EFFICACY OF NEW PESTICIDES AGAINST SIXSPOTTED MITE *EOTETRANYCHUS SEXMACULATUS* (RILEY) (ACARI: TETRANYCHIDAE) ON AVOCADOS

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ABSTRACT

Sixspotted mite, *Eotetranychus sexmaculatus* (Riley) (Acari: Tetranychidae) has been causing severe damage to avocado trees in New Zealand in recent years. The majority of the damage has occurred in Northland, in the Whangarei and the Far North growing regions. High populations of sixspotted mite can cause severe defoliation of trees from spring until mid-summer and occasionally in autumn. Control options for sixspotted mites compatible with the Avogreen® system are required urgently. This report details a spray trial using single tree plots to evaluate new or potential miticides to control sixspotted mites in avocados. The results of this trial indicate that Mit`e mec® with and without Excel™ Oil®, Avid® and Excel™ Oil® and possibly Acramite have the potential to reduce infestations of sixspotted mites on avocados. These products also have the potential to become part of an integrated pesticide resistance management programme in the medium term, before more desirable non-chemical methods for controlling sixspotted mites are found.
Keywords: pest control, miticides

INTRODUCTION

Sixspotted mite, *Eotetranychus sexmaculatus* (Riley) (Acari: Tetranychidae) has been causing severe damage to avocado trees in New Zealand in recent years. The majority of the damage has occurred in Northland, in the Whangarei and the Far North growing regions. High populations of sixspotted mite can cause severe defoliation of trees from spring until mid-summer and occasionally in autumn. Control options for sixspotted mites compatible with the Avogreen® system are required urgently.

This report details a spray trial to investigate miticides to control sixspotted mites. The aim was to evaluate a range of pesticides against sixspotted mites that would be compatible with either an integrated mite control strategy or organic production.

There are very few pesticides currently registered for avocados that are effective in suppressing mite populations and none are registered for this use. Lorsban® a broad-spectrum organo-phosphate and the avermectin product Avid® with Excel™ Oil® are both being used with some success to control sixspotted mites in avocado crops. The use of Lorsban® is not sustainable in the long-term as it is likely to be withdrawn from the market in the near future. Avid® with Excel™ Oil® gives reasonable control of sixspotted mites during periods of active growth. However to avoid the rapid build-up of resistance by the mites to this product it is wise to investigate alternatives and to assess the efficacy of other products.

There are a number of selective miticides registered on other crops and new miticides being developed that may be able to control sixspotted mites without disrupting biological control. These products would also allow a resistance management strategy to be developed by allowing the rotation of chemicals from different chemical groups.

Acramite (Nufarm NZ Ltd) is a selective miticide belonging to a new class of miticides (Carbazate) that acts as an antagonist to the nervous system. This is being researched on pipfruit, stonefruit and berryfruit in New Zealand. Natrasoap (Yates NZ Ltd) is a new insecticidal soap formulated using potassium salts combined with fatty acids in a vegetable oil base that has a label claim for mites in summerfruit. This is an organic product and is exempt from residue issues.

Mit`e mec® (Yates NZ Ltd.) is a milbemectin based miticide. The active ingredient belongs to the macrocylic lactone chemical group which Avid (abamectin) also belongs to. However it is reputed to be effective at controlling Avid®-resistant mites so may be useful in a resistance management strategy. It is also said to have better activity against mite eggs than Avid®. It is expected that this product will be registered in apples this season and Yates NZ Ltd. is developing Mit`e mec® towards a label claim in avocados.

The use of these products in a resistance management strategy would provide the best medium term solution for sustainable management of sixspotted mites in avocado.

MATERIALS AND METHODS

A small-plot field trail comparing the efficacy of seven pesticide treatments against sixspotted mites was carried out in a Whangarei orchard with a high sixspotted mite population. Eighty experimental trees were set aside for the purposes of the trial and no other sprays were applied to these trees over the period of the trial.

The trial was conducted in January/February 2002 and consisted of seven treatments and an untreated control (Table 1).

Table 1 List of products used in sixspotted mite spray trial

Product	Rate per 100ml
Acramite	50 mls
Natrasoap (organic)	2 %
Mit`e Mec®	75 mls
Mit`e Mec® + Excel™ Oil®	75 mls + 0.5 %
Mit`e Mec®	150 mls
Avid® + Excel™ Oil®	37.5 mls + 0.5 %
Excel™ Oil®	0.5 %
Unsprayed control	-

Single tree plots were allocated in a randomised block design with ten replicates of each treatment. Three applications were applied at 7-10 day intervals (depending on weather conditions) as outlined in Table 2.

