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CONTROL OF CITRUS NURSERY PESTS BY SOIL APPLICATIONS OF DIMETHOATE

by D. L. Milne, Citrus & Subtropical Fruit Research Institute, Nelspruit.

ABSTRACT

Solutions of dimethoate (Perlok hion 40% EC) were applied to the soil of nursery trees growing in plastic containers. Rates of 0.5 ml to 2.5 ml of formulation per 20 l bag i.e., 0.1 m² were applied. It was found that at a rate of 1.0 ml/bag, and higher, citrus psylla, Trioxa erytreae, was unable to establish nymphs, and the black citrus aphid, Toxoptera citricids and citrus thrips, Scirtothrips aurantii were controlled for 5 to 6 weeks with a single application. No phytotoxicity was recorded at the dosage rates used.

INTRODUCTION

Over the past three years it has been found that certain systemic pesticides, when applied to the soil, have a suppressive effect on many citrus insects (Milne & de Villiers, 1977; Wortmann & Schafer, 1977). For this reason a trial was laid out to test the effect of such applications on nursery trees.

PROCEDURE

The trees selected for the trial consisted of grafted trees with four mid-season cultivars, Palmer navel, Olinda Valencia and ten mandarin scions and the following rootstocks: Empress mandarin, Troyer citrange, Cleopatra mandarin, Citrus volkameriana and rough lemon. At the time of the trial, the trees were all approximately 50 cm tall, i.e. ready for transplanting.

Dimethoate, in the form of Perlokion 40% EC, was used at rates varying from 0.5 ml of formulation per 20 l plastic container (i.e., 0.1 m²) to 2.5 ml per bag. For each plant the dimethoate was diluted in 250 ml of water and poured onto the soil around the base of the plant. The date of treatment was 1976-11-10.

At the time of the trial, the pressure of citrus psylla was very high, and four weeks after treatment a high population of the black citrus aphid built up. citrus thrips were plentiful on the Control trees throughout the trial period.

There were 9 single-tree replications of each treatment, and assessments of insect occurrence were carried out weekly for a period of 2 months. Particular attention was paid to citrus psylla, and all stages were recorded throughout the trial. Regular observations were also made for any signs of phytotoxicity.

RESULTS

The psylla pressure can be gauged by the fact that within 48 hours of placing the trees in the open for the trial, 40% were already infested with eggs of psylla. At the end of the first week it was clear that some degree of repellency of adult psylla was being exerted by the dimethoate. Out of 9 untreated trees, 5 were infested with adults, whereas at 1 ml/0.1 m² dimethoate, no adults were recorded on 18 trees. Also at this time (1 week after treatment) 4 out of 9 Control trees had live nymphs present whereas out of 81 treated trees (various dosages) none were infested with nymphs.

As the trial progressed it became clear that the dimethoate persisted in repelling adults (although small numbers did occur) and in reducing egg-laying. Furthermore, as demonstrated previously (Milne & de Villiers, 1977) most of the eggs were killed by the systemic action of the dimethoate apparently acting via the micropiles of the eggs which are inserted into the leaves.

After 1 month, psylla adults became more plentiful on the treated trees but there was still no nymphal development at any of the dosage levels. After 5 weeks, the citrus aphid began to build up rapidly on the Control trees and this reproduction continued into the 6th week. However, at dosage rates of 1 ml of dimethoate and more, no aphids became established on the treated plants even after 6 weeks. The dosage rate of 0.5 ml was found to be inadequate to give complete protection against aphids at 5 weeks. During the 7th week, excess heat caused the disappearance of the aphid infestation.

An assessment carried out at 6 weeks revealed that at dosage rates of 1 ml or more, no pock-marking of leaves by psylla had occurred. At 0.5 ml however, 4 trees out of 18 had 1 to 4 leaves pock-marked. After this the hot, dry weather also eliminated the psylla population on the Control trees.

Thrips were found to be active on the trees treated with 0.5 ml and 1.0 ml after the 5th week. At higher rates (i.e., 1.5 ml and more) thrips damage was still not detected after 6 weeks, but after 8 weeks all treatments had become infested.

