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STUDIES OF ROOT-KNOT NEMATODE CONTROL IN GINGER WITH NON-VOLATILE NEMATOCIDES APPLIED AT AND AFTER PLANTING

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SUMMARY

Five field trials were set out in the 1970-71 season to assess the value of granular formulations of "Mocap", "Nemacur", "Temik" and "Vydate" in controlling the root-knot nematode *Meloidogyne javanica* (Treub) in ginger 'seed' crops.

The materials were applied (1) at planting in a 6 in. wide band between the seed-piece and the soil surface at 10 lb a.i./ac; (2) broadcast at 10, 20 and 40 lb a.i./ac in mid November; and (3) broadcast at 20 lb a.i./ac (a) in mid November, (b) in late January, and (c) at 10 lb a.i./ac in mid November followed by the same rate in late January.

Nemacur was the only material to give the desired degree of nematode control in the rhizomes.

I. INTRODUCTION

Planting ginger seed-pieces (the portions of rhizomes used for planting) infested with the root-knot nematodes *Meloidogyne javanica* (Treub) and *M. incognita* (Kofoid and White) is a common cause of low yields (Colbran 1962; Colbran and Davis 1969). Following a series of field trials (Colbran and Davis 1969), a programme involving hot-water treatment of selected seed-pieces and planting in sites of low nematode infestation fumigated with DD or "Telone" was recommended as a means of obtaining nematode-free planting material (Colbran 1968). Although failure was sometimes attributable to the neglect of one or more steps in the programme, it has become apparent that a low root-knot nematode infestation in the soil at the time of planting may lead to a heavy infestation in rhizomes harvested 10–11 months later.

The studies reported in this paper were carried out in the 1970-71 season to determine whether the rate of nematode increase could be reduced by the use of the non-volatile nematocides "Mocap", "Nemacur", "Temik" and "Vydate" applied at planting or during the growth of the crop. Owing to the nature of the ginger crop, materials applied after planting cannot be incorporated in the soil by cultivation and their penetration to the root-zone is dependent on rain and irrigation.

II. MATERIALS AND METHOD

The nematocides used in the trials were:

"Mocap".—A granular formulation containing 10% by weight of 0–ethyl S, S-dipropylphosphorodithioate.

"Nemacur".—A granular formulation containing 5% by weight of ethyl 4–(methylthio)–m–tolyl isopropylphosphoramidate.

"Temik".—A granular formulation containing 10% by weight of 2–methyl–2–(methylthio) propionaldehyde–0–(methylcarbamoyl) oxime.

"Vydate".—A granular formulation containing 10% by weight of S–methyl 1–(dimethylcarbamoyl)–N–((methylcarbamoyl) oxy) thioformimidate.

The assessment of nematode infestation was made as follows. After a plot was dug, a piece of rhizome was broken from each of 20 plants. The piece was taken from the most heavily infested portion of the plant. The pieces, averaging 135 g in weight, were peeled and given ratings of 0, 1, 2, 3 or 4 corresponding to increasing numbers and sizes of the discolored infestation sites. Ratings were converted to indices (0–100) by the method of Smith and Taylor (1947).

The five trial sites were fumigated with EDB prior to planting.

In trial 1, at Maroochy Horticultural Research Station, the effects of 6 in. wide bands of the four nematocides, applied about 1 in. above infested seed-pieces and 2–3 in. below the soil surface, on nematode infestation in the rhizome and yield were compared with hot-water treatment (48°C x 20 min) carried out on the day prior to planting. The nematocides were used at the rate of 10 lb a.i./ac.

The design was a 6 x 7 randomized block with 4-row plots each 10 ft long. Rows were 18 in. apart. The seed-pieces were planted on September 18 and the inner rows harvested on June 24 and 25.

Trials 2 (Imbil) and 3 (Amamoor), based on a 15 x 4 randomized block layout, were designed to allow comparison of post-plant applications of the four nematocides at rates of 10, 20 and 40 lb a.i./ac. There were three untreated plots in each replicate. A plot consisted of three rows 18 in. apart and 13 ft long.

