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Persistence of chemical residues on onion leaves

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A report prepared for
New Zealand Onion Exporters Association

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1 Executive summary

Insecticides may kill thrips either through direct contact of the wet spray with insects or as a result of insects walking over sprayed surfaces. Information about the persistence of chemical effects will guide the development of recommendations for the more effective use of insecticide products.

The objective of this project was to test the persistence of chemical residues on onion leaves after simulated commercial spraying with insecticides that have label claims for the control of onion thrips on onion crops.

Pot-grown onion plants were sprayed and placed outside in full sun where they were exposed to the weather. The ability of chemical residues of insecticides on leaves to kill onion thrips was assessed 0, 1, 2, 3, 7, 14 and 21 days after spraying. Segments of sprayed leaves were placed in agar in small ventilated plastic dishes. After thrips were added to dishes the dishes were closed and kept at 25°C for 24 h. Mortality was then assessed.

The trial was carried out in April 2000 using the following insecticides:

- **Thiodan** (350 ml endosulfan/litre) 200 ml/100 litres,
- **Diazinon 50 W** (500 g diazinon/kg) 150 g/100 litres,
- **Nuvan** (1000 g dichlorvos/litre) 100 ml/100 litres,
- **Folidol M 50** (600 g parathion-methyl/litre) 80 ml/100 litres,
- **Tamaron** (600 g methamidophos/litre) 1 litre/ha, 800 ml/ha, 160 ml/100 litres.

Methamidophos killed most of the thrips for at least three weeks, while diazinon, endosulfan and parathion-methyl showed greatest activity on day 0. This activity declined rapidly in the first 24 hours. Parathion-methyl was the least effective of the three chemicals on day 0. Dichlorvos caused no mortality even when residues had recently dried. These data confirm the results of previous experiments except that in May 1999 parathion-methyl was as effective and as persistent as diazinon and endosulfan. Other experiments suggest that some of our thrips colonies are resistant to parathion-methyl.

The implications for control of onion thrips are that diazinon, endosulfan and parathion-methyl should be applied as clusters of sprays with very short intervals, e.g. 3-5 days apart, scheduled to cover the whole generation of thrips. On the other hand, the persistence of methamidophos means that it can be applied at 7-14 day intervals, but there is a greater risk that onion thrips will develop resistance to this chemical. There are also risks that chemical residues may persist in the bulbs and for this reason it would be desirable to obtain a residue decay curve. Juvenile onion thrips often feed on

the emerging central leaves. It would be useful to know whether, on quickly growing onion plants, methamidophos chemical residues are transferred to these new leaves. If they are not, this would make short intervals between sprays more necessary.

2 Introduction

In 1998/99 Crop & Food Research undertook to test the persistence of insecticides with label claims for onion thrips control in onion crops. Low mortality rates were recorded in the first trial so in the second trial high concentrations (10 times the recommended rate) of insecticides were used. This year (1999/00) the trial was repeated using the recommended concentration of insecticides.

Onion plants were grown in pots. After spraying, the pots were placed outdoors to simulate the effects of natural weathering on chemical residues. The efficacy of the residues was assessed on insecticide-susceptible onion thrips.

The trial was conducted in April 2000.

3 Objective

To test the persistence of chemical residues on onion leaves after simulated commercial spraying of five insecticides that were registered or being evaluated for control of onion thrips on onion crops.

4 Methods

4.1 Onion plants

Onion bulbs were planted in pots (150 mm diameter) and kept in a greenhouse until they had grown to a sufficient size. Seven pots were allocated to each insecticide treatment. Sprouted bulbs were sprayed once and then placed outdoors for 28 days where they received natural rain and sunlight.

On 20 April 2000 the plants were ranked for vigour prior to spraying and arranged in 6 groups of 7 pots in a sheltered place outside where sun was received for most of the day. All pots in a group received the same insecticide treatment.

4.2 Onion thrips

Onion thrips (*Thrips tabaci*) from a conservatory in Wellington were reared on segments of leek leaves in Agee jars (500 ml) at 25°C and in16 h light: 8 h dark. The population was susceptible to synthetic pyrethroid insecticides.

4.3 Insecticide application

4.3.1 Insecticides

Recommended concentrations for field crop application were used, assuming 500 litres spray per hectare.

- water control
- endosulfan 70 g ai/100 litres — **Thiodan** (350 ml endosulfan/litre) 200 ml/100 litres
- diazinon 50 g ai/100 litres — **Diazinon 50 W** (500 g diazinon/kg) 150 g/100 litres
- dichlovos 100 g ai/100 litres — **Nuvan** (1000 g dichlorvos/litre) 100 ml/100 litres
- parathion-methyl 48 g ai/100 litres — **Folidol M 50** (600 g parathion-methyl/litre) 80 ml/100 litres
- methamidophos 96 g ai/100 litres — **Tamaron** (600 g methamidophos/litre) 1 litre/ha, 800 ml/ha, 160 ml/100 litres

Note: all treatments, including the water control, contained Citowet (25 ml/100 litres water).

