POST-PLANT CONTROL OF NEMATODES IN BAREROOT NURSERIES ---F.D. McElroy

ABSTRACT: The effect of fenamiphos (Nemacur) on Pratylenchus penetrans under Douglas-fir seedlings was evaluated in a Washington State transplant nursery. Optimum nematode control was obtained using 6 lb ai/a. Nematodes in the roots were reduced by almost 88 percent, and in the soil by 90 percent fifteen weeks after treatment. Nemacur at 3 and 6 lb ai/a increased seedling height by 15 and 23 percent respectively, and root weight by 38 and 43 percent respectively over untreated seedlings. These treatments had little effect on mycorrhizae development.

INTRODUCTION

The root-lesion nematode, Pratylenchus penetrans, can cause considerable damage to young conifer seedlings in forest nurseries (Ruehle 1975). Direct damage caused by feeding of the nematode results in a decreased and rotted root system, with a significant lack of fine feeder roots. Frequently, heavily infected roots have a witches-broom symptom resulting from proliferation of short roots. Indirectly, the nematode appears to affect the development of mycorrhizae on the roots (unpublished data). All of this root damage results in above ground growth that is stunted and chlorotic.

There are several preplant nematicides which effectively control this nematode, but to date, no postplant treatments have been available to the nurseryman. This is a report on the use of fenamiphos (Nemacur) applied after the planting of Douglas-fir seedlings to control Pratylenchus penetrans.

MATERIALS AND METHODS

Tests were carried out at a transplant nursery near Bow, Washington. This is a relatively young nursery, which had previously been cropped to grain for a number of years. As a result, a rather large population of Pratylenchus penetrans built up to the point where conifer seedling growth was affected.

Paper presented at combined meeting of the Western Forest Nursery Council and Intermountain Nurseryman's Association, Coeur d'Alene, ID, August 14-16, 1984.

F.D. McElroy, Consultant and owner of Peninsu-Lab, Kingston, Washington.

Plot establishment.--Two-year-old Douglasfir seedlings obtained from another bareroot nursery were planted into the test site on 11 April 1983 using standard transplanting procedures. Application of Nemacur was delayed until mid-June to allow for completion of transplanting operations and for development of root activity.

On 14 June 1983 Nemacur 3 was applied at 0, 3, 6, and 12 lb ai/a. Nalco-trol at 6-ounces per 150-gallons of water was mixed with each treatment as an adjuvant. Within 24 hours after application of the Nemacur, one inch of water was applied through a fixed line overhead irrigation system to move the chemical into the root zone. Each treatment consisted of three 4-foot beds containing six rows of seedlings 1,000-feet long, with the exception of the 12-pound rate, which was only 25-feet long. The latter rate was for determination of phytotoxicity only.

Six plots 4 X 30 feet were established for each treatment. Two soil textures were present in the 1,000-foot of bed, a fine sandy loam on the west half, and a loam on the east half. Three of the six plots per treatment were established on each soil texture.

Nematode evaluation.--Nematode samples were collected postplant, pretreatment on 16 May, and 15 weeks after treatment on 28 September. Twenty 1 X 8-inch soil cores were taken from the center four rows of each plot at each sampling time. On 28 September five seedlings were dug at random from the center four rows of each plot for growth analysis and nematode extraction from the roots. All samples were transported to the lab in poly bags in a cooler. Nematodes were extracted from the soil using the centrifugal-flotation technique and from the roots by misting for 72 hours.

Growth evaluation.--The height (soil line to terminal bud) of ten seedlings within each plot was measured in the nursery. Caliper, weight of mycorrhizal and non-mycorrhizal roots, and total root weight was determined for the five dug seedlings per plot.

RESULTS AND DISCUSSION

Effect of Nemacur on nematode numbers.-The effect of Nemacur on P. penetrans under Douglas fir seedlings is shown in tables

Table 1.-- The effect of fenamiphos on numbers of Pratylenchus penetrans in soil under Douglas-fir

Rate	Pratylenchus/pint of soil Pretreat	Posttreat	% Decrease
0 gpa	1316.7	1083.3	17.7
1	2491.2	666.7	73.3
2	2320.8	225.0	90.3
4	1275.0	100.0	92.0

Table 2.-- The effect of fenamiphos on numbers of Pratylenchus penetrans in the roots of Douglas-fir

Rate	Pratylenchus/gram of root +Mycor	-Mycor	Total	% of CK
0 gpa	349.1	421.2	235.8	-
1	162.0	150.5	126.2	46.4
2	26.0	37.6	28.8	87.8
4	0.9	4.3	2.6	98.8

+Mycor = mycorrhizal roots; -Mycor = non-mycorrhizal roots.

