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Integrated pest management considerations for Greenhouse Thrips control in coastal avocado orchards

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SYNOPSIS
The key pest causing economic damage on California's Hass fruit is the Greenhouse Thrips, Heliothrips haemorrhoidalis, *and chemical treatments using malathion are disrupting biological control of other pests. The IPM approach to pest management in avocados shows great prospects for reduced pesticide use and improved Hass fruit quality.*

INTRODUCTION

For many years, commercial avocado production in southern California was thought to be pest-free. Actually, the groves were benefiting from a high degree of biological control. As plantings have become more dense and time allowed the introduction and buildup of harmful pests, growers have found it increasingly necessary to apply pesticides to prevent foliage and fruit injury, which ultimately caused both increased costs of production and reduced sales incomes. The more pesticides were applied, the worse the overall pest problems became.

The previous paragraph illustrates not only what has been happening in the avocado industry, but also with many other commodities and areas. It is the prologue for what has been referred to as the Integrated Pest Management (IPM) approach - to monitor pest dynamics so as to judiciously apply safe pesticides only when absolutely necessary, to provide all appropriate conditions for biological control and to liberate effective parasites or predators when available.

The authors are the nucleus of those in California who are trying to apply the IPM approach to the avocado industry. This is a summary report of the first two seasons of this on-going effort. Other reports will cover other specific projects that are a part of this approach (see bibliography and companion unpublished article by Bailey, *et al:* 'Development of an IPM Program for California Avocados').

This article will specifically focus on the key pest problem of Greenhouse Thrips, *Heliothrips haemorrhoidalis,* on Hass variety fruit produced in coastal areas.

HISTORIC DEVELOPMENTS

Greenhouse Thrips (GHT) fruit scarring was a problem in coastal orchards which started in the 1930s and it was the subject of much research and writing by Ebling, the summary of which is presented in his book published in 1959 (2). This is not only the basic text on the subject, but very little research has been done since. Fleschner *et al* (3), and McMurtry *et al* (4) have continued to study biological control, introduced parasites and predators and pointed out the great importance of maintaining balances between pests and beneficials. The most recent review published on the developments and increased costs of pest control was by Bailey & Tourney (1) in 1985.

In the Santa Barbara and Ventura counties' coastal areas, the Hass variety is predominant and it is there that the major economic damage has been occurring for at least two decades. It is 'bad' because a large proportion of the Hass fruit is held on the trees through the warm summer months for late-summer and fall harvest, to take advantage of the higher prices during that period. With the injury-susceptible, mature fruit and the mild, humid coastal climatic conditions and with no effective biological control agent, the pest is checked only by spray treatments of malathion.

ECONOMIC DAMAGE AND IMPORTANCE

In recent years, as much as 75 per cent of the orchards have been sprayed, mostly by helicopter, usually in June or July. Unsprayed orchards have had as much as 80 per cent of the fruit scarred. More typically, unsprayed groves would experience one-fifth to one-third of the fruit being graded out as culls or standard grade fruit; the loss in grower income is from $1 250-$5000 per hectare. When compared to $65-$90 per hectare for pest control costs, the economic incentive to spray is obvious. This has been occurring in an area that totals about 6 000 hectares and that provides about half of the Californian Hass crop. Potential damage is estimated at a minimum of $10 million. Control costs probably total about $500000 annually; this gives a cost benefit ratio of 20:1.

However, other problems occur. Some growers have had to spray three or four times a year. Some have experienced economically damaging populations of other pests that are normally under satisfactory biological control, because the parasites and predators are killed by the malathion. These include Avocado Brown Mite, *Oligonichus punicae,* Six-Spotted Mite, *Eotetranychus sexmaculatus*, Omnivorous Looper, Sabulodea aegrotata, Avocado Leaf Roller, *Amorbia cuneana*, and Latania Scale, *Hemiberlesia* lataniae. For some of these pests there are no registered pesticides or for those that do have registered materials, they are either ineffective, expensive or difficult to apply to hillside orchards. In all cases, these pests could be under biological control.

Based on growers' requests for more research, the willingness of the University of California Co-operative Extension and Agricultural Experiment Station staff, special funds from the Production Research Committee of the California Avocado Commission, cooperation of many growers, pest control advisers and chemical company representatives, this programme is underway, and this is a first progress report.

RESEARCH METHODOLOGY AND RESULTS

After surveys, a hillside Hass orchard was selected at Summerland near Santa Barbara, which had medium populations of GHT and in which the grower agreed not to apply any pesticides. The mature trees were medium- to small-sized, not crowded, and within one to two miles of the Pacific Ocean. From this base orchard other observations and treatments can be accomplished.

At the Summerland site, weekly counts of pests and beneficials are made a representative sample of fruit and leaves. A thermograph is operated. Differential chemical and biological treatments are applied and evaluated weekly and monthly by counts on tagged fruit and representative leaves.

In July 1985, the two registered chemical controls - malathion and Pyrenonea - were compared with unregistered materials - acephate (Orthene®), fluvalinate (Spur®), abamectin (Avid®), ryania and sabadilla. Results are shown in Figure 1.

