THRIPS CONTROL ON STONEFRUIT AT HARVEST WITH FLUVALINATE

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SUMMARY

The use of fluvalinate at low application rates for preharvest control of thrips on peach (*Prunus persica*) fruit was investigated. Peach fruits were sampled at local market maturity (var. Redhaven) and export market maturity (var. Flamecrest) for thrips. The New Zealand Flower Thrips (*Thrips obscuratus*) was the predominant species present. Low application rates of fluvalinate (20% to 5% of recommended field rates) reduced thrips infestation on both peach varieties. On Flamecrest one application of fluvalinate at 10% of field rates, 15 days prior to harvest, was more effective at reducing thrips infestation than the current recommended spray programme.

INTRODUCTION

The New Zealand Flower Thrips is strongly attracted to ripening stonefruit, including apricots, nectarines and peaches. Large populations are often found in stonefruit orchards during harvest where adult female thrips feed and oviposit on the fruit and some larvae hatch before the fruit is picked. Feeding damage is minor unless infestations are severe. The main economic problem is due to contamination of export fruit by thrips adults, eggs and larvae.

Present preharvest control strategies for thrips on fruit of stonefruit rely on applications of the short residual action carbamate insecticide, carbaryl (60 g/100 litres), 14 days prior to harvest, immediately prior to harvest and at 7 day intervals during harvest (Anon 1987). Field treatments do not give complete control of adult and larval thrips on peaches and nectarines so postharvest treatments have also been investigated (McLaren and Dale 1987). These add further costs to stonefruit production. Improvement in preharvest controls would be a significant development.

Some pyrethroid insecticides have important repellent and antifeedant properties useful in pest control in addition to their direct toxicity (Elliot *et al* 1978). Fluvalinate is a pyrethroid with known contact action against thrips as well as other insects (O'Connor 1987). Penman *et al* (1986) showed that repellency was also an important factor in the activity of fluvalinate on spider mites.

In this paper we report the use of fluvalinate at low application rates for preharvest control of thrips on stonefruit.

MATERIALS AND METHODS

Field trials were conducted on two peach varieties, Redhaven and Flamecrest, in two stonefruit blocks in the Horticultural Research Area, Lincoln College, Canterbury, New Zealand.

A. Redhaven

Preliminary experiments were aimed at giving an indication of fluvalinate activity during the period of peak thrips abundance (Teulon unpubl.) and providing fruit for residue analysis. These were conducted on four adjacent peach trees (var. Redhaven) from within a group of 12 in a mixed variety stonefruit block. Trees were in their 7th year of fruiting and received no insecticide applications after 1/12/86 other than those described below. Single trees were treated with fluvalinate (Mavrick Aquaflo, flowable formulation) at full recommended field rate (4.5 g/100 litre), at 20% and 10% of field rate, and one tree was untreated. Insecticide was applied to half of the tree (north side) with a motorised back-pack sprayer (Solo Model 423) on 13/1/87, 13 days

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before harvest. About 5 litres were applied to each half tree (400 trees/ha).

Ten fruit from the treated half of each of the four trees were harvested at local market maturity (26/1/87). Fruits were picked and placed separately into plastic bags which were then sealed. The fruit was examined for thrips immediately on return to the laboratory. Adult thrips (both live and dead) were removed and counted for each fruit. Later they were mounted on slides and identified to species. Egg infestation was established by boiling peach skins in lactophenol and aniline blue and examining the skin under a binocular microscope (Teulon unpubl.). Larval infestation was determined using a binocular microscope.

The diameter of each fruit was measured and its surface area determined assuming that a peach fruit approximated the shape of a sphere. In this way infestation levels for thrips could be expressed in terms of numbers per unit area of peach skin. Five additional fruit were picked from each fluvalinate treated tree, wrapped in tin foil and deep frozen for late pesticide residue analysis using gas liquid chromatography (J. Read, pers. comm.).

Detailed statistical analysis was not undertaken with Redhaven peaches because replication was inadequate.

B. Flamecrest

Twenty-four trees bearing at least eight fruit per tree were selected from two adjacent rows of 1 year old peach trees (var. Flamecrest) in a mixed stonefruit block. These trees received no insecticide applications after 27/12/86 other than those described below. The following four treatments were randomly assigned to six individual trees:

1. Untreated. No insecticide application.
2. Carbaryl. (Septan 800, 80% WP, 80 g/100 litre). Applied on 3/2/87, 15 days before harvest and 17/2/87, 1 day before harvest.
3. Fluvalinate. 10% field rate (0.45 g/100 litre). Applied on 3/2/87, 15 days before harvest.
4. Fluvalinate. 5% field rate (0.22 g/100 litre). Applied on 3/2/87, 15 days before harvest.

Insecticide was applied with a hand-pump back-pack sprayer. Trees were sprayed to runoff, about 5 litres per six trees (1110 trees/ha). Fruit were harvested at export ripeness (18/2/87) and placed separately in plastic bags which were then sealed.

Samples were placed in lined packing cartons and placed in a cool room at 0 °C for 19 hours. Thrips numbers were determined as for Redhaven but larvae were not counted.

