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Grower use of insecticides for onion thrips control in onion crops —TBG milestone: 2.7 (modified)

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Copy 21 of 21

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Contents

1 Executive summary

The revised (1999) onion thrips resistance management strategy for onion crops recommends that insecticides are only applied after an action threshold has been exceeded and that each insecticide product is applied as a cluster of three or four sprays. If further treatments are required a different insecticide should be used for the next cluster of sprays. This project assesses the results of this new approach to insecticide control of onion thrips in ten crops in three regions in which onion crops are grown.

The objectives of the study were to:

- test the validity of insecticide spray thresholds in commercial fields using the grower monitoring system, and
- assess the efficacy of clusters of insecticide sprays in commercial fields using the grower monitoring system.

Onion thrips in 10 onion crops were monitored regularly from early summer until crop tops fell or the onions were cut-out. The percentage of infested plants (in Auckland crops) and the mean number of adult and juvenile thrips per plant (in all crops) were determined. Five Auckland, two Manawatu and three Canterbury crops were monitored.

Data on thrips populations and information on insecticide spray applications for each crop were graphed and data on insecticides and intervals between clusters of the same product were tabulated.

There was a good correlation between the proportion of plants infested and the mean number of thrips per plant.

Thrips populations were low (less then 2.5 per plant) in Auckland and Manawatu, but reached more than 4 and 20 per plant in two Canterbury crops.

The recommended action threshold is 0.1 thrips per plant. It was not possible to assess its suitability due to the number of crops in which the first spray of a cluster was applied when populations were below the threshold, and because where the threshold was observed most crops did not receive a complete cluster of sprays.

The number of insecticides applied varied from 4 to 18 per crop. The two crops receiving the highest numbers of sprays were both late crops and the thrips were resistant to synthetic pyrethroid (SP) insecticides.

Growers are still using more than one SP product.

Most growers are using insecticides as clusters of two to four sprays, but some growers are still using single applications of a product and sometimes the interval between sprays in a cluster is too long.

Most growers rotated insecticides, i.e. switched to a new product after completing a cluster of sprays.

Most insecticides appeared to be effective, even the first two applications of SPs reduced populations of thrips that included SP-resistant insects.

Although most growers observed the insecticide use recommendations in the onion thrips resistance management strategy, there were breaches of most aspects of it by at least one grower. Greater effort is required to ensure that growers are thoroughly familiar with the key elements:

- once a decision has been made to spray, a cluster of sprays of a product should be used rather than a single application,
- the time interval between sprays in a cluster should be short,
- chemicals should be applied in rotation, and
- all SP products should be regarded as one 'chemical' and products that are SPs clearly recognised.

2 Introduction

The 1998 pesticide resistance management strategy recommended that pesticides are only applied to control onion thrips when populations reach or exceed predetermined action thresholds. As a result of the experience in the 1998/99 growing season, the thresholds were lowered. The new thresholds were tested in ten crops in three regions.

3 Objectives

To test the validity of insecticide spray thresholds in commercial fields using the grower monitoring system.

Assess the efficacy of clusters of insecticide sprays in commercial fields using the grower monitoring system.

4 Methods

4.1 Crop monitoring

Five Auckland crops were monitored by HortResearch. They inspected 50 or 100 plants according to the recommendations of the strategy for 1999/2000 and they recorded the numbers of plants infested and the numbers of juvenile and adult thrips per plant. Consultants or growers monitored two Manawatu crops and three Canterbury crops. They recorded the number of thrips on 50 plants and usually distinguished between juvenile and adult thrips. The results of the monitoring were provided through Richard Wood.

4.2 *Insecticide data and analysis*

Details of insecticide applications were provided by growers and consultants through Richard Wood. The data were tabulated and examined graphically.

5 *Results*

Tables 1-10 give the application rates of the insecticides used in each crop and the intervals between clusters of sprays. Where known, they also show the levels of onion thrips infestation before and after a cluster of sprays.

Figs 1-10 illustrate the changes in thrips populations and the relationship between insect numbers and the application of insecticides more clearly than the tables.

5.1 *Proportion of infested plants*

The proportion of infested plants showed a good correlation with the numbers of thrips per plants (Figs 1a-5a). Exceptions occurred early season and when numbers of nymphs were high (cf Figs 1b-5b). This could be a result of the clumped sampling of plants (10 groups of 5 plants) or the timing of the thrips breeding cycle.

5.2 *Thrips populations*

Thrips populations in Auckland were much lower in 1999/00 than in 1998/99 with the largest populations at site 4 where 70% of plants were infested and the mean number of thrips reached 2.5 per plant (Figs 4a-b). Manawatu populations remained below 0.4 thrips per plant while in Canterbury one population exceeded 20 thrips per plant. The much lower population numbers this year enabled the efficacy of grower insecticide applications to be more easily assessed.

