ROOT KNOT AND STEM NEMATODES OF LUCERNE

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The two most important nematode parasites of lucerne (*Medicago sativa*) are root knot nematode (*Meloidogyne hapla*) and stem nematode (*Ditylenchus dipsaci*). Both nematodes may be contributing factors to poor establishment, general decline, and poor growth of lucerne. Chemical control trials against both nematodes with a variety of nematicides are described. Fenamiphos and oxamyl gave the best control. Results did not substantiate the reported effectiveness of isazophos (CGA12223) in controlling stem nematode. In a selection trial of 12 lucerne varieties, 'Nevada Synthetic XX' showed the greatest resistance to root knot nematode.

INTRODUCTION

The detrimental influence various pathogens may have on lucerne (*Medicago sativa*) is becoming more widely appreciated as the area of lucerne is increased. These pathogens tend to be of more significance in the sand and pumice areas. The two main nematode parasites of lucerne in New Zealand are the root knot nematode (*Meloidogyne hapla*) which affects the roots, and the stem nematode (*Ditylenchus dipsaci*) which attacks the foliage.

ROOT KNOT NEMATODE

The root knot nematode is probably distributed throughout New Zealand, being found from Whangarei to Canterbury. It is not known if its presence causes serious crop yield loss, but it is suspected of being detrimental to plant establishment, growth and tolerance to drought in the central pumice plateau and the coastal sandy soils of Himatangi and North Auckland.

If a seedling is attacked by root knot nematodes, the root system tends to branch excessively. This results from the damage caused by larval penetration of the root tip region causing suppression of cell division in the apical meristem and the consequent cessation of growth. This suppression of growth of the radicle stimulates the formation of secondary roots in the region of infestation. Thus damaged roots tend to be near the soil surface and are more subject to drought stress than plants with a well developed normal tap root.

1974 Trial

Granular formations of fenamiphos, oxamyl, carbofuran, and ethoprophos at 9 kg/ha, and chlorobromopropane at 35 kg/ha were broadcast and rotovated in immediately before seeding at the MAF, Research Area, Bulls, in October 1974. Plots were 8 × 2.3 m, randomised in 4 blocks. Ten roots from each treatment were set up in a mist chamber to extract the parasitic root knot nematodes. Nematode counts from the roots 3 months after treatment showed no significant difference between treatments (Table 1). The major tap root systems were better developed in the fenamiphos, oxamyl and carbofuran treatments.

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Yield data from five cuts throughout the year showed no significant difference ($P < .05$) between fenamiphos, oxamyl or carbofuran, but all three were significantly ($P < .05$) better than ethoprophos, chlorobromopropane, and control.

TABLE 1: EFFECTS OF NEMATOCIDES ON ROOT KNOT NEMATODE AND YIELD OF LUCERNE

1974 Treatment	Rate kg/ha	No. nematodes/g root	Yield kg DM/ha
oxamyl 10G	9	1946 a	2232 a
fenamiphos 10G	9	1795 a	2294 a
carbofuran 10G	9	1033 a	2333 a
ethoprophos 20G	9	3135 a	1826 b
chlorobromopropane 20G	35	2594 a	1806 b
control		6299 b	1854 b

1975 Trial

Two trials were set down at the MAF Research Area, Bulls, in October 1975. The granular formulations were applied with seeding.

- (a) Fenamiphos, oxamyl and carbofuran at 1.5, 4.5, 9 kg/ha, and
- (b) isazophos at 1.5, 4.5, and 9 kg/ha, oxamyl at 1.5 and 9 kg/ha, and chlorobromopropane at 60 kg/ha.

Each trial was a replicated incomplete randomised block layout with plots of 8×1.5 m. After 3 months, an analysis of variance of the number of nematodes in the roots, showed no significant difference ($P < .05$) between treatments and untreated. Infestations were variable, averaging 862 and 2697 nematodes/g root in the untreated plots for trials (a) and (b) respectively.

By visual assessment, the root systems were better developed at 9 kg/ha rates than the lower rates, with fenamiphos, oxamyl, and carbofuran being the best treatments.

Yield cuts have yet to be taken.

