ha increased sprouting at $P = 0.01$). Field data show that chemical treatment did not affect sprouting of yams in the following growing season as compared with untreated controls (Table 1).

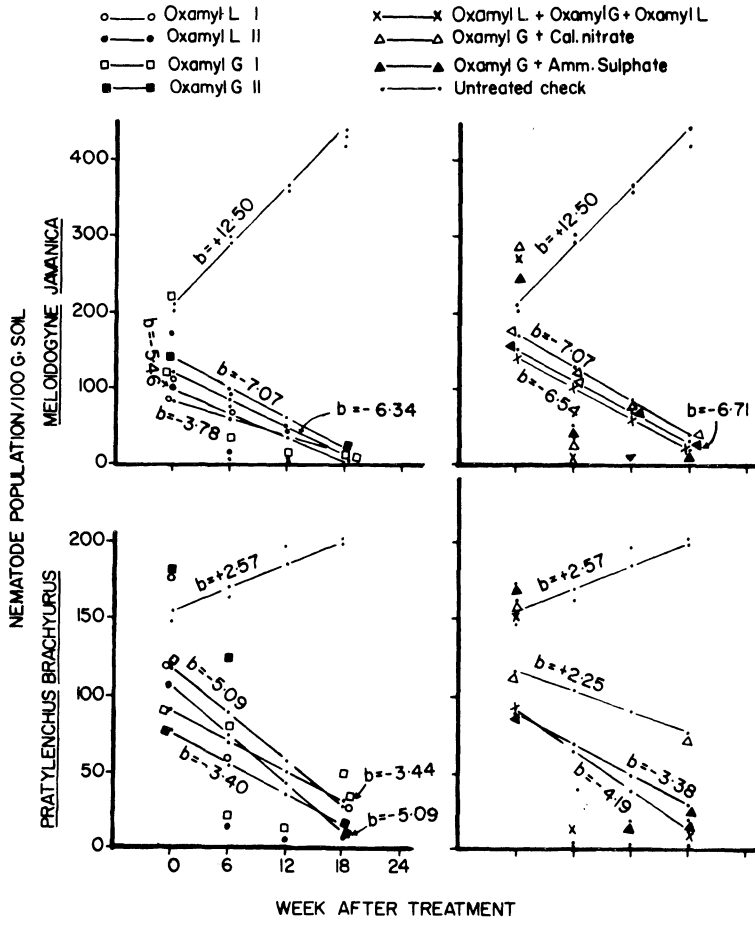


Fig. 1. Effects of oxamyl alone and in combination with nitrogenous fertilizers on population densities of *Meloidogyne javanica* and *Pratylenchus brachyurus* infesting yams in the field. I and II = 3 and 6 kg a.i./ha.

## DISCUSSION

Results show that treatment with oxamyl alone as a non-fumigant nematicide, and in combination with a nitrogenous fertilizer, can significantly increase yam tuber yields. Findings demonstrated that the usefulness of nematicidal treatments comprise: 1) significant suppression of nematode populations in the field during the growing season, 2) significant increases in tuber yield at harvest, and 3) reduction in tuber decay in storage without any adverse effects on emergence of treated tubers in the succeeding growing season.

Table 1. Effects of oxamyl alone and in combination with nitrogenous fertilizers on tuber yield, quality and sprouting of yams.

| Treatment & rate per ha (a.i.) | Application method & No. of intervals every 4 wks | Tuber yield | Tuber rotting in storage | Tuber sprouting in storage | Tuber sprouting in the field |
|---|---|---|---|---|---|
| | | Ton/ha | % | % | % |
| Single treatments: | | | | | |
| Oxamyl L 3 kg | Foliar (Three intervals) | 28.8* | 44.5 | 31.9 | 74.1 |
| Oxamyl L 6 kg | Foliar (Three intervals) | 26.6 | 40.9* | 17.9** | 76.2 |
| Oxamyl G 3 kg | Row (Three intervals) | 24.0 | 45.1 | 37.9** | 83.9 |
| Oxamyl G 6 kg | Row (Three intervals) | 25.7 | 38.0** | 28.9 | 78.6 |
| Combined treatments: | | | | | |
| Oxamyl L 2 kg + Oxamyl G 2 kg + Oxamyl L 2 kg | Set steeping (At planting) Row (One interval) Foliar (One interval) | 19.9 | 54.4 | 32.2 | 74.6 |
| Oxamyl G 3 kg + Calcium nitrate (180 kg N) | Row (At planting) Row (Three Intervals) | 33.6** | 51.3 | 22.9 | 75.9 |
| Oxamyl G 3 kg + Ammonium sulphate (180 kg N) | Row (At planting) Row (Three Intervals) | 32.0** | 41.6* | 34.3 | 78.6 |
| Untreated control | - - - - - | 22.6 | 53.5 | 27.6 | 76.8 |
| LSD 0.05 | | 5.3 | 10.6 | 6.9 | 11.2 |
| LSD 0.01 | | 7.2 | 14.5 | 9.5 | 15.2 |

Improvements in the keeping quality of treated tubers are of special interest with regard to yams. Nematode infection in the field persists in yam tubers during storage causing serious cell destruction which predisposes the tuber to the dry-and wet-rot diseases of yams (2, 5). With such improvement in quality and yield increase after nematicidal treatments, the improved productivity, marketability and palatability of yams can help meet the increasing demands of growers and consumers in the tropics.

## RESUMEN

Se efectuó una investigación para determinar la eficacia del nematicida no fumigante oxamil en el combate del daño causado por el nematodo nodulador *(Meloidogyne javanica)* y el nematodo lesionador *(Pratylenchus brachyurus)* en el ñame blanco *(Dioscorea rotundata)* bajo condiciones de campo y de almacenamiento. La infección de los ñames por estos nematodos en el campo afecta la supervivencia de los tubérculos durante el almacenamiento y representa una amenaza para el mantenimiento de clones para propagación vegetativa. Poblaciones de *M. javanica* y *P. brachyurus* en las raíces y en la rizoesfera de los tubérculos aumentaron notablemente a través de la estación de crecimiento en los testigos no tratados. Oxamil 10G aplicado a razón de 6 kg i.a./ha en el surco fue más efectivo para el combate de *M. javanica,* mientras que oxamil 24L en la misma dosis pero aplicado por aspersión foliar fue más efectivo en el combate de *P. brachyurus* (b (= -7.1 y -5.3, respectivamente). Los rendimientos de tubérculos aumentaron en 49 y 42 por ciento en relación a los testigos cuando oxamil granular en dosis de 3 kg i.a./ha se combinó con nitrato de calcio o con sulfato de amonio a razón de 180 kg N/ha, respectivamente (P=0.01). Despues de cuatro meses de almacenamiento a partir de la cosecha, 53 por ciento de los tubérculos de las parcelas testigos mostraron pudrición mientras que hubo pudrición en 39 por ciento de los tubérculos provenientes de las parcelas con el mejor tratamiento nematicida. El nematicida causó un ligero aumento de brotes durante el almacenamiento en comparación con los ñames testigos pero no redujo el grado de emergencia en los tubérculos cuando se sembraron en las estación subsecuente. Las plantas derivadas de tubérculos tratados fueron normales.


*Claves: Meloidogyne javanica, Pratylenchus brachyurus, Dioscorea rotundata, oxamil, fertilizantes nitrogenados.*

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