5.3 *Insecticide use*

5.3.1 *Action thresholds*

The action threshold recommended for 1999/00 was 0.1 thrips per plant (10 thrips per 100 plants or 5 thrips per 50 plants). However, there is an element of confusion because the strategy summary implies the early season threshold is 6 thrips per 100 plants (0.06 thrips per plant). Tables 1-10 show that where there were pre-spray data, quite a few crops received the first spray of a cluster when populations were below the 0.1 thrips per plant threshold.

Table 1: Auckland site 1—infestation of plants with onion thrips before and after applications of insecticide clusters.

Date (1st spray of cluster or date of count)	Insecticide and days between cluster of sprays	Number of thrips per plant (percentage of infested plants)
12 Oct 1999		0.09 (3)
15 Oct 1999	Lorsban 50EC (0.5 ℓ/ha) (chlorpyriphos)	
19 Oct 1999		0.43 (7)
9 Nov 1999		0.02 (2)
12 Nov 1999	Lorsban 50EC (1 ℓ/ha) (chlorpyriphos) 7, 11, 8	
14 Dec 1999		0.26 (20)
15 Dec 1999	Thiodan (2 ℓ/ha) (endosulfan)	
21 Dec 1999		0 (0)
22 Dec 1999	Lorsban 50EC (1 ℓ/ha) (chlorpyriphos) 13	
5 Jan 2000		0.24 (6)

Table 2: Auckland site 2—infestation of plants with onion thrips before and after applications of insecticide clusters.

Date (1st spray of cluster or date of count)	Insecticide and days between cluster of sprays	Number of thrips per plant (percentage of infested plants)
23 Nov 1999		0.08 (6)
24 Nov 1999	Lorsban 50EC (1 ℓ/ha) (chlorpyriphos) 9, 5	
14 Dec 1999		0.04 (4)
16 Dec 1999	Karate Zeon (40 ml/ha) (SP) 7	
28 Dec 1999		0.02 (2)
31 Dec 1999	Fastac (250 ml/ha) (SP)	
5 Jan 2000		0.16 (10)

Table 3: Auckland site 3—infestation of plants with onion thrips before and after applications of insecticide clusters.

Date (1st spray of cluster or date of count)	Insecticide and days between cluster of sprays	Number of thrips per plant (percentage of infested plants)
10 Oct 1999	Lorsban 50EC (0.5 ℓ/ha) (chlorpyriphos)	
12 Oct 1999		0.02 (2)
26 Oct 1999	Chlorpyrifos (1.0 or 0.9 l/ha) (chlorpyriphos) 7, 7	0.01 (0.5)
16 Nov 1999	Tamaron (1 ℓ/ha) (methamidophos) 8, 10	0.06 (3.5)
7 Dec 1999		0 (0)
14 Dec 1999		0.12 (8)
17 Dec 1999	Dominex (330 ml/ha) (SP) 7, 7, 5	
12 Jan 2000		0.22 (10)

Table 4: Auckland site 4—infestation of plants with onion thrips before and after applications of insecticide clusters.

Date (1st spray of cluster or date of count)	Insecticide and days between cluster of sprays	Number of thrips per plant (percentage of infested plants)
14 Oct 1999	Monitor (1 ℓ/ha) (methamidophos) 13, 6	
2 Nov 1999		0.04 (4)
16 Nov 1999	Chlorpyrifos (1 ℓ/ha) (chlorpyrifos) 9, 6	0.24 (15.5)
7 Dec 1999		2.12 (54)
8 Dec 1999	Decis (360 - 400 ml/ha) (SP) 8, 11, 10	
12 Jan 2000	Fastac (200 ml/ha) (SP) 7, 9	0.84 (36)
25 Jan 2000		1.22 (44)
28 Jan 2000	Nuvan (800 ml) (dichlorvos) 7, 4	
8 Feb 2000		2.48 (42)

Table 5: Auckland site 5—infestation of plants with onion thrips before and after applications of insecticide clusters.