The plantings had been established by the growers with 'seed' treated in hot water (51°C x 10 min) on August 31 and planted on September 14 (trial 2) and October 6 (trial 3). The nematocides were broadcast on November 20, after which trial 3 was mulched with sawdust. Trial 2 was harvested in the week commencing July 18 and trial 3 in the week commencing August 15.

Trials 4 (Beerwah) and 5 (Palmwoods) were duplicate trials designed to study the effects of time of application and split applications of the four nematocides on nematode control and yield. A total of 20 lb a.i./ac was used in each treatment. A plot consisted of three rows of ginger 18 in. apart and 13 ft long.

In trial 4, untreated 'seed' was planted in the first week of September. The design was a 16 x 4 randomized block with four untreated plots in each replicate. The early application of nematocide was broadcast on November 13 and the late application on January 29. The crop was dug in the week commencing July 4.

In trial 5, 'seed' treated in hot water (51°C x 10 min) on September 8 was planted on September 21. The design was a 15 x 4 randomized block with three untreated plots in each replicate. Dates of early and late treatment were the same as those in trial 4. The crop was dug in the week commencing August 1.

III. RESULTS

Data on nematode infestation in the rhizomes and yields are presented in Tables 1–3. Nematode infestation analyses were carried out using the inverse sine transformation and root-knot indices are equivalent mean percentages.

TABLE 1

TRIAL 1: EFFECTS OF NEMATOCIDES APPLIED AT PLANTING AND HOT-WATER TREATMENT ON NEMATODE INFESTATION AND YIELD

Treatment	Root-knot Index	Yield (tons/ac)
Control	69·8 (0·989)	11·7
Hot water—(48°C × 20 min)	69·8 (0·989)	13·9
Mocap (10 lb a.i./ac) ..	62·0 (0·907)	11·2
Nemacur (10 lb a.i./ac) ..	49·4 (0·780)	12·6
Temik (10 lb a.i./ac) ..	41·5 (0·700)**	14·2
Vydate (10 lb a.i./ac) ..	35·0 (0·633)**	12·6
Necessary differences for significance 5%	(0·234)	2·7
Necessary differences for significance 1%	(0·315)	3·7

TABLE 2

TRIAL 2 (IMBIL): EFFECTS OF RATE OF APPLICATION ON NEMATODE INFESTATION AND YIELD

Nematocide	Rate (lb/ac)	Root-knot Index	Yield (tons/ac)
Nil	..	98·9 (1·465)	22·7
Mocap	10	93·6 (1·316)	22·6
Mocap	20	96·4 (1·379)	24·7
Mocap	40	61·5 (0·901)**	25·4*
Nemacur	10	59·4 (0·880)**	25·3
Nemacur	20	22·0 (0·488)**	26·8**
Nemacur	40	5·7 (0·240)**	25·8*
Temik	10	98·6 (1·454)	26·7**
Temik	20	94·2 (1·327)	25·9*
Temik	40	91·3 (1·272)*	26·4**
Vydate	10	94·6 (1·337)	26·2*
Vydate	20	88·7 (1·228)*	26·1*
Vydate	40	86·0 (1·188)**	24·2
Necessary differences for significance (from control) 5%		(0·193)	2·7
Necessary differences for significance (from control) 1%		(0·257)	3·7

In trial 1, banded treatment with Nemacur, Temik and Vydate reduced the nematode infestation but did not give the desired degree of control. No treatment gave a significant increase in yield.

Nemacur (40 lb a.i./ac) was the only treatment to give a satisfactory level of nematode control in trials 2 and 3.

A satisfactory level of nematode control was obtained by treatment with Temik (late, split) and Nemacur (early, late, split) in trial 4 and Nemacur (late, split) in trial 5.

