

COMPARISON OF METHODS OF APPLICATION OF OXAMYL FOR CONTROL OF *HETERODERA SACCHARION* SUGARCANE PLANTS

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ABSTRACT

Garabedian, S., and N. Hague. 1982. Comparison of methods of application of oxamyl for control *Heterodera sacchari* on sugarcane plants. *Nematropica* 12: 39-44.

Foliar applications of oxamyl prevented *Heterodera sacchari* Luc and Merny juveniles from invading roots of 10-day-old sugarcane seedlings. Two and three sprays of 1000 and 2000 $\mu\text{g}/\text{ml}$ applied at 5 day intervals were more effective than 1, 2, or 3 sprays of 500 $\mu\text{g}/\text{ml}$ of oxamyl, sprays of 2000 $\mu\text{g}/\text{ml}$ were phytotoxic. Dipping of sets and soil sprays at 500 and 1000 $\mu\text{g}/\text{ml}$ were effective in reducing nematode invasion.

Additional key words: sugarcane cyst nematode, Saccharum officinarum.

RESUMEN

Garabedian, S. y N. Hague. 1982. Comparación de métodos de aplicación de oxamil para combatir *Heterodera sacchari* en caña de azúcar. *Nematropica* 12: 39-44.

Aplicaciones foliares de oxamil impidieron la penetración de raíces de caña de azúcar (*Saccharum officinarum* L.) por formas juveniles de *Heterodera sacchari* Luc & Merny. Dos y tres asperjaciones de 1000 y 2000 $\mu\text{g}/\text{ml}$ aplicadas cada cinco días fueron más eficaces que una, dos o tres asperjaciones de 500 $\mu\text{g}/\text{ml}$ de oxamil; las asperjaciones con 2000 $\mu\text{g}/\text{ml}$ fueron fitotóxicas. La inmersión de plántulas en soluciones de oxamil con 500 y 1000 $\mu\text{g}/\text{ml}$ o la asperjacion de esas soluciones al suelo resultaron en una disminución en la penetración del nematodo en las raíces.

Palabras claves adicionales: nematodo enquistador de la caña, métodos de combate, Vydate, nematodos enquistadores.

INTRODUCTION

The control of plant parasitic nematodes following foliar application of oxamyl has been reported (10). Multiple applications have been shown to be more effective than a single application of a more concentrated solution (5). Granule applications have been used with satisfactory results on sugarcane

(*Saccharum officinarum* L.) (3, 6), but results with foliar sprays have been inconclusive (1), probably because most foliar sprays of oxamyl were used on established sugarcane plants.

The following study was designed to determine the effectiveness of one to three foliar applications of oxamyl in preventing *Heterodera sacchari* Luc and Merny juveniles from invading sugarcane seedlings, and to compare dipping of sets and the use of soil sprays for the control of sugarcane cyst nematode.

MATERIALS AND METHODS

This study consisted of two experiments. In the first experiment, seed pieces from the sugarcane cv "B4119" were obtained from 9-12 month-old plants and were planted in a tray. After sprouting plants were selected for uniformity and transplanted into 10-cm diameter pots containing 100 gm of sterilized sandy loam soil. Ten-day-old plants between 16-20 cm in length were inoculated with 10 cysts of *H. sacchari* with an average of 184 eggs/cyst. Following inoculation, plants were sprayed 1, 2, or 3 times with 500, 1000, or 2000 μg (a.i.)/ml of oxamyl plus Agral 90 wetting agent (0.025% v/v), at 5 day intervals. Using a low pressure hand sprayer, oxamyl was sprayed on the upper and lower leaf surfaces until run-off. To prevent any of the chemical from reaching the soil or root tissues, plants were inverted at time of treatment and were dried before they were turned upright. Four pots containing 10 day-old plants and 10 cysts remained as controls and were sprayed with water and wetting agent. The plants were kept in a greenhouse at $24 \pm 2^\circ\text{C}$. Nine days after the final oxamyl application, plants (roots and tops) were removed from the pots and washed and 250 gm of soil was assayed for nematodes by a modification of Flegg's (4) sieving and sedimentation method. The roots were stained with 0.1% hot acid fuschin, cleared in lactophenol, then macerated in a blender to release the females.

In the second experiment, two methods of application were used to compare their efficacy in controlling *H. sacchari*.

Dipping of sets: Sugarcane sets of known weight were placed in a beaker containing aqueous solutions of oxamyl at 500 and 1000 μg (a.i.)/ml with Agral 90 wetting agent (0.025% v/v). Untreated sets were also placed in a beaker containing water and wetting agent. The sets were removed from the solution after 24 hrs and the amount of chemical solution absorbed was calculated by weighing seed pieces after dipping, (approximately 2-2.4 mg of oxamyl was recorded). The sets were planted in 9.5 cm diameter pots containing sterilized soil at field capacity. Six cysts containing an average of 170 eggs/cyst (1.5 eggs/gm soil) were placed in holes 2 cm deep in the soil around the set. A soil temperature of $23 \pm 2^\circ\text{C}$ was maintained throughout the experiment.