Date (1st spray of cluster or date of count)	Insecticide and days between cluster of sprays	Number of thrips per plant (percentage of infested plants)
9 Nov 1999		1.3 (30)
14 Nov 1999	Tamaron (800 ml/ha) (methamidophos) 8, 7, 7	
14 Dec 1999		0.4 (18)
15 Dec 1999	Lorsban (750 ml/ha) (chlorpyriphos) 7	
28 Dec 1999	Tamaron (600 ml/ha) (methamidophos)	0.18 (10)
5 Jan 2000	Lorsban (750 ml/ha) (chlorpyriphos) 6, 7	0.32 (14)
19 Jan 2000		1.73 (55)
20 Jan 2000	Karate Zeon(40 ml/ha) or Fastac (200 ml/ha) (SP) 4, 3, 5	
3 Feb 2000		1.28 (52)
5 Feb 2000	Tamaron (500 ml/ha) (methamidophos)	
8 Feb 2000		0.98 (48)
9 Feb 2000	Karate Zeon(40 ml/ha) (SP)	
14 Feb 2000	Monitor (500 ml/ha) (methamidophos) 5	

Table 6: Manawatu site 1—infestation of plants with onion thrips before and after applications of insecticide clusters.

Date (1st spray of cluster or date of count)	Insecticide and days between cluster of sprays	Number of thrips per plant
26 Nov 1999	Thiodan (2 ℓ/ha) (endosulfan) 7	
14 Dec 1999		0.26
17 Dec 1999	Thiodan (2 lℓha) (endosulfan) 5, 8, 10	
17 Jan 2000		0.02
4 Feb 2000	Folidol (1 ℓ/ha) (parathion-methyl)	0.18
15 Feb 2000	Karate (200 ml/ha) (SP)	
21 Feb 2000		0.02

Table 7: Manawatu site 2—infestation of plants with onion thrips before and after applications of insecticide clusters.

Date (1st spray of cluster or date of count)	Insecticide and days between cluster of sprays	Number of thrips per plant
2 Dec 1999	Basudin (1.3 ℓ/ha) (diazinon)	
10 Dec 1999		0.28
15 Dec 1999	Basudin (1.3 ℓ/ha) (diazinon)	
23 Dec 1999		0.21
29 Dec 1999	Basudin (1.3 ℓ/ha) (diazinon)	
	7	
12 Jan 2000		0.20
13 Jan 2000	Nuvan (800 ml/ha) (dichlorvos)	
26 Jan 2000		0.28
27 Jan 2000	Folidol (1 ℓ/ha) (parathion-methyl)	
4 Feb 2000		0.08
5 Feb 2000	Karate Zeon (40 ml/ha) (SP)	
	13	
29 Feb 2000		0.0

Table 8: Canterbury site 1—infestation of plants with onion thrips before and after applications of insecticide clusters.

Date (1st spray of cluster or date of count)	Insecticide and days between cluster of sprays	Number of thrips per plant
19 Nov 1999		0.34
25 Nov 1999	Karate (200 ml/ha) (SP)	
26 Nov 1999		0.48
29 Nov 1999	Tamaron (800 ml/ha) (methomidophos)	
	16	
21 Dec 1999	Karate (200 ml/ha) (SP)	
24 Dec 1999		0.08
7 Jan 2000		0.14
12 Jan 2000	Karate (200 ml/ha) (SP)	
14 Jan 2000		0.18

Table 9: Canterbury site 2—infestation of plants with onion thrips before and after applications of insecticide clusters.

Date (1st spray of cluster or date of count)	Insecticide and days between cluster of sprays	Number of thrips per plant
15 Nov 1999	Decis (400 ml/ha) (SP) 15	
3 Dec 1999		0.08
10 Dec 1999		0.66
16 Dec1999	Diazinon (400 ml/ha)	
17 Dec 1999		0.70
7 Jan 2000	Diazinon (400 ml/ha)	5.04
14 Jan 2000		5.96
28 Jan 2000		21.56
29 Jan 2000	Decis (400 ml/ha) (SP)	
4 Feb 2000		18.12
21 Feb 2000		11.6
28 Feb 2000	Decis (400 ml/ha) (SP)	
29 Feb 2000		5.62

Table 10: Canterbury site 3—infestation of plants with onion thrips before and after applications of insecticide clusters.

Date (1st spray of cluster or date of count)	Insecticide and days between cluster of sprays	Number of thrips per plant
29 Dec 1999		0.28
4 Jan 2000	Folidol (600 ml/ha) (parathion-methyl)	
11 Jan 2000	Basudin (1.0 litres/ha) (diazinon)	
17 Jan 2000		0.12
24 Jan 2000	Karate ?Zeon (40 ml/ha) (SP) 10	

5.3.2 *Choice of insecticides*

The insecticides registered for thrips control on onions include endosulfan, diazinon, parathion-methyl, dichlorvos and several SPs. In addition to these chemicals growers used chlorpyrifos and methamidophos, two chemicals that showed promise in tests last spring. The strategy recommends that growers only use one cluster of SP sprays. At least one grower (site Ak-4) applied two SP products apparently in the belief that they were from different chemical groups. This suggests that there is a need to educate growers about the chemical class to which each product belongs.