Breeding for lucerne resistant to root knot nematode

In co-operation with Crop Research Division, DSIR, a long-term policy to breed a tolerant or resistant line of lucerne has been commenced. Ten randomised blocks, each of 10 plants, of 12 varieties were screened at Wairakei Research Station in 1976. A subjective assessment of the degree of galling of the test varieties was made after 12 weeks. Each plant was rated on a scale of 1 to 4: 1 = no galls, 2 = 1 to 10 galls, 3 = 11 to 100 galls, and 4 = > 100 galls. All plants having a 1 rating were placed in a mist chamber for 7 days for nematode extraction to confirm the rating.

The percentage of resistant plants (1 rating) for each variety was: 'Nevada Synthetic XX', 59.7%; 'Florida 66', 10.5%; 'Wairau', 5.3%; 'Hunter River', 4.7%; 'Chanticleer', 1.0%; 'Apalachee', 'Arch', 'Gladiator', 'Mesilla', 'Saranac', 'Vernal', and 'Washoe', all 0%. 'Nevada Synthetic XX' was the only variety to show a reasonable degree of resistance. As 2 of the 10 replicates of 'Nevada Synthetic XX' had a rating of 4, this trial is being repeated.

STEM NEMATODE

Morrison (1957) first recorded this nematode on lucerne in New Zealand. The author has found the nematode throughout the South Island and at 4 sites in the North Island (Mahia Peninsula [courtesy of MAF], Havelock North, Palmerston North, and Bulls). The symptomology and economic implications have been well discussed (Wood 1972; Grandison 1974).

A trial was carried out at Flock House, MAF, Bulls, on a well-established stem nematode infected lucerne paddock, using granular formulations of isazophos, oxamyl, fenamiphos at 8 kg/ha and a herbicide TCA at 35 kg/ha. The lucerne plots of 10 m² were grazed to 3-10 cm prior to treatment. Granules were applied by shaker bottle and the herbicide applied by spraying with sufficient water to give a good coverage of foliage. Treatments were randomised within each of four blocks. Three samples of 10 whole plants were harvested from each plot 21 days after treatment. Each sample was chopped into approximately 0.5 cm pieces and set up in a mist chamber for 7 days to extract the nematodes.

Observations showed no foliar chlorosis with fenamiphos or control, slight chlorosis with isazophos, slightly more chlorosis with oxamyl while plants were severely burnt and stunted with TCA.

The herbicide was used because Grasslands Division, DSIR (pers comm) had found that the stem nematode population was virtually eliminated after using TCA at 35 kg/ha for couch grass control in a clover/stem nematode area.

An analysis of variance was carried out on a square root transformation of the data. Oxamyl was the most effective treatment, giving an 88% decrease in stem nematode numbers in the foliage, whereas isazophos gave only a 42% decrease. This does not agree with Rae's (1975) results of a 99% decrease with isazophos. There was no significant control of the soil population of the stem nematode. With the exception of the TCA yield which was lower, there was no significant difference between treatments and control for two harvests taken at 9 and 19 weeks after treatment (Table 2).

TABLE 2: NEMATODE COUNTS

Treatment	Rate kg/ha	(21 days after treatment — mean of 12 replications)		Yield kg DM/ha
		No. nematodes/ 10 plants	No. nematodes/ 100 g soil	
oxamyl 10G	8	321 a	30	3809 a
fenamiphos 10G	8	1182 ab	48	3707 a
isazophos 10G	8	1504 b	50	3698 a
TCA	35	1816 b	39	1664 b
control		2600 b	55	3620 a

CONCLUSIONS

Oxamyl, fenamiphos, and carbofuran broadcast at 9 kg/ha to a stand of lucerne infected with root knot nematode significantly ($P < .05$) increased yield over ethoprophos, chlorobromopropane, and control. The lucerne variety 'Nevada Synthetic XX' showed resistance to root knot nematode in a selection trial of 12 varieties.

Oxamyl and fenamiphos broadcast at 8 kg/ha to a stand of lucerne infected with stem nematode each reduced the population of nematodes within the plant. No foliar chlorosis was caused by fenamiphos, while the plants grew out of the slight chlorosis caused by oxamyl. There was no effect upon yield of lucerne, except that TCA at 35 kg/ha reduced yield by causing severe chlorosis.

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