TABLE 3

TRIAL 3 (AMAMOOR): EFFECTS OF RATE OF APPLICATION ON NEMATODE INFESTATION AND YIELD

Nematocide	Rate (lb/ac)	Root-knot Index	Yield (tons/ac)
Nil	..	73·0 (1·024)	17·4
Mocap	10	58·0 (0·865)	18·6
Mocap	20	57·6 (0·861)	16·5
Mocap	40	55·2 (0·838)	14·3
Nemacur	10	54·2 (0·828)	18·3
Nemacur	20	45·5 (0·740)*	19·8*
Nemacur	40	21·6 (0·483)**	18·8
Temik	10	70·3 (0·994)	17·1
Temik	20	75·5 (1·053)	17·3
Temik	40	53·9 (0·824)	19·2
Vydate	10	58·8 (0·873)	18·0
Vydate	20	43·6 (0·722)*	18·4
Vydate	40	75·2 (1·049)	18·5
Necessary differences for significance (from control)	5%	(0·280)	2·4
	1%	(0·374)	3·3

TABLE 4

TRIAL 4 (BEERWAH): EFFECTS OF TIME OF APPLICATION ON NEMATODE INFESTATION AND YIELD

Nematocide	Time of Application	Root-knot Index	Yield (tons/ac)
Nil	..	60·0 (0·886)	30·7
Mocap	Early	29·1 (0·570)**	30·4
Mocap	Late	40·0 (0·684)	28·1
Mocap	Split	25·7 (0·531)**	30·0
Nemacur	Early	5·9 (0·246)**	33·5*
Nemacur	Late	15·2 (0·401)**	31·1
Nemacur	Split	9·8 (0·318)**	32·3
Temik	Early	53·6 (0·822)	32·5
Temik	Late	22·1 (0·490)**	31·2
Temik	Split	20·2 (0·466)**	30·9
Vydate	Early	33·9 (0·621)*	33·7*
Vydate	Late	37·1 (0·655)*	32·2
Vydate	Split	31·1 (0·591)**	33·5*
Necessary differences for significance (from control)	5%	(0·218)	2·4
	1%	(0·291)	3·2

TABLE 5

TRIAL 5 (PALMWOODS): EFFECTS OF TIME OF APPLICATION ON NEMATODE INFESTATION AND YIELD

Nematocide	Time of Application	Root-knot Index	Yield (tons/ac)
Nil	..	79·0 (1·094)	24·2
Mocap	Early	77·1 (1·072)	24·8
Mocap	Late	75·0 (1·047)	23·3
Mocap	Split	87·3 (1·207)	23·4
Nemacur	Early	44·4 (0·729)*	27·0
Nemacur	Late	18·7 (0·447)**	26·8
Nemacur	Split	18·8 (0·449)**	26·6
Temik	Early	51·4 (0·799)	26·9
Temik	Late	38·0 (0·664)*	25·7
Temik	Split	82·3 (1·137)	28·2**
Vydate	Early	85·7 (1·183)	25·4
Vydate	Late	82·8 (1·143)	22·9
Vydate	Split	59·6 (0·882)	26·8
Necessary differences for significance (from control)	5%	..	3·0
	1%	..	4·0

IV. DISCUSSION

The results of the five trials substantiate the observation that, in areas infested with root-knot nematodes, hot-water treatment of the planting material and soil fumigation at normal rates are insufficient to ensure the production of 'seed' with a tolerable level of nematode infestation. The main problems are (1) to obtain a higher level of control by preplant fumigation, and (2) to reduce the increase in infestation during the subsequent growth of the crop.

In these trials Nemacur was consistently more effective against root-knot nematodes than Mocap, Temik and Vydate, and increased yields by 1–15%. When applied early, a rate exceeding 20 lb a.i./ac was required to consistently give the desired level of control. In trial 5, where the early application of Nemacur at 20 lb/ac did not give the desired control, the late and split applications gave excellent results, suggesting that these methods of application are more promising than high rates applied early in the growth of the crop. The overall results indicate that there is little to be gained in testing surface dressings without mechanical soil incorporation of Mocap, Temik, and Vydate on other crops with lower moisture requirements and deeper root systems than the ginger crop.

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