The strategy also recommended that SPs were used late in crop development, in the generation prior to top fall. This was generally observed, although two crops in Canterbury received SP sprays in November and early December. There was also a suggestion in the strategy that dichlorvos could be used after top fall, and on this basis one grower (Ak-5) made two applications in February. One grower (Ak-5) applied methamidophos during the last few weeks of crop monitoring. The residue decay curve for this chemical on onions is not known, but methamidophos kills thrips for up to three weeks after spraying, so late season applications of this chemical could result in unacceptably high residues in onion bulbs, which may affect market access for bulbs destined for export.

5.3.3 *Use of insecticides in clusters*

The strategy recommended that when an insecticide application was required growers apply the same chemical in a cluster of 2-4 sprays. Most growers followed this advice, but there were some notable exceptions:

- Ak-1 where widely spaced chlorpyrifos applications were made throughout crop development and C-1 with widely spaced sprays,
- only single applications of an insecticide were made instead of a minimum of two sprays, e.g. M-1, parathion-methyl in February; and Ak-1, endosulfan in December,
- quite often the interval between two sprays in a cluster was longer than recommended, e.g. C-1, 16 days in summer between two methamidophos applications; and M-2, diazinon applications up to 14 days apart.

5.3.4 *Rotation of insecticides*

The strategy recommended that after applying a cluster of one insecticide, a different chemical is selected if further insecticide sprays are required. Most growers observed this practice (e.g. Figs 4a-b for grower Ak-5 who used five products although both Decis and Fastac are SP insecticides and so only one should have been used. There were several growers who did not observe that part of the strategy, notably Ak-1 and M-1.

5.3.5 *Efficacy of insecticides*

It is difficult to interpret with certainty the efficacy of insecticides from field monitoring data, but some conclusions can be drawn based on the observations made of the 10 properties.

- Methamidophos, which was only used in Auckland, appears to have kept thrips population numbers low although it is difficult to determine its effect when applied in February to a late crop (Figs 5a-b),
- Chlorpyrifos was also only used in Auckland. The widely spaced applications at Ak-1 did not prevent an increase in population numbers.

Populations also increased under clusters of three sprays 6-9 days apart (Ak-4) and 6-7 days apart (Ak-5).

- Endosulfan was only used on two crops, but appears to reduce thrips numbers (Fig. 1a and 6).
- A single spray of parathion-methyl appears to reduce thrips numbers (M-2).
- The data for diazinon are inconclusive.
- The field evidence suggests that SP insecticides were in some circumstances able to reduce onion thrips populations and prevent increases. At Ak-3 Dominex prevented population increases of thrips, while at Ak-4 the first applications of Decis reduced populations of onion thrips, but then they increased again, especially while Fastac was being applied. This indicates that this combination of sprays has selected for thrips resistant to the SP insecticides.

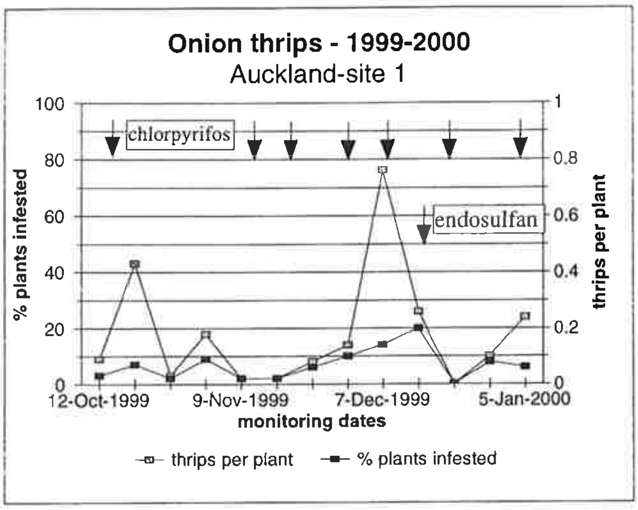

Figure 1a: Proportion of onion plants infested with onion thrips and numbers of thrips per plant with insecticide applications.

