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THE ROLE OF TWO INSECTICIDES IN CONTROLLING INSECT PESTS OF AVOCADOS

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ABSTRACT

The *efficacy of two insecticides, methamidophos and monocrotophos as stem treatments, were assessed at three trial sites (Zebediela Estate, Westfalia Estate and Kiepersol) on mature Hass avocado trees.*

The insecticide treatments showed no phytotoxicity symptoms or detrimental effect on flowering and fruit set. Although the infestation levels were low, insects on fruit and leaves were controlled.

INTRODUCTION

An increase in the avocado pest complex and seasonal variation of insect attack of avocado fruits has been reported (Dennill & Erasmus, 1991; Erichsen & Schoeman, 1992). The most important insects attacking fruits include the sap-sucking members of the taxa Thysanoptera, Pentatomidae, Coreidae, and Cicadellidae. Most of these pests are under good biological control by natural enemies, but pest outbreaks may occur frequently and losses to fruit can be extensive (Erichsen & Schoeman, 1993a;b).

The use of systemic stem treatments for pest control in citrus has largely been successful (Buitendag & Naudé, 1991; 1992). Stem treatments are compatible with biological control and no pest repercussions have been reported in the citrus industry (Buitendag & Naudé, 1992). The systemic action of the insecticide facilitates its distribution throughout the tree and has a number of advantages over other methods of insecticide application (e.g. soil application) (Buitendag & Naudé, 1992).

Insect pests that attack citrus are known also to occur on avocados (e.g. citrus leafhopper, flower & citrus thrips) and as a result of the success achieved with stem treatments on citrus, trials were carried out on avocados. No stem treatment insecticides are registered for use on avocados.

MATERIALS AND METHODS

Insecticide application

The insecticides, Citrimet (methamidophos), and Azodrin (monocrotophos) were applied to Hass avocado trees at three trial sites *viz.* Zebediela Estate,

Westfalia Estate, and at Lulu Farm (A.P. Vos en Seuns), Kiepersol. The ages of the trees at each trial site were 12, 14, and 15 years of age respectively. Trials began on 10 August 1992 and ended on 25 January 1993. At each trial site, 10 treatment trees (five for each insecticide) and five control trees were selected randomly throughout the orchard. The insecticides were applied every 21 days by 35 mm paintbrush to the trunks of the trees as per label instruction. The amount of insecticide applied was associated with the diameter of the tree trunk below the first branch.

Monitoring of avocado trees

The following was monitored every 21 days corresponding to visits for insecticide applications:

Flowering

Insecticide applications were applied to trees that had not yet begun to flower. Effect of the treatments on flowering was monitored by labelling two inflorescences per tree and counting the number of flowers developed per inflorescence.

Fruit set

Fruit set was monitored by counting the number of fruit that set on the same two inflorescences labelled for monitoring of flowers.

Tree growth

Growth of the tree was monitored with a phenological study on a branch selected on the northern side of the tree.

Phytotoxicity

Tree-trunk drawings from each of the trunks of the treatment and control trees were traced onto paper at commencement of the trial. Drawings were then matched against the trunks at the end of the trial and differences noted. Signs of leafburn were also noted.

Insect damage and presence

Damage by, and presence of, insects were noted on the leaves and fruit on each of the treatment and control trees. A maximum of eight single and four pairs of touching fruits and eight leaves were selected at random on each tree and examined for damage. Insects that were recorded on the leaves and fruits are tabulated (Table 1). All pests were recorded when they were seen on the fruit or the leaves, except in the case of citrus leafhopper where the presence of eggs oviposited on the leaves were counted.

TABLE 1 Insect pests recorded on fruit during the trial period at the three trial sites.

INSECT PEST	SITE RECORDED		
	Zebediela	Westfalia	Lulu Farm
THRIPS*			
Citrus thrips	yes	?	?
Flower thrips	yes	yes	yes
SCALE			
Palm scale	yes	yes	yes
Heart-shaped scale	no	yes	yes
OTHER			
Mites*	yes	yes	yes
Long-tailed mealybug	yes	yes	yes
Citrus leafhopper	yes	yes	yes

* Pest identiication to be confirmed.

RESULTS AND DISCUSSION

Flowering

Insecticide treatments had no adverse affect on flowering at any of the trial sites. Some trees, however, did not flower at all. In some cases, the flowering stage was missed when it took place between visits to the trial sites.

Fruit set

There was seemingly no difference in fruit set between treatment and control trees at each of the sites (fruit numbers were too low for statistical analysis). The amount of fruit present on each of the trees was in some cases as low as two. Although it was thought that these trees might flower later in the season, this did not occur and sampling of flowers and fruit from the trees did not take place. However, too few inflorescences were marked for an effective analysis of fruit set to take place. Many fruitlets were lost as a result of wind, mechanical damage, and natural fruit drop.