The overall results of the insect assessments are shown clearly for the 1.0 ml dosage rate in Fig. 1. It can be seen from the figure that this treatment prevented establishment of psylla, aphids and thrips for 5 to 6 weeks following a single treatment, even under conditions of severe insect pressure.

No phytotoxicity was recorded in this trial even at the 2.5 ml/0.1 m² dosage rate. However, in a supplementary trial in which small (10 cm) seedlings were treated at much higher dosage rates and were then exposed to hot, sunny conditions, it was found that 5.0 ml/0.1 m² induced severe leaf scorch and 10.0 ml caused a high level of mortality in the test plants. Furthermore, glasshouse observations have shown kumquat (Fortunella sp.) and cuttings of Etrog citrus and West Indian lime seedlings to be sensitive to high
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dosages of dimethoate (S. P. van Vuuren, personal communication). Even seed of citron has been shown to be highly sensitive to this pesticide whereas rough lemon is not (J. H. de Lange, personal communication).

**DISCUSSION**

It is clear from this experiment that the concept of using soil systemics in the nursery holds considerable promise. One advantage is that the pesticide moves into the new growth flush of young trees, thereby affording a continuous and long protection, which cannot usually be achieved with conventional contact pesticides. Furthermore, predators and parasites are not destroyed as they are usually by foliar sprays, so that they are also able to play a role in combating other nursery pests, such as scale insects.

In addition, field trials have already demonstrated that this pesticide has a suppressive effect on red scale, Aonidiella aurantii (H. E. Naumann, personal communication, and O. Skarup-Jensen, personal communication). Also it is claimed that application at a rate of 1 ml/0.1 m² gives effective control of thrips in field transplants (including trees up to 4 years old) and that this treatment reduced feeding by the orange dog caterpillar (or larva of the citrus swallowtail), Papilio demodocus (N. C. Lodewijks, personal communication).

A wide spectrum of pests can therefore be expected to be controlled by this treatment.

**ACKNOWLEDGEMENTS**

Thanks are expressed to Messrs BASF who supplied the insecticide for these trials and to Dr J. H. de Lange and Mr P. Müller for supplying the nursery plants.

**OPSOMMING**

Grondtoedienings van dimetoaat om sitrus kwekeryplante te bestry

Oplossings van dimetoaat (Perfekthion 40% EC) is op die grond toegedien met kwekeryboompies in plastiese sakke. Dit is toegedien teen konsentrasies van 0,5 ml tot 2,5 ml formulasie per 20 ℓ sak. Dit is bewys dat teen 1,0 ml/20 ℓ sak en hoër, nimi van die sitrusbladvlooi, Triozoa erytreae, nie gevestig het nie. Die swarttitsrupsplantlus, Toxoptera citricidus, en sitrusblaastrapontjie, Scirtothrips auranti, word ook vir 5 tot 6 weke onder beheer gehou. Geen fitotoksiteit is teen bogenoende konsentrasies waargeneem nie.

**REFERENCES**


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**Fig. 1.**

Relative incidence of three insect pests on citrus seedlings, recorded over an 8-week period

<table>
<thead>
<tr>
<th>Treatment</th>
<th>1 week</th>
<th>2 weeks</th>
<th>4 weeks</th>
<th>5 weeks</th>
<th>6 weeks</th>
<th>8 weeks</th>
<th>Insect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>xxx</td>
<td>xxx</td>
<td>xxx</td>
<td>xxx</td>
<td>xxx</td>
<td>0</td>
<td>Psylla: adults</td>
</tr>
<tr>
<td></td>
<td>xx</td>
<td>x</td>
<td>xx</td>
<td>xx</td>
<td>x</td>
<td>0</td>
<td>Eggs</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>xx</td>
<td>xx</td>
<td>xxx</td>
<td>Nymphs</td>
</tr>
<tr>
<td>Perfekthion 40% EC: 1 ml/20 ℓ bag</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>x</td>
<td>Thrips</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>xxx</td>
<td>Psylla: adults</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>x</td>
<td>xxx</td>
<td>Thrips</td>
<td></td>
</tr>
</tbody>
</table>

**Key:**

0 = not present
x = very few recorded
xx = moderate numbers on most plants
xxx = large numbers on most plants