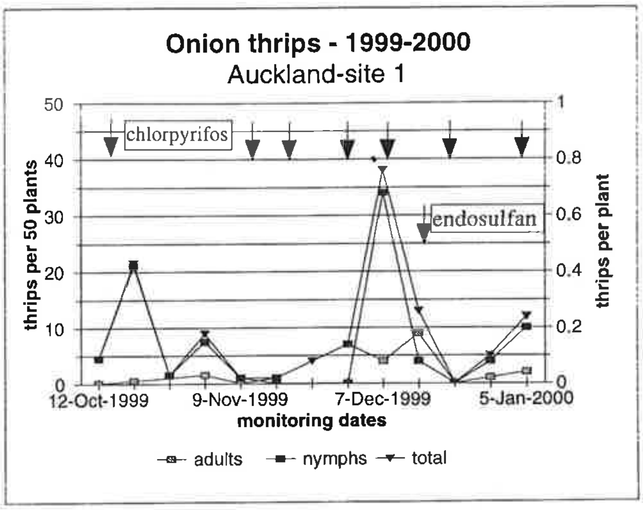

Figure 1b: Numbers of juvenile and adult onion thrips insecticide applications.

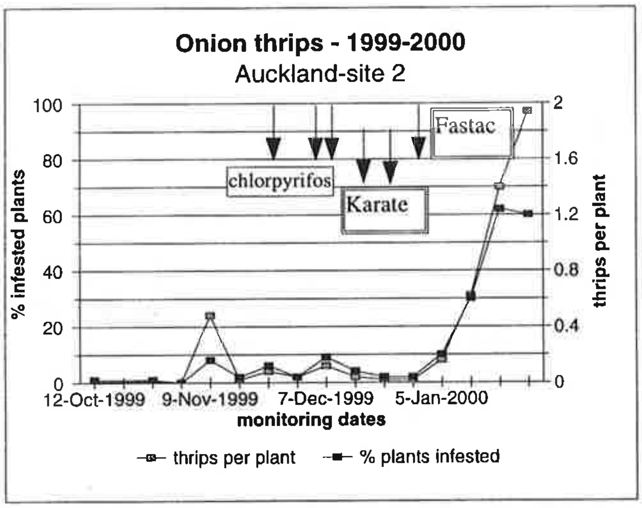

Figure 2a: Proportion of onion plants infested with onion thrips and numbers of thrips per plant with insecticide applications.

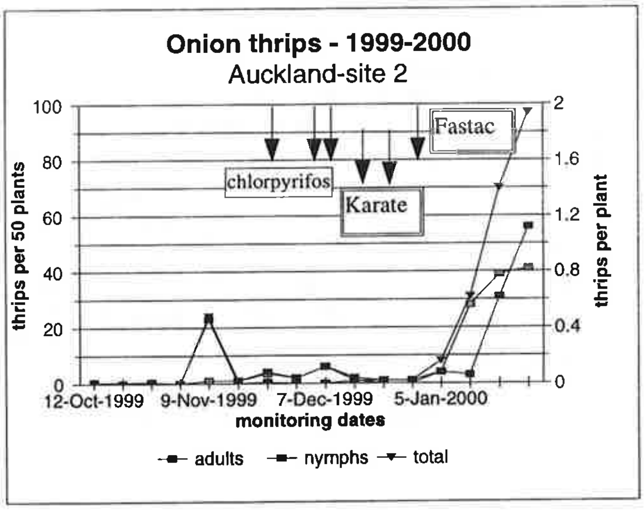

Figure 2b: Numbers of juvenile and adult onion thrips insecticide applications.

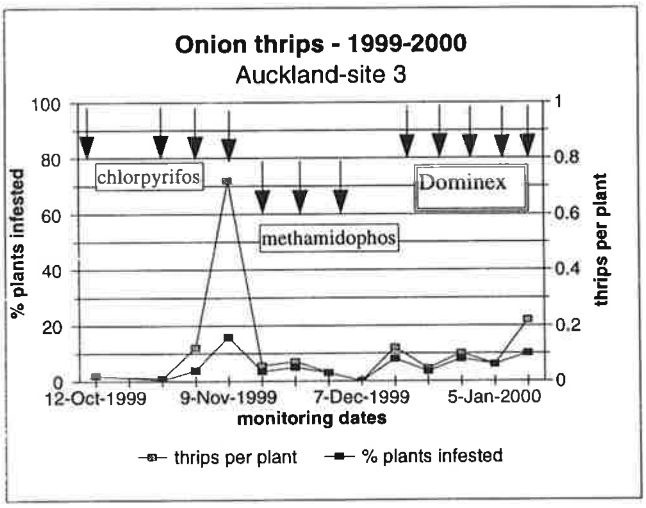

Figure 3a: Proportion of onion plants infested with onion thrips and numbers of thrips per plant with insecticide applications.