Table 2 Spray application and assessment dates

Spray/ assessment	Dates	Spray conditions
Assessment 1 – pre-spray	7 January 2002	-
Spray 1	16 January 2002	Fine, nil to slight cloud cover, nil to slight breeze.
Spray 2	24 January 2002	Fine, nil to slight cloud cover, nil to slight breeze.
Assessment 2	30 January 2002	-
Spray 3	31 January 2002	Fine, nil to slight cloud cover, nil to light gusty breeze at finish.
Assessment 3 – final	7 February 2002	-

Samples of 20 leaves per tree were collected into pre-labelled bags prior to the first spray, after the second spray and after the third spray (Table 2). Sample leaves were selected randomly from the whole circumference of the tree avoiding the new flush leaves. Leaves were collected from 7am to 10am on all occasions and transported to Auckland in chilli-bins with frozen cooler pads for assessment. Leaves were microscopically examined and all stages of sixspotted mites, including eggs, were recorded within 36 hours of collection. The mean number of mites/leaf and the percentage of infested leaves in each treatment were determined. The percent decrease of both mean number of mites per leaf and the percentage of infested leaves, was also calculated. Data was analysed using Analysis of Variance. Least Significant Differences were calculated to separate individual treatments where a significant difference was shown.

All analysis was carried out using the statistics programme SAS (SAS Institute 1985). Percentages were angular transformed prior to analysis, however untransformed percentages are shown in tables. Following analysis of the pre-spray assessment results there were no significant differences between blocks and the final trial layout was assigned as shown in Appendix 1. The trial trees were marked with colour coded tree tape.

Foliar condition was observed for each tree after the final spray to determine whether any of the treatments caused any phytotoxicity.

RESULTS

Prior to the spray applications there were very high numbers of mites on the trees and evidence of recent leaf drop below the trees. There were no significant differences between trees in the percentage of infested leaves (58-71%) or the mean number of mites per leaf as detailed in Table 3. At the first post-spray interim assessment (after two sprays) the overall numbers of mites in all treatments had reduced including the control as shown in Table 3. By the third (final) assessment following three spray applications the overall mite numbers had reduced again for all

treatments and the unsprayed control. However, trees from four of the treatments (the three Mit`e mec® and the Avid® + Excel™ Oil®) had significantly lower percentages of leaves infested with mites than the control trees (Table 3).

Table 3 Numbers of sixspotted mites and percentage of leaves infested on avocado leaves before spraying and after three sprays of eight treatments. Values are means ± standard errors of means.

Treatment	Percent infested leaves (± sem)	Mean number of mites/leaf (± sem)
Pre-spray assessment 7 January 2002		
Unsprayed	61.0 ± 6.2 a[1]	4.9 ± 0.8 a*
Acramite	58.0 ± 6.8 a	4.9 ± 1.3 a
2% Natrasoap	69.0 ± 8.3 a	7.2 ± 2.0 a
Mit`e Mec® 75 ML	58.5 ± 5.1 a	3.6 ± .07 a
Mit`e Mec® 75 ML + Excel™ Oil®	58.5 ± 4.6 a	3.5 ± 0.7 a
Mit`e Mec® 150ML	71.0 ± 5.7 a	5.6 ± 1.2 a
Avid® + Excel™ Oil®	66.5 ± 8.1 a	4.7 ± 1.1 a
0.5% Excel™ Oil®	58.5 ± 5.7 a	4.0 ± 0.5 a
P value	0.6247	0.3551
Post-spray interim assessment 31 January 2002		
Unsprayed	17.5 ± 2.1 ab	0.7 ± 0.2 b
Acramite	7.5 ± 2.4 cd	0.4 ± 0.2 b
2% Natrasoap	25.5 ± 6.8 a	1.5 ± 0.6 a
Mit`e Mec® 75 ML	10.0 ± 4.6 cd	0.4 ± 0.2 b
Mit`e Mec® 75 ML + Excel™ Oil®	8.0 ± 2.7 cd	0.3 ± 0.1 b
Mit`e Mec® 150ML	9.5 ± 2.7 bcd	0.2 ± 0.1 b
Avid® + Excel™ Oil®	4.5 ± 1.6 d	0.2 ± 0.1 b
0.5% Excel™ Oil®	18.0 ± 4.0 abc	0.9 ± 0.3 ab
P value	0.0079	0.0151
Post-spray final assessment 7 February 2002		
Unsprayed	5.5 ± 1.6 a	0.16 ± 0.06 ab
Acramite	3.0 ± 1.3 ab	0.09 ± 0.05 b
2% Natrasoap	6.5 ± 1.8 a	0.30 ± 0.14 a
Mit`e Mec® 75 ML	1.0 ± 1.0 bc	0.01 ± 0.01 b
Mit`e Mec® 75 ML + Excel™ Oil®	0 c	0 b
Mit`e Mec® 150ML	0.5 ± 0.5 bc	0.01 ± 0.01 b
Avid® + Excel™ Oil®	0.5 ± 0.5 bc	0.05 ± 0.05 b
0.5% Excel™ Oil®	5.0 ± 1.7 a	0.10 ± 0.04 b
P value	0.0001	0.01

[1]Numbers within the same column for each assessment date with the same letter are not significantly different.