Soil sprays: Sugarcane sets were planted in 9.5 cm diameter pots. Liquid formulations of 500 and 1000 μg (a.i.)/ml of oxamyl were sprayed on the surface of the soil. Untreated sets were sprayed with water. The amount of

solution applied was determined by weighing a piece of glass (of known area) before and after the chemical had been sprayed (approximately 2-2.4 mg. of oxamyl was recorded). The inoculation method was the same as for the dipping treatment.

The pots were covered with polythene bags to prevent the soil from drying out. This eliminated the need for watering for five days. The bags were then removed and the soil watered twice daily. Eight days after treatment, the plants were removed. Their roots were washed and stained in hot acid fuschin, cleared in lactophenol for 48 hrs, then macerated and the number of juveniles that had penetrated were counted.

RESULTS

None of the three concentrations, when applied as a single spray resulted in a significant reduction in the number of females in the roots (Table 1). Two sprays of oxamyl at 1000 and 2000 $\mu\text{g}/\text{ml}$ produced significant reductions in the number of females compared to untreated controls, while with three sprays, a significant reduction in the number of females occurred at all three concentrations.

Two or three sprays of 1000 $\mu\text{g}/\text{ml}$ of oxamyl resulted in significant increases in the total plant weight compared to that from the untreated control. Plants treated three times with 2000 $\mu\text{g}/\text{ml}$ yielded significantly less than those treated two or three times with 1000 $\mu\text{g}/\text{ml}$. This indicates that phytotoxic dosage rates had been reached.

Soil sprays of 500 and 1000 $\mu\text{g}/\text{ml}$ resulted in 53.0% and 72.5% reduction in invasion by juveniles, respectively (Table 2). Dipping of sets proved to be more effective, with the number of juveniles entering the roots being reduced by 59.2% and 86.9% with dips of 500 and 1000 $\mu\text{g}/\text{ml}$ respectively.

DISCUSSION

The persistence of non-volatile nematicides in actively growing sugarcane plants will depend upon the continuous availability of nematicides to the root system. Satisfactory control is required for at least 6 weeks after germination to enable the plant to grow rapidly and produce roots to overcome nematode problems (2).

Multiple applications of oxamyl resulted in reduced numbers of females in roots of sugarcane seedlings. Periodic applications of oxamyl may result in higher concentrations of the chemical in roots. Thus there may still be enough unmetabolized oxamyl in root tip area to affect the entry of juveniles, even when most of the oxamyl has degraded in the plant to less toxic metabolites. It was reported that oxamyl applied to the leaves of small cucumber (*Cucumis sativus* L.) was effective against *Meloidogyne incognita* (Kofoid & White) Chitwood in the soil and, that oxamyl was exuded from the roots unmetabolized (10).

Before the first multiple application experiment was conducted, our preli-

TABLE 1. Plant weight and the number of females of *Heterodera sacchari* in the roots of sugarcane plants following treatment with oxamyl.^y

No. of Treatments	$\mu\text{g/ml}$	Total Plant Weight ^x (gm)	Females per root system ^y
one spray	500	26.5	507
	1000	30.2	478
	2000	32.1	392
two sprays	500	29.6	404
	1000	33.8*	313*
	2000	32.0	240**
three sprays	500	31.2	350*
	1000	34.8**	295**
	2000	27.9	255**
Control	0	30.1	524

^x = Averages of 4 replications

^y = Data were collected 24 days after plants were inoculated with *H. sacchari* larvae. Sprays were applied at 5 day intervals.

*,** = Significantly different from untreated at $P < 0.05$ and 0.01 respectively.

minary observations indicated that foliar applications of oxamyl to seedlings one month or older, resulted in poor control of *H. sacchari*. This suggests that oxamyl may be metabolized faster in older plants and may provide an explanation as to the many contradictory results obtained with foliar sprays of oxamyl. It appears that maintaining an adequate concentration of the chemical in the plants is an important factor.

Two spray applications of oxamyl gave similar reductions as three sprays. This could be due to the short period between sprays. However, because *H. sacchari* is able to hatch in a few hours at high temperatures (8), it was necessary to compress treatments to contain the experiment within one life cycle of the nematode.

Oxamyl dips are effective in preventing invasion by juveniles of *H. sacchari*. Preliminary observations had shown that oxamyl was phytotoxic at concentrations above 2000 $\mu\text{g/ml}$ and that dipping sets bearing well-developed buds were more effective in preventing juveniles from entering the roots. This indicates that well-developed buds take up more oxamyl and suggests that oxamyl uptake is mainly through actively growing meristems

TABLE 2. Number of *Heterodera sacchari* juveniles recovered from roots of sugarcane plants treated by different application methods.

Treatment method	Rate $\mu\text{g/ml}$	No. juveniles per root system ^x	% reduction in invasion
Dipping of sets	500	258**	59.2
	1000	83***	86.9
Soil sprays	500	298*	53.0
	1000	174***	72.5
Control	0	632	---

^x = average of 4 replications

,*, and * = significantly less than untreated at $P < 0.05$, 0.01 and 0.001 respectively.

rather than the actual seed piece.

Based on these tests, we believe that multiple applications of oxamyl, dipping of sets and/or soil sprays can provide protection to young sugarcane plants. The first few days after sprouting is a critical period for the plants to survive high nematode infestations.

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