Methamidophos was included because a persistent synthetic pyrethroid was not available on the day of spraying.

4.3.2 Insecticide application

The plants were sprayed outdoors and transferred to a sheltered place exposed to wind and rain. Each group of 7 plants was sprayed with up to 1 litre of made-up solution of an insecticide treatment or water until the plants were thoroughly wet.

4.4 Assessment of the toxicity of insecticide residues

Toxicity of leaf residues to thrips was assessed when plants were sprayed (day 0) and then 1, 2, 3, 7, 14, 21, 28 days after spraying.

For each assessment, five leaves were removed from one plant only in each treatment and a portion of each leaf, 20-30 mm long, that was well covered by the spray was selected. Each portion was placed in 2% water agar in a Petri dish (50 mm diameter) so that only the adaxial leaf surface was exposed. There were five dishes per treatment and 50 thrips were used per treatment.

Ten adult onion thrips were transferred to each dish which was closed with a ventilated lid. Ventilation was provided by a hole 12 mm in diameter. The dishes were kept at 25°C in 16 h light: 8 h dark for 24 h. The numbers of live and dead thrips in each dish were recorded and the percentage mortality calculated. Thrips were considered to be dead if they failed to move when they were gently touched with a fine camel hair brush.

4.5 *Data analysis*

The percentage mortality was calculated and the data tabulated and graphed.

5 *Results*

Rates of thrips mortality in the water control were low throughout the trial and clear differences between the efficacy of chemical residues were found (Table 1, Figs 1-6).

Methamidophos killed most thrips for at least three weeks, while diazinon, endosulfan and parathion-methyl showed greatest activity on day 0. This declined rapidly in the first 24 hours. Parathion-methyl was the least effective of these three chemicals causing less than 10% mortality. This was different to the experiments in 1999 where parathion-methyl caused similar mortality to diazinon and endosulfan. Other evidence indicates that some of our colonies are resistant to parathion-methyl. Dichlorvos caused no mortality even when residues had only recently dried.

Table 1: Percentage mortality[1] of onion thrips after 24 hours' exposure to onion leaves sprayed with insecticide, Trial 1, November 1999.

Days after spraying	Water control	**Thiodan** (endosulfan) 200 ml/100 litres	**Diazinon 50 W** (diazinon) 150 g/ 100 litres	**Nuvan** (dichlorvos) 100 ml/100 litres	**Folidol M 50** (parathion-methyl) 80 ml/100 litres	**Tamaron** (methamidophos) 160 ml/100 litres
0	1.7	56.9	91.2	2.1	8.6	89.6
1	0.0	1.8	12.5	1.5	3.3	96.1
2	1.8	1.8	3.6	0	5.7	98.2
3	1.8	2.1	1.8	0	3.9	92.7
7	0	2	0	3.9	0	100
14	1.8	-	-	-	-	98.3
21	1.8	-	-	-	-	100

[1] Abbots correction was used to account for the percentage mortality in the control treatment.

6 Discussion

This experiment confirms the results of previous experiments which showed that dichlorvos had no residual effect and that diazinon, endosulfan and parathion methyl lost most activity in the first 24 hours. The experiment also confirmed the persistence of methamidophos.

The implications for control of onion thrips is that diazinon, endosulfan and parathion methyl should be applied as clusters of sprays with very short intervals, e.g. 3-5 days apart, scheduled to cover the whole generation. On the other hand, the persistence of methamidophos means that it can be applied at 7-14 day intervals, but there is a greater risk that onion thrips will develop resistance to this chemical. There are also risks that chemical residues may persist in the bulb and for this reason it would be desirable to obtain a residue decay curve. Juvenile onion thrips often feed on the emerging central leaf. It would be useful to know whether, on quickly growing onion plants, methamidophos chemical residues are transferred to this new leaf. If they are not, this would make short intervals between sprays more necessary.

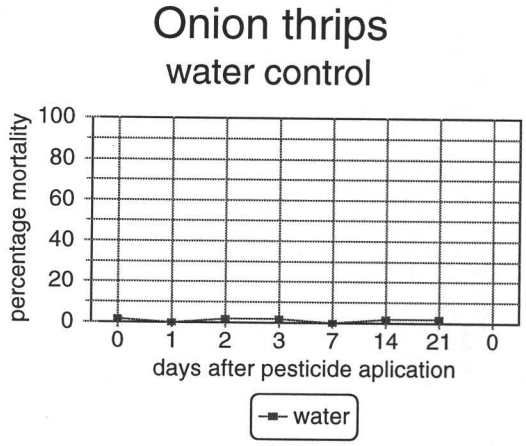

Figure 1: Percentage mortality of onion thrips when kept for 24 hours on sprayed onion leaves.