The acephate and fluvalinate clearly had the best results, with fair control by malathion and initial knock-downs by Pyrenone and sabadilla. No serious build-up of other pests occurred.

By July 1986, when the next applications were applied, fluvalinate was no longer available for trial and abamectin and ryania were discarded. For the second season it was decided to try a water check (to test the drowning of the spray potential) and a double treatment of the botanicals, on the theory that a second application three to four weeks later would kill the newly-hatched larvae. Briefly, the results in Figure 2 show that the water check made no difference and that the two botanicals – Pyrenone® and sabadilla - were not effective in satisfactorily killing either the first or second treatment. Acephate continued to perform well. No serious build-up of other pests occurred.

Late in 1986, McMurtry placed some experimental parasites on the monitor trees; it is too early yet to draw conclusions.

Plans are underway to continue monitoring the dynamics of pests and beneficials; to test the more promising pesticides again, especially to evaluate their effects on other potentially harmful pests; to further test improved counting and pest evaluation techniques; and to evaluate the potential for liberating parasites.

OTHER OBSERVATIONS

Early in 1985, the area experienced one of the hottest weeks in history - maximum daily temperatures were over 38°C and the hottest day at the Summerland site reached 41°C. The counts of GHT dropped by more than 50 per cent in subsequent weeks. Chemicals were applied a week later. In other orchards, where temperatures up to 45°C were recorded, nearly all the GHT were killed. This illustrated the potential for control by excessive heat.

In January 1987, a severe freeze occurred for three nights, with minimum temperatures at this site just below 0°C; the GHT populations, already low at this mid-winter period, dropped to nearly zero. This other extreme of climate is being illustrated as a control. It will be interesting to see what will happen to populations during the summer of 1987.

Extensive monthly counts have been made of predaceous mites, *Euseius* sp, on leaves. Close correlations have been noted between high populations of predaceous mites and low populations of Avocado Brown Mites and Six-Spotted Mites, When the predaceous mites disappear, the other pest mites begin increasing almost immediately, if untreated. No consistent observations could be made relating to the different pesticides tried, except the general trend of low predators causing higher harmful mites.

Another question for which a better answer can now be given is, how young are the Hass fruit when scarred? Observations are that the GHT can move on to young fruit by late summer of the fruit season, when the fruits are about five months old. They will stay on the fruit through the following winter - mostly between fruits in clusters - and until all the fruit surfaces have been scarred, or until the fruits are picked or fall off the following summer or fall,

SUMMARY

The key pest control problem in coastal Hass orchards is Greenhouse Thrips. Most other potential pest problems are controlled by beneficial insects, especially the predaceous mites on other mite pests. The existing registered materials - malathion and Pyrenone - are providing only fair control of GHT and in the case of malathion, are contributing to the elimination of beneficials on other potential pests.

Among the unregistered experimental materials, the most promising is acephate; continued trials are planned to particularly look at its effects on the biological control of avocado pests.

The dynamics and interaction of insects and mites and the materials applied in the orchards, are such that the prospects for the IPM approach to avocado pest management look very bright. This should result in fewer pesticide applications and improved Hass fruit quality.