The remaining fruit were removed from the trees, wrapped in tin foil and deep frozen. From these a pooled subsample of five fruit per treatment was analysed for residues.

Flamecrest results were analysed using the Kruskal Wallis test with pairwise comparisons of the treatments (Hettmansperger 1984) for total adult and egg counts. Because live thrips are the main problem in export produce and, in these experiments, some thrips were killed in the sampling process, no distinction was made between live and dead thrips in the analysis. It is not clear whether reduced numbers of dead thrips is of any practical importance (McLaren and Dale 1987).

RESULTS AND DISCUSSION

On Redhaven peaches all treatments of fluvalinate reduced the number of thrips adults, eggs and larvae in comparison with the untreated tree (Figure 1). Adults and eggs were found on fruit from all treatments but none of the adults or larvae found on fruit treated at the full rate of fluvalinate were alive. Adults and dead larvae only were found on fruit treated with 20% field rate of fluvalinate and only one live larva was found on all fruit treated with 10% field rate of fluvalinate. All adult thrips were identified as *T. obscuratus* females except for one male. This preliminary experiment suggested that even lower rates of fluvalinate should be tested in the subsequent trial.

Adult and egg counts for Flamecrest peaches (Figure 2) had high standard deviations due to zero counts within the samples, but the Kruskal-Wallis test showed significant differences between treatments for total adults ($p < 0.025$), and eggs

($p < 0.005$). Significant differences between rank sums of treatments at $p < 0.05$ are shown in Table 1. There was no significant difference in thrips infestation on fluvalinate (5%) treated, carbaryl treated, and untreated fruit. Fluvalinate (10%) applied once prior to harvest was significantly more effective at reducing the total number of adults and eggs than the two carbaryl applications at full rates. Adults were identified as *T. obscuratus* females (68), males (4) and *Thrips tabaci* females (21).

Fig. 1: Mean number of thrips on Redhaven peaches harvested for local market. A. Adults, B. Eggs, C. Larvae. CI = 0.05.

Successful control at low application rates in these trials and earlier evidence of repellency with mites (Penman *et al* 1986) all suggest that fluvalinate repellency, rather than direct toxicity, is of major importance in reducing thrips infestation on peach fruit. No measure of direct toxicity was obtained in these experiments. Egg numbers, a possible source of export contamination, were higher in the carbaryl treatments than in fluvalinate (10%) (Table 1) which suggests that carbaryl may not have been effective in limiting oviposition by thrips throughout fruit maturity. The short persistence of carbaryl may allow thrips to oviposit on fruit between treatments. A single application

Fig. 2: Mean number of thrips on Flamecrest peaches harvested for export. A. Adults, B. Eggs.

of fluvalinate (10%) applied 15 days prior to harvest remained effective in reducing total egg numbers. One important feature of carbaryl reported by McLaren (1985) is its ability to continue to kill thrips after several days in the coolstore. This was not taken into consideration in this trial as fruit were kept in the coolstore for only 19 hours after harvest.

Residue levels of fluvalinate detected in fruit sampled from the different treatments are found in Table 2. In New Zealand present maximum residue levels (MRL) on stonefruit require nil residues of fluvalinate at harvest. Fluvalinate is registered for use over the flowering period. MRL's for use of fluvalinate overseas are uncommon but in France there is a 7 day withholding period on peach with an MRL of 0.1 ppm (J. Read pers. comm.). Residue levels detected at all rates used on both varieties in these trials fell well below these figures.

Higher thrips numbers were found on Redhaven in comparison to Flamecrest peaches because Redhaven fruit were harvested when they were more mature and at peak thrips flights. Teulon (unpubl.) has shown that fruit infestation increases with fruit maturity. Flamecrest peaches which ripen later than Redhaven were harvested after peak thrips activity and at export maturity. In spite of lower thrips numbers, treatment of Flamecrest with a 10% field rate of fluvalinate gave significantly better control than the normal carbaryl programme.

TABLE 1: Rank sums for thrips counts on Flamecrest peaches at harvest.

Treatments	Adults	Eggs
Untreated	116a*	116a
Carbaryl	79a	89a
Fluvalinate 5%	70ab	69ab
Fluvalinate 10%	35b	26b

* Letter indicates absolute differences of rank sums at $p < 0.05$.

Thrips are active fliers and are likely to migrate into orchards throughout the period of fruit maturity. Because of this, single or half-tree applications would have been subjected to higher infestation pressures than would occur if a whole block was treated. The possible repellent action of fluvalinate may be enhanced by larger scale applications. Given appropriate residue clearances fluvalinate may provide a low rate, single application strategy for preharvest thrips control.

TABLE 2: Residue levels of fluvalinate detected on ripe peach fruit.

Variety	Treatment	Residue mg/kg*
Redhaven	Full fluvalinate	0.02
Redhaven	20% fluvalinate	0.03
Redhaven	10% fluvalinate	none
Flamecrest	10% fluvalinate	0.01
Flamecrest	5% fluvalinate	0.02

* Calculated on the whole fruit including the stones. Limit of detection was estimated to be 0.01 mg/kg.

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