The results were analysed to account for the mite population decrease in all treatments including the control (Table 4). Following the final spray the percentage decrease in infested leaves and mean number of mites per leaf showed a significantly larger decrease in all the Mit`e mec® and the standard (Avid® + Excel™ Oil®) treatments compared to control trees. Natrasoap and 0.5% Excel™ Oil® treated leaves resulted in a similar percentage decrease in mite infestation and number of mites per leaf to the unsprayed control. The percent decrease in infested leaves for Acramite was intermediate between the unsprayed control and the Mit`e mec® and Avid® treatments.

No phytotoxic effects were observed during this trial for any of the treatments.

Table 4 Percent decrease in numbers of six spotted mites and percentage of leaves infested on avocado leaves before spraying and after three sprays of eight treatments. Values are means ± standard errors of means.

Treatment	Percent infested leaves (± sem)	Mean number of mites/leaf (± sem)
Post-spray interim assessment 31 January 2002		
Unsprayed	69.0 ± 5.3 b[1]	82.2 ± 4.0 bcd
Acramite	85.7 ± 4.6 a	91.8 ± 3.3 ab
2% Natrasoap	62.8 ± 8.6 b	73.3 ± 8.8 d
Mit`e Mec® 75 ML	84.8 ± 5.9 a	92.6 ± 3.3 ab
Mit`e Mec® 75 ML + Excel™ Oil®	85.9 ± 5.4 a	91.3 ± 4.1 abc
Mit`e Mec® 150ML	88.1 ± 3.1 a	96.4 ± 1.1 a
Avid® + Excel™ Oil®	92.3 ± 3.4 a	92.4 ± 4.5 a
0.5% Excel™ Oil®	68.0 ± 6.0 b	77.4 ± 6.5 cd
P value	0.0030	0.0092
Post-spray final assessment 7 February 2002		
Unsprayed	89.3 ± 3.5 c	96.9 ± 1.0 b
Acramite	94.9 ± 2.4 bc	97.1 ± 1.6 b
2% Natrasoap	90.1 ± 2.8 c	97.1 ± 0.9 b
Mit`e Mec® 75 ML	98.8 ± 1.3 ab	99.8 ± 0.2 a
Mit`e Mec® 75 ML + Excel™ Oil®	100 a	100 a
Mit`e Mec® 150ML	99.2 ± 0.8 ab	99.9 ± 0.1 a
Avid® + Excel™ Oil®	99.5 ± 0.5 ab	99.6 ± 0.4 a
0.5% Excel™ Oil®	91.8 ± 3.3 c	97.9 ± 0.9 b
P value	0.0001	0.0006

[1]Numbers within the same column for each assessment date with the same letter are not significantly different.

DISCUSSION

The aim of this trial was to evaluate a range of pesticides for controlling sixspotted mites. These pesticides were specifically selected for their compatibility with an integrated mite control strategy or organic production system.

Mite numbers at the start of the trial were very high at the trial site. The subsequent decline in mite numbers over the trial period was characteristic of sixspotted mites particularly over the January to March period (Stevens *et al*. 2001). The reduction in mite numbers was most likely due to either hot weather or the influence of natural enemies in the orchard. The reduction in the mite population did not markedly effect the relevance of the results, as we observed a difference in the rate of decrease between treatments.

There were no phytotoxic effects observed in any of the treatments for the duration of the trial, however, the sprays were only applied on three occasions during January. It is possible that sprays applied over a wider application period could result in phytotoxicity and this should be monitored carefully. It is of note that the application of Excel™ Oil® alone did not significantly reduce mite numbers.

These products may be harmful to any natural enemies already present in the orchard such as *Stethorus* ladybirds and predatory mites. More information on the compatibility of these pesticides with natural enemies would be desirable.

SUMMARY

The results of this trial indicate that Mit`e mec® with and without Excel™ Oil®, Avid® and Excel™ Oil® and possibly Acramite have the potential to reduce infestations of sixspotted mites on avocados. These products have the potential to become part of an integrated pesticide resistance management programme in the medium term, until more desirable non-chemical methods for controlling sixspotted mites are found.

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