Tree growth

All marked branches exhibited normal growth and no deformations were recorded on the phenological branch.

Phytotoxicity

No phytotoxicity was recorded on any of the avocado trees at any of the sites. There were no discrepancies between trunk drawings taken from the beginning and end of the trial period. Large vertical splits were noticed on the rootstocks of the trees at Westfalia, but no increase in the size of the splits was observed. No leafburn as a result of insecticide treatments was observed.

Insect damage and presence

Damage to fruit at each of the trial sites was negligible (Table 2). At Zebediela, not one damaged fruit was obtained on the Citrimet treatment for the duration of the study (Table 2). The damage to fruit was too low for statistical analysis to be conducted.

TABLE 2 Percentage of fruit damaged on the two treatment and control sets of trees at the three trial sites, n=80 fruit per treatment per site.

SITES	CITRIMET	AZODRIN	CONTROL
Zebediela	0%	4%	9%
Westfalia	9%	13%	7%
Lulu Farm	12%	12%	28%

Zebediela Estate

Damage to fruit is tabulated (Table 2). Of the fruits inspected across the entire trial period, 13% exhibited insect damage and/or presence. No damaged fruits were recorded on the Citrimet treatment trees (Table 2). As a result of the total number of damaged fruit recorded for all treatments being very low (due to a low incidence of pest occurrence), it cannot be conclusively stated that the Citrimet treatment gave better control than Azodrin.

There was a significant difference in the percentage of insect infested avocado leaves between the insecticide treatments and the control ($P<0.001$) (Table 3). The percentage of infested leaves was similar for the insecticide treatments. Although the avocado pest-complex at Zebediela is very small, differences for each of the pests between the treatments and the control is evident (Table 4). Palm scale was only found on the control trees and no heart shaped scale was recorded from Zebediela. The number of leaves with *Penthimida bella* eggs was high for both the insecticide treatments and the control (Table 4).

TABLE 3 Percentage of insect infested leaves on the two treatment and control sets of trees at the three trial sites, n=720 leaves per treatment, and significant differences in the percentage leaves damaged between treatments are denoted by dissimilar lower case letters.

SITES	CITRIMET	AZODRIN	CONTROL
Zebediela	11% a	10% a	12% b
Westfalia	8% a	12% b	20% c
Lulu Farm	7% a	10% a	20% b

TABLE 4 Number of leaves infested with insect pests at Zebediela, n=720 leaves per treatment.

PEST	CITRIMET	AZODRIN	CONTROL
Thrips	2	4	5
Scale	-	-	6
Mites	-	-	-
Mealybug	-	1	1
Citrus leafhopper	78	71	83

Westfalia Estate

Damage to fruit is tabulated (Table 2). 29% of the fruit inspected over the entire trial period exhibited damage or presence of insects. The percentage of damaged fruit recorded for the control was less than that of the insecticide treatments (Table 2). This was not expected and is in contrast with the results found at Zebediela (Table 2) and Lulu Farm (Table 2) and no apparent reason for such a result is evident.

The percentage of leaves on which insects were recorded was significantly lower on the insecticide treatments than the number of leaves found on the control ($P<0.001$) (Table 3). The percentage of leaves recorded on the Citrimet treated trees was less than half and two-thirds of that found on the control and Azodrin trial trees respectively (Table 3). Citrimet was most effective in controlling leaf pests.

A difference for each of the insect pests between the insecticide treatments and the control is evident (Table 5). The treatment trees exhibited a lower number of leaves/insect presence than that of the control. The efficacy of Citrimet against mites and mealybug was better than that of Azodrin (Table 5). Buitendag & Naudé (1992) found similar results against mites and mealybug on citrus. The number of scale leaves from each of the insecticide treatments was similar, and less than that recorded from the control. The number of leaves with *P. bella* eggs was similar for both the treatments and the control leaves (Table 5).

Lulu Farm

Damage to fruit is tabulated (Table 2). 52% of the fruit inspected over the whole trial period exhibited insect damage or presence. The percentage of damaged fruit recorded from the insecticide treatments was less than that found on the control trees. Control of insect pests that damage fruit is apparent for both Citrimet and Azodrin (Table 2).

There was a significant difference in the overall efficacy of the treatments versus the control in controlling insect pests on avocado leaves ($P<0.001$) (Table 3). The percentage of leaves recorded on the insecticide treated trees was significantly lower than that found on the control trees (Table 3). The percentage of infested leaves recorded for the control was twice and thrice that of Azodrin and Citrimet respectively.

TABLE 5 Number of leaves infested with insect pests at Westfalia, n=720 leaves per treatment.

PEST	CITRIMET	AZODRIN	CONTROL
Thrips	1	-	5
Scale	34	32	80
Mites	2	31	28
Mealybug	5	17	20
Citrus leafhopper	16	10	10

TABLE 6 Number of leaves infested with insect pests at Lulu Farm, n=720 leaves per treatment.