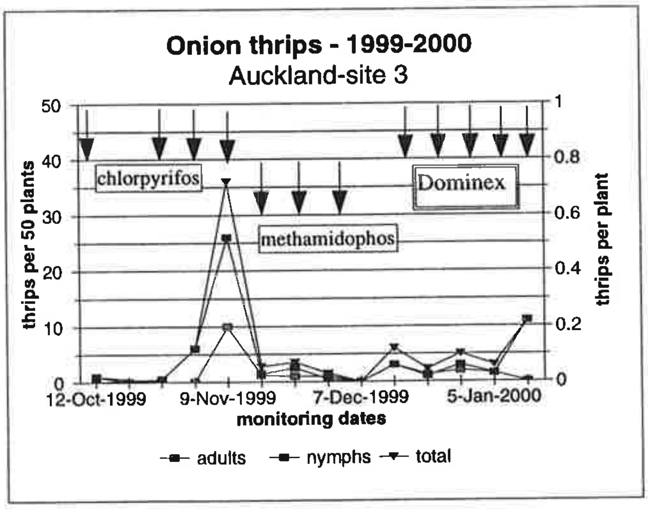

Figure 3b: Numbers of juvenile and adult onion thrips insecticide applications.

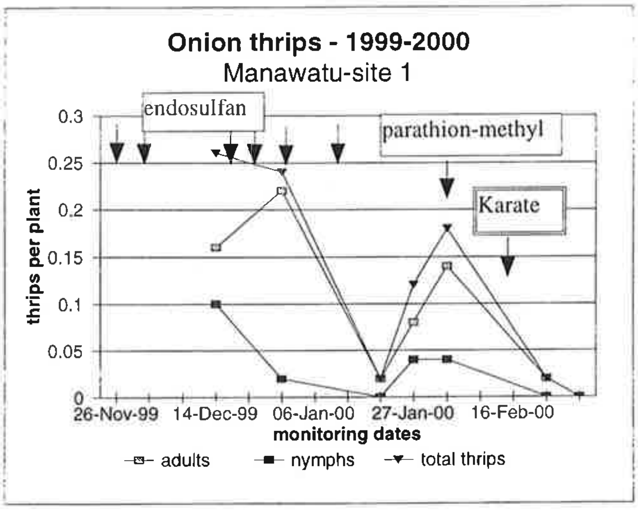

Figure 6: Numbers of juvenile and adult onion thrips with insecticide applications.

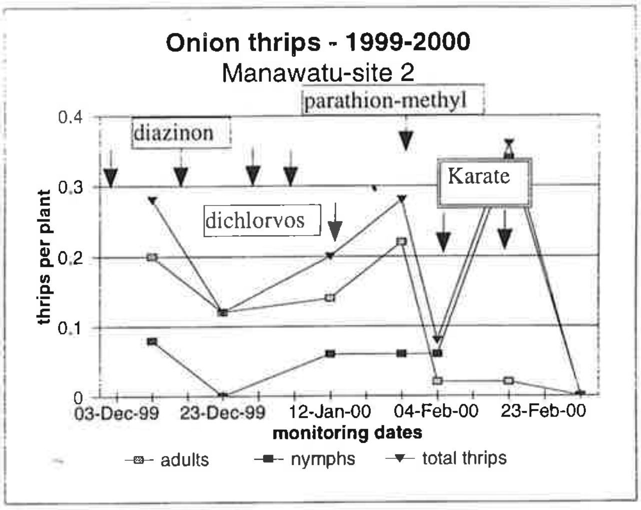

Figure 7: Numbers of juvenile and adult onion thrips ɩ insecticide applications.

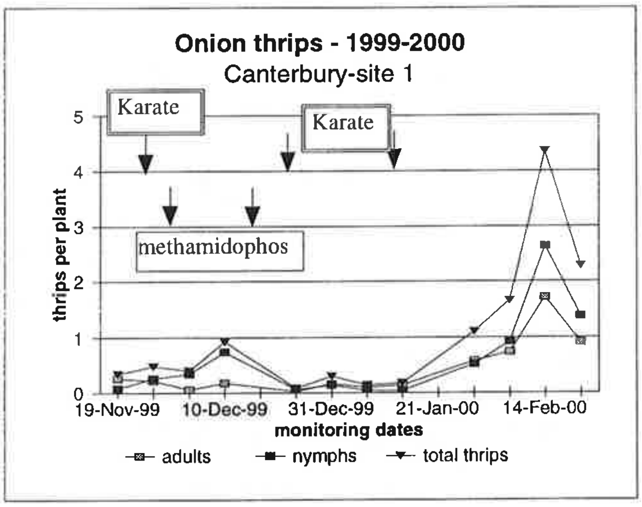

Figure 8: Numbers of juvenile and adult onion thrips with insecticide applications.