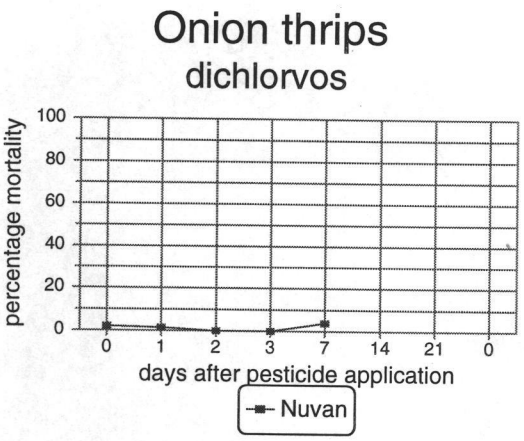

Figure 2: Percentage mortality of onion when kept for 24 hours on sprayed onion leaves.

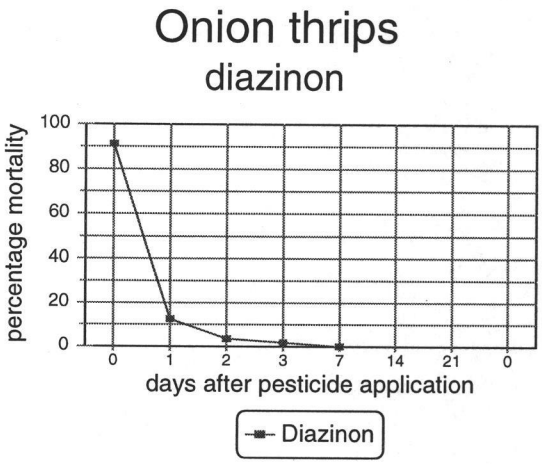

Figure 3: Percentage mortality of onion thrips when kept for 24 hours on sprayed onion leaves

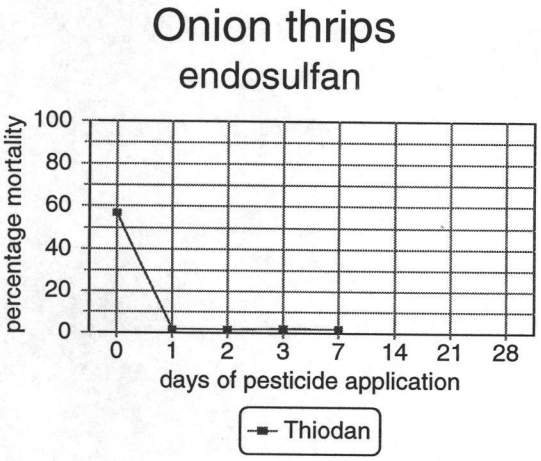

Figure 4: Percentage mortality of onion thrips when kept for 24 hours on sprayed onion leaves.

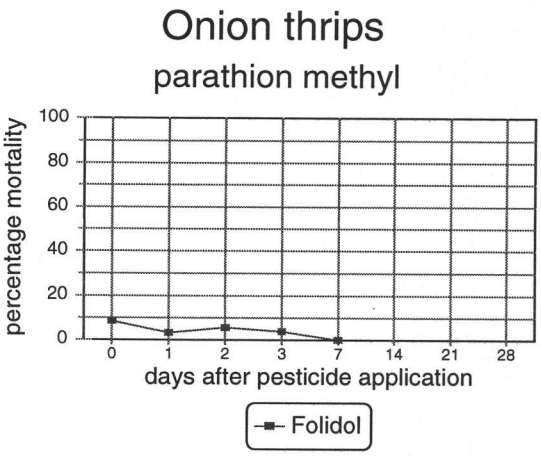

Figure 5: Percentage mortality of onion thrips when kept for 24 hours on sprayed onion leaves.

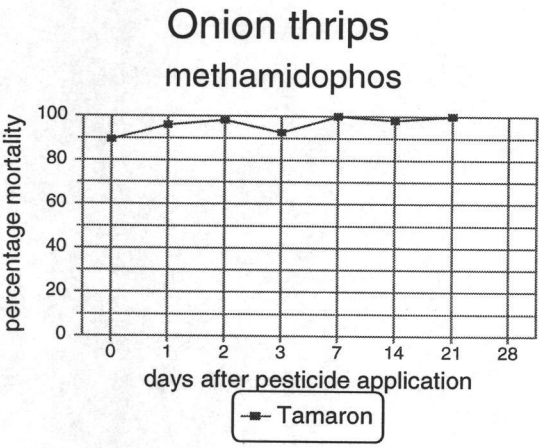

Figure 6: Percentage mortality of onion thrips when kept for 24 hours on sprayed onion leaves.

7 Acknowledgements

Peter Workman and Rebecca Bush for technical assistance with rearing the thrips and conducting the insecticide experiments.