1 and 2. Optimum control was obtained with the 6 lb ai/a rate. Nematodes in the roots were reduced by almost 88 percent and in the soil by 90 percent fifteen weeks after treatment. The lower rate resulted in survival of significantly more nematodes in both soil and roots. While the highest rate was represented by only one plot, nematode control in the roots was almost 100 percent.

Because of the mode of action of this nematicide, i.e. prevention of feeding and reproduction of the nematode, populations may have continued to decline beyond the fifteen week period, and may have even been lower by seedling lifting time in December and January. A greater reduction in numbers may also have been obtained by applying the nematicide closer to planting time, as the chemical was applied here eight weeks after planting.

Previous observations at this and other nurseries indicated that P. penetrans prevented the development of mycorrhizae on the roots of conifer seedlings. However, no differences could be detected in this test. While populations of nematodes were generally lower in the mycorrhizal roots, differences were not significant due to the amount of variability. A different type of test is needed to determine this effect.

Table 3 shows the effect of soil texture on nematode populations. Populations were consistently higher in the loam than in the fine sandy loam soils. However, soil type appeared to have little effect on control by Nemacur. Numbers were reduced by similar amounts in both soil types.

Effect of Nemacur on seedling growth.-Nemacur at 3 and 6 lb ai/a increased seedling height by 15 percent and 23 percent

Table 3.-- The influence of soil type on control of Pratylenchus penetrans by fenamiphos

Rate	Type	Soil (#/pt) Pre	Post	% Change	Roots (#/g)
0 gpa	SL	400.0	891.7	+55.1	84.1
	L	2233.3	1275.0	-42.9	387.5
1	SL	1208.3	258.3	-78.8	36.3
	L	3775.5	1075.0	-71.5	216.1
2	SL	916.7	175.0	-80.9	14.3
	L	3725.0	275.0	-92.6	43.5

SL = sandy loam; L = loam.

Table 4.-- The effect of fanamiphos on growth of two-year-old Douglas-fir seedlings

Rate	Ht	Caliper	Root Weight (grams) +Mycor	-Mycor	Total
0 gpa	62.2	10.6	2.039	6.513	8.554
1	73.4	11.5	3.959	9.771	13.754
2	80.0	10.7	3.859	11.139	15.000

Ht = height in cm; Caliper = diameter in cm of the stem at the root collar;
+Mycor = mycorrhizal roots; -Mycor = non-mycorrhizal roots.

respectively, and root weight by 38 percent and 43 percent respectively over untreated seedlings (table 4). There was little difference in the percent of mycorrhizal roots (65-68 percent) in any of the treatments. Caliper was also unaffected by treatment.

CONCLUSIONS

The results of these tests show that Nemacur is an effective postplant nematicide for controlling P. penetrans in forest nurseries.

It not only is effective in reducing nematode populations in the soil and roots, but also increases root production and seedling height.

Nemacur offers several advantages for use in forest nurseries:

1. Application of the nematicide after transplanting is complete prevents exposure of transplanting personnel to the chemical;
2. The postplant treatment provides for control of nematodes which might be introduced into a transplant nursery with planting stock;
3. Unexpected nematode problems in young stock can be corrected without loss if diagnosed early;
4. Nematode problems can be corrected in a proposed planting block where rotation schedules do not allow for preplant fumigation;
5. This nematicide has no harmful effect on mycorrhizae development on seedling roots;
6. Applied as a bed treatment it is less expensive than a preplant fumigation.

REFERENCES

Ruehl, J.L.; Nematodes. In: Peterson, G.W. and R.S. Smith, Jr., ed. Forest Nursery Diseases in the United States; Agric. Handbook No. 470. 1975. 125 p.