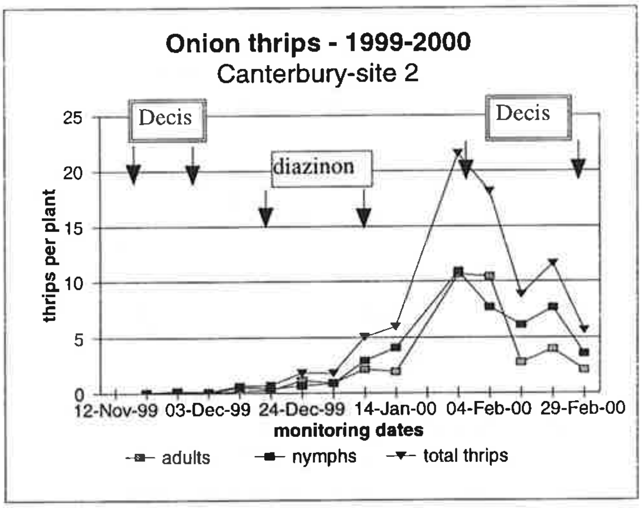

Figure 9: Numbers of juvenile and adult onion thrips ɩ insecticide applications.

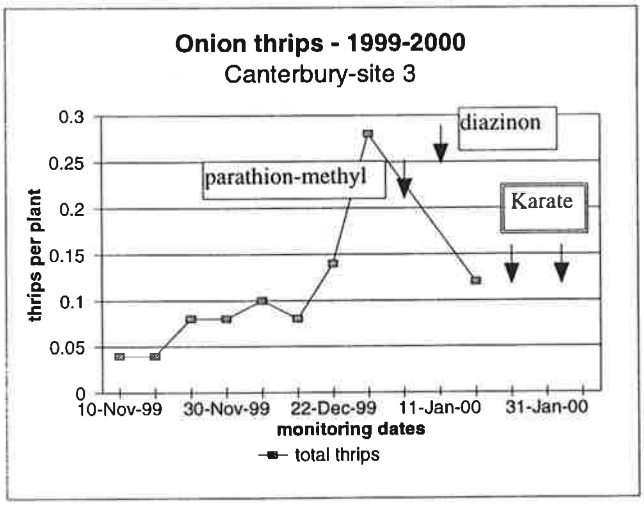

Figure 10: Numbers of juvenile and adult onion thrips with insecticide applications

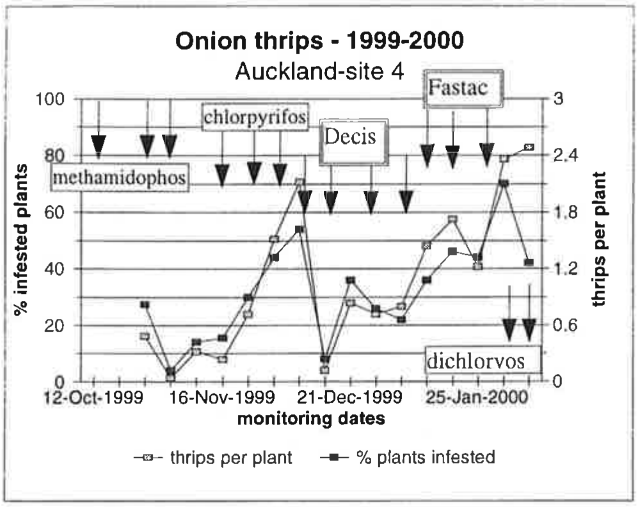

Figure 4a: Proportion of onion plants infested with onion thrips and numbers of thrips per plant with insecticide applications.

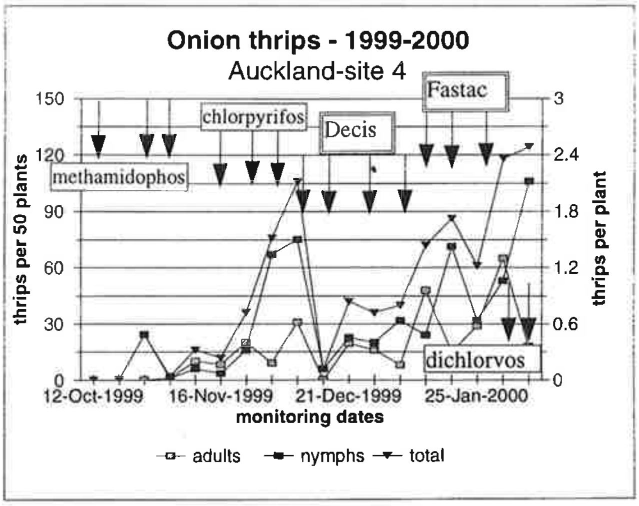

Figure 4b: Numbers of juvenile and adult onion thrips insecticide applications.