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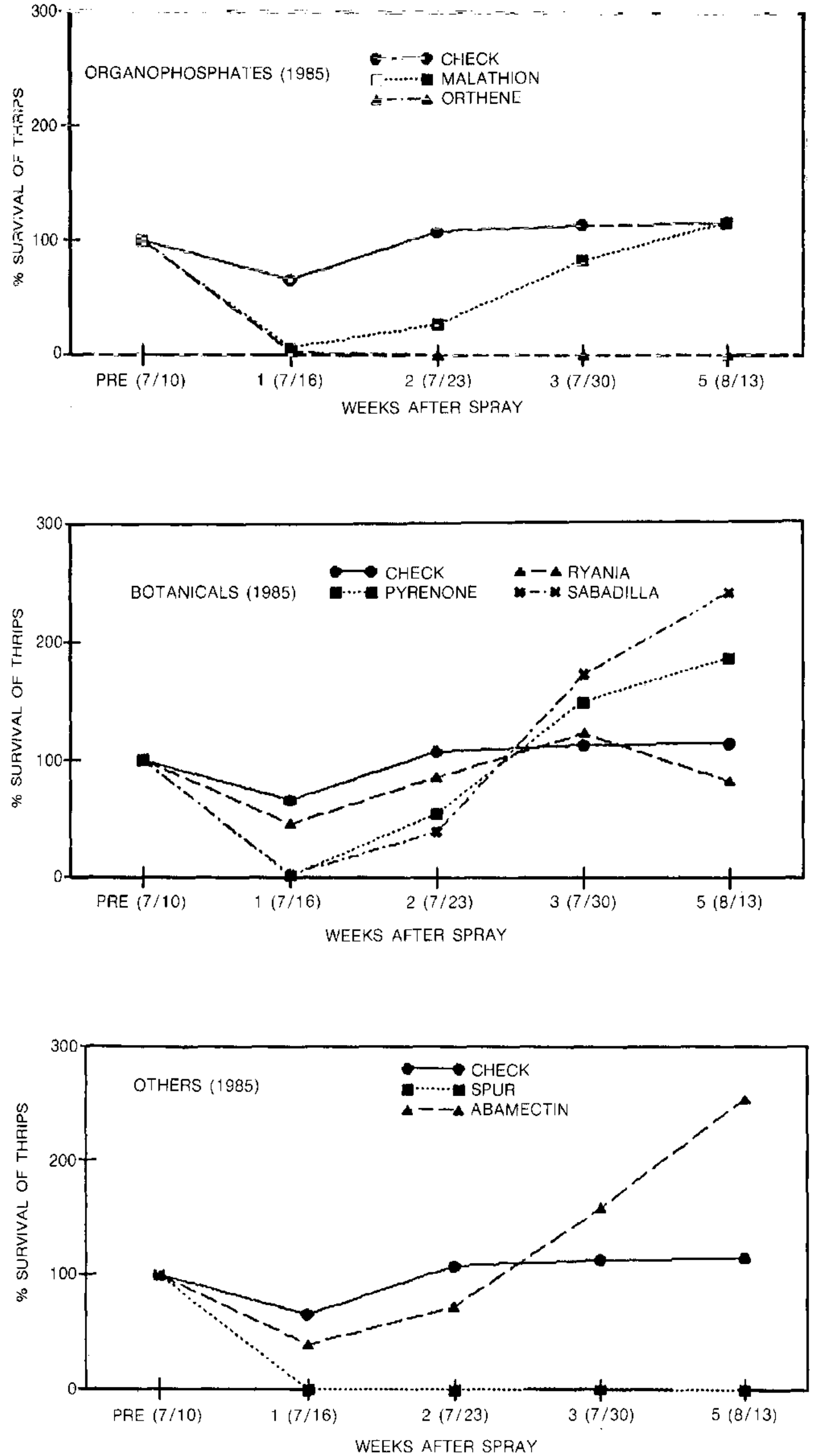

Fig 1 Thrips counts: (a) Organophosphates 1985; (b) Botanicals 1985 and (c) Others 1985.

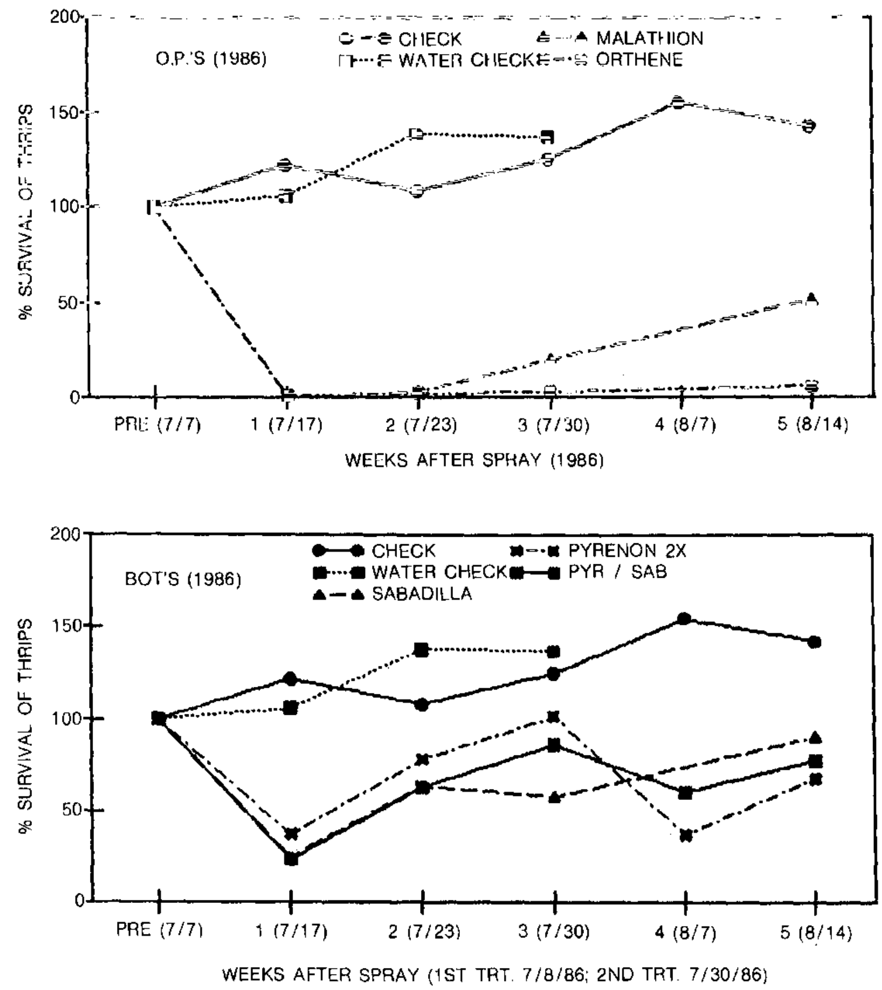

Fig 2 Thrips control: (a) OP's 1986 and (b) BOT's 1986.