PEST	CITRIMET	AZODRIN	CONTROL
Thrips	2	-	3
Scale	9	23	34
Mites	4	11	34
Mealybug	15	34	63
Citrus leafhopper	13	6	12

A difference for each of the insect pests between the treatments and the control was evident (Table 6). The number of leaves exhibiting insect damage/presence was lower on the insecticide treated trees than that of the control for all insect pests (Table 6). However, the efficacy of Citrimet against mites, mealybug and scale was superior to that of Azodrin. This was also found to be the case in citrus (Buitendag & Naudé, 1992). The number of leaves with *P. bella* eggs was similar for both the insecticide treatments and the control.

CONCLUSION

The results indicate that both Citrimet and Azodrin show promise for the control of insect pests on avocado (Tables 2 & 3). Insecticide treatments had no detrimental effect on flowering and fruit set, and no phytotoxic symptoms were observed. Control of insect pests on leaves and fruit was convincing, even though insect levels at the trial sites were low. However, some inconsistencies in control by the insecticides were found. At Westfalia Estate, control trees exhibited less damage to fruit than either of the insecticide treatments (Table 2). The efficacy of scale control by Citrimet and Azodrin at Westfalia and Lulu Farm differed (Tables 5 & 6). Although it is not known whether this was a result of resistance in the scale species, it is most unlikely because there is no annual insecticidal programme recommended for avocados.

ADDITIONAL RESEARCH

Research on the efficacy of the insecticides needs to be expanded before any conclusions can be made. Additional research is required in a number of areas. The

concentrations of insecticide used in the trials were those recommended for the control of pests on citrus. Suitable concentrations and number of applications needed to facilitate effective control of pests on avocados must be established. The circumference of the trunk of mature avocado trees is generally twice that of mature citrus trees and rates of absorption and translocation in avocado trees have not been established. In addition, methods of application must be investigated to achieve the best results for pest control.

The efficacy of the insecticides should be tested on a larger scale during a season of high insect pest pressure. Trials should be extended to include other avocado cultivars, and the effect of the insecticides on various rootstock-scion combinations established. In citrus, Citrimet and Azodrin applications cause gum exudation on Volckameriana rootstock, although this is not considered a serious problem as the trees recover quickly (Buitendag & Naudé, 1992).

Specific testing of the effect of the insecticides on various insect pests is required. Which insects are effectively controlled and the lethal doses involved needs to be established. It is also important to determine the effect of the insecticide on natural enemies (indirectly e.g. parasitism of scale). Control of citrus pests by Citrimet and/or Azodrin does not necessarily guarantee equal effectiveness against the same pest on avocados when following the same label instructions as for citrus.

Careful integration of insecticide applications and farming practices need to be studied. The effect of fertilization and irrigation on the efficacy of the insecticide also needs to be determined.

Residues in fruit and leaves must be investigated and safety periods established. In citrus, for example, Citrimet and Azodrin are not absorbed by fruit larger than golf ball size (Buitendag & Naudé, 1992).

This study has gauged the efficacy of Citrimet and Azodrin in controlling insect pests of leaves and fruit on mature avocado trees. The results are preliminary and serve as a foundation for further investigation into pest control on avocados. Although the use of insecticides is sometimes warranted, a biological control programme on avocados remains more beneficial in the long term.

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REFERENCES

BUITENDAG, C.H. & NAUDÉ, W. 1991. Navorsingsverslag met betrekking tot ondersoek uitgevoer in verband met die beheer van sitrus insekplae. *Entomologie Afdeling,* Nelspruit.

BUITENDAG, C.H. & NAUDÉ, W. 1992. Insecticide stems treatments for the control of

citrus pests. *Citrus Journal 2,* 5: 36 - 39.
DENNILL, G.B. & ERASMUS, M.J. 1991. A packhouse survey of insect damage to avocados in the Nelspruit/Hazyview area during 1990. *South African Avocado Growers' Association Yearbook* 14: 79 - 82.
ERICHSEN, C. & SCHOEMAN, A.S. 1992. Economic losses due to insect pests on avocado fruit in the Nelspruit/Hazyview region of South Africa during 1991. *South African Avocado Growers' Association Yearbook* 15: 49 - 54.
ERICHSEN, C. & SCHOEMAN, A.S. 1993a. Monolepta apicallis (Sahlberg) (Coleoptera: Chrysomelidae): a new addition to the avocado pest complex. *South African Avocado Growers' Association Yearbook* 16, (In press).
ERICHSEN, C. & SCHOEMAN, A.S. 1993b. Invasion of orchards by the avocado beetle, *Monolepta apicalis* (Sahlberg) (Coleoptera: Chrysomelidae): Assessment of damage to leaves and fruit. *South African Avocado Growers' Association Yearbook* 16, (In press).