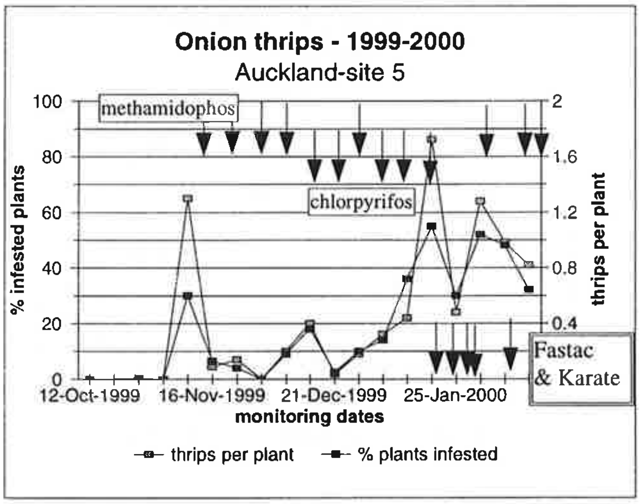

Figure 5a: Proportion of onion plants infested with onion thrips and numbers of thrips per plant with insecticide applications.

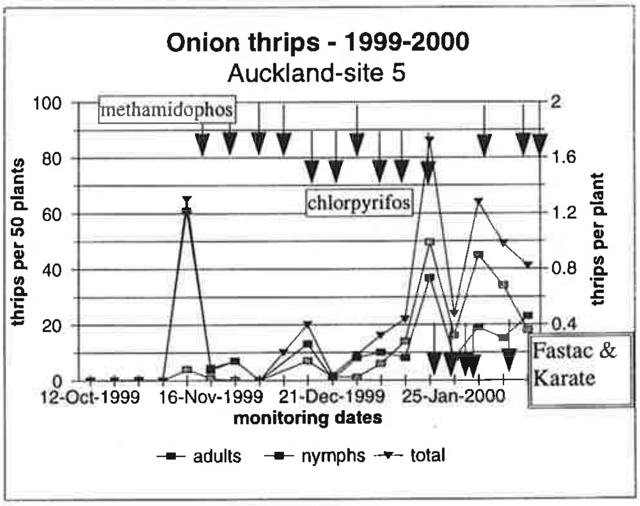

Figure 5b: Numbers of juvenile and adult onion thrips insecticide applications.

6 Discussion

Growers maintained much better field control of onion thrips in 1999/00 than in the previous year. This was probably due to a combination of a lower action threshold and use of more effective insecticides, especially in the Auckland region.

It is difficult to assess the suitability of the 0.1 thrips per plant action threshold for two reasons. Firstly, several crops received the first spray of a cluster when the last count was lower than the threshold and, secondly, crops that were sprayed after the threshold was exceeded often did not receive an effective cluster of sprays, i.e. only a single spray or sprays at too wide an interval were applied. The suitability of the current threshold depends on the effectiveness of available insecticides and the number of thrips per plant at top fall that are acceptable. More information is needed before the current threshold can be confirmed as appropriate.

In general, growers observed the insecticide use recommendations in the onion thrips resistance management strategy, although there were breaches of most aspects of it by at least one grower. This indicates that greater effort is required to ensure growers are thoroughly familiar with all of the key elements of the strategy, namely that:

- once a decision has been made to spray, a cluster of sprays of a product should be applied and not just a single application,
- the time interval between sprays in a cluster should be kept suitably short,
- chemicals should be rotated,
- all SP insecticides should be regarded as one 'chemical', and
- all SP products should be clearly recognised by growers as belonging to this chemical class.

The field data indicated that most chemicals were effective at least some of the time. The increase in thrips numbers during a cluster of chlorpyrifos sprays may be due to a longer than desirable interval between sprays. This chemical is not persistent, whereas methamidophos is very persistent. There was also strong evidence (Fig. 4) of effective use of at least two applications of an SP (Decis) in a population in which subsequent testing confirmed there were resistant insects. This indicates that the strategy is working and that SPs have a role to play in it.

The number of insecticides applied varied from 4 (C-3) to 18 (A-5). The two Auckland crops that received more than 10 sprays were late crops and were infected with SP-resistant thrips. High populations in two Canterbury crops were probably associated with poor timing of spray applications rather than with the use of clusters of sprays and the choice of insecticides.

7 Acknowledgements

Karyn Froud (HortResearch) for providing data on the percentage infestation of plants and mean numbers of thrips per plant in Auckland, and to Rob Petry and Lisa Jamison (HortResearch) for monitoring the Auckland sites. To the various consultants and growers for providing the results of the field monitoring and the spray application data. To the growers for allowing their crops to be used, and to Richard Wood for co-ordinating the study and for collating and passing on the information about the crops.