PRELIMINARY STUDIES ON CONTROL OF ROOT-KNOT NEMATODE ON KIWIFRUIT WITH FENAMIPHOS

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Summary

In a field study on the control of root-knot nematode (*Meloidogyne hapla*) infecting kiwifruit (*Actinidia chinensis*), fenamiphos 40% at 15 kg/ha and 60 kg/ha per application, was applied to the soil at three monthly intervals. Nematode numbers were significantly ($P < .1$) smaller, after treatment at 60 kg/ha than at 15 kg/ha, in roots, soil and a bioassay rating. Highest nematode populations were found in untreated plots. There was no significant improvement in yield due to treatment in the first two seasons.

INTRODUCTION

In 1977 there were 1544 ha of kiwifruit planted in New Zealand, compared with 134 ha in 1967. Production over this period increased from 1820 to 8064 tonnes. The value of the crop is now \$10-12 million. With this increasing interest in kiwifruit growing in New Zealand, any pest or disease which is likely to cause a decline in yield is of great concern to growers. Fortunately, in New Zealand, there are few serious pests or diseases on kiwifruit. One of the most commonly observed pest is the root-knot nematode which is present in all growing regions.

It is not known if root-knot nematode invasion reduces yield. Very little study has been given to chemical control of root-knot nematode on kiwifruit in New Zealand. Dale and van der Mespel (1972), successfully treated infected planting material with ethoprophos and thionazin, as bare root dips, but since then new chemicals have become available. In a field trial, Griffin and Dixon (1975) and Paulin (pers comm) obtained inconclusive results with nematicidal chemicals applied to the soil around vines but their work was sufficiently encouraging to suggest that further study should be carried out. In this paper we present preliminary data after 18 months study of root-knot nematode control in the field.

METHODS

A plot of 24 kiwifruit vines cv "Haywood", was selected in a 10 year old commercial orchard at Kumeu, Auckland. The site is on a yellow brown loam soil (13% sand, 35% silt, 52% clay and a total carbon content of 6.34%).

The site was divided into four blocks of three treatments. Treatment plots were 12.5 x 3 m, and contained 2 vines 6.1 m apart. A pre-trial sampling showed that there was a high and evenly distributed root-knot nematode population within blocks, as determined by direct sampling of soil and roots, and indirectly, by tomato bioassay. The trial was commenced in November 1976. Two paraquat-diquat herbicide sprays with a spreader, were applied at one or two weeks before each treatment. The resulting dead vegetation was raked off the plots before the nematicide was applied to the undisturbed soil surface. Fenamiphos 40% EC at 15 kg/ha and 60 kg/ha was applied with a pressure sprayer in 6 litres of water

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TABLE 1: Relative abundance of root-knot nematodes in kiwifruit roots and soil, and bioassay rating, after treatment with fenamiphos

<i>Numbers in roots</i>		Mean loge number of nematodes/g root									
Rates		1976					1977				
kg/ha		2 Nov *	2 Feb *	28 Feb	2 May *	23 Aug *	19 Sept	14 Nov	15 Dec	31 Jan	1978
0	4.46 a	6.47 a	5.81 a	4.93 a	5.32 a	5.10 a	4.89 a	4.49 a	5.29 a	6.69 a	
15	4.81 a	5.65 ab	5.62 a	2.30 a	3.51 b	2.31 b	4.01 a	3.43 a	3.57 a	3.78 b	
60	3.88 a	4.69 b	5.41 a	3.35 b	3.17 b	1.84 b	2.21 b	1.24 b	1.85 b	1.87 c	
<i>Numbers in soil</i>		Mean loge number of nematodes/100 ml soil									
0	5.01 a	5.77 a	5.65 a	5.97 a	5.77 a	5.47 a	5.59 a	4.79 a	4.69 a	5.08 a	
15	5.06 a	5.00 ab	4.76 ab	4.91 b	4.95 ab	4.52 ab	4.90 ab	3.90 a	2.93 b	4.02 b	
60	4.95 a	4.25 b	4.57 b	4.55 b	4.19 b	3.60 b	3.89 b	2.44 b	1.53 c	2.78 a	
<i>Bioassay rating</i>		Average gall rating on indicator plant (tomato)									
0	3.6 a	3.6 a	3.2 a	2.8 a	2.1 a	2.4 a	3.0 a	2.3 a	2.5 a	3.0 a	
15	3.7 a	3.7 a	1.6 b	1.2 b	1.2 b	1.4 b	1.1 b	1.6 b	1.2 b	1.2 b	
60	3.6 a	2.1 b	1 c	1 b	1 b	1.1 b	1.1 b	1 c	1.1 b	1.3 b	

Scale: 1 = 0 galls, 2 = 1-10 galls, 3 = 11-100 galls, 4 > 100 galls.

* treatments applied

Duncan's letters in this table refer to 10% level of significance

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per plot, at three-monthly intervals. Prior to, and 21 days after treatment, soil and root samples were taken. Four soil cores, 25 x 200mm, were taken from the rooting zone of each vine and bulked. This was duplicated for each vine. This sampling technique was based on Ferris and McKenry (1974). Roots were carefully separated from the soil, washed, blotted dry, weighed and set up in an intermittent mist chamber to extract hatching larvae. Larvae from 100ml of soil were extracted by a centrifugation-flotation technique. A bioassay to determine viable larvae in the soil was carried out by growing a root-knot susceptible variety of tomato seedling in 150ml of the soil sampled. The root galling on the tomato was assessed after 10 weeks on a 1-4 scale (Table 1).

RESULTS

Nematodes

Numbers in roots:

Plots treated with fenamiphos had significantly ($P < .1$) less nematodes than untreated plots at most sampling times (Table 1). As the trial progressed nematode numbers in the 60 kg/ha treatment became significantly less than in the 15 kg/ha treatment. The nematode population showed a marked seasonal variation, with a peak in summer.

Numbers in soil:

Plots treated with 60 kg/ha fenamiphos generally had significantly less nematodes ($P < .1$) than untreated plots (Table 1). The nematode populations in plots treated at 15 kg/ha were similar to that in untreated plots but were significantly higher than in plots treated at 60 kg/ha from November 1977 onwards.

Bioassay rating:

Bioassay results supported data on nematode numbers in roots and in soil. Both treatment rates gave significantly ($P < .1$) lower nematode populations than in the control after only two applications of fenamiphos. This difference continued throughout the trial period. The effect of the 60 kg/ha rate was only significantly better than the 15 kg/ha on three dates (Table 1).

Yield

Both the number and total weight of fruit harvested were significantly greater in 1978 than in 1977 (Table 2). In 1977 treated plants produced less fruit ($P < .1$) than untreated plants. Yields from individual vines were highly variable. In 1978 neither the number nor weight of fruit harvested were influenced by the treatments.

TABLE 2: Yield of kiwifruit after treatment with fenamiphos

Mean weight and number of fruit per vine				
Rate kg/ha	1977		1978	
	Wgt. kg	No.	Wgt. kg	No.
0	15.0 a	139 a	53.1 a	640 ab
15	12.2 a	100 b	61.3 a	721 a
60	5.8 a	47 b	55.7 a	551 b

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DISCUSSIONS AND CONCLUSIONS

Both 15 kg/ha and 60 kg/ha rates of fenamiphos applied four times per year gave marked control of root-knot nematode numbers. This control became significant following the second application (February 1977). There was no significant improvement in yield between treatments in either 1977 or 1978 but it is possible that beneficial effects of nematode control on yield improvement may take several seasons to become apparent. The five-fold increase in yield from 1977 to 1978 may be due to the greatly improved orchard husbandry.

In the Gisborne district some infected plants have shown severe wilting under summer moisture stress (Pollock pers comm). This has also been observed in Australia at Merbein (Sauer pers comm) where severe moisture stress can occur. It is possible that root-knot nematode may not cause serious plant debilitation or yield decline in New Zealand except when the plants are under some environmental stress. Nematode control could increase the ability of a plant to withstand such stress.

Excessively high rates of chemical were applied to determine if fenamiphos, when applied to the soil surface, could prevent infection or kill nematodes within the roots. This objective has been achieved.

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