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# Persea Mite Pesticide Efficacy Trial

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Persea mite, *Ollgonychus perseae* Tuttle, Baker, & Abbatiello (Acari: Tetranychidae), was first detected attacking avocados in California in San Diego County in 1990 (Bender 1993) and by the summer of 1993, had spread north to Ventura County (Hoddle 2000). By 1994 it was detected in Santa Barbara County and in 1996 had established in San Luis Obispo County. High mite densities (ca. 100-500 per leaf) and subsequent feeding can cause partial or total defoliation of trees, opening the tree canopy, increasing the risk of sunburn to young fruit, and causing premature fruit drop and reduced fruit size at harvest (see Fig. 1, Aponte & McMurtry 1997, Hoddle 2000).

A number of endemic natural enemies attack persea mite including the predatory phytoseiid mite *Euseius hibisci* (Chant), the coccinellid *Stethorus picipes* Casey, the six-spotted thrips, *Scolothrips sexmaculatus* (Pergande), and predatory cecidomyiids, *Feltiella* sp. Field trials evaluating commercially available phytoseiid mites for biological control of persea mite have identified *Galendromus helveolus* (Chant) and *Neoseiulus californicus* (McGregor) as the most efficacious predators and both give statistically identical levels of pest suppression, and in some instances provide better control than that achieved with 7% NR-415 oil (Hoddle et al. 1999, Kerguelen and Hoddle 1999).

*Neoseiulus californicus* is recommended because it is 33% cheaper to purchase and holds persea mite feeding damage to slightly lower levels than *G. helveolus* (Hoddle 2000). Subsequent field trials have indicated that successful persea mite control is achieved with release of 2,000 *N. californicus* per tree as either a single release or two releases of 1,000 predators. Releasing fewer than 2,000 predators onto 15 foot trees does not provide persea mite control, while releasing more than 2,000 *N. californicus* doesn't significantly increase control. At this release rate (2,000 *N. californicus* per tree), biological control is not economically competitive with pesticides as it is 13-14 times more expensive per acre than the use of NR-415 oil (Hoddle et al. 2000). All trials conducted with predators have involved releasing phytoseiid adults mixed with corn grits into paper cups attached to branches with binder clips. Predators disseminate from cups and disperse through the canopy searching for prey. One potential way to reduce the cost of biological control would be to purchase and release fewer predators. A reduced release rate could be achieved if phytoseiids could be more evenly spread through the canopy and successful control may then be achieved with fewer natural enemies. We have been experimenting with a modified Stihl backpack sprayer (same model as below) to distribute predators over the tree canopy for biological control of persea mite. This work is ongoing.

Although persea mite populations in San Diego County appear to have become less damaging in the late 1990's, this pest is becoming more severe in Ventura and other northern coastal counties. As a result, we were asked to evaluate available miticides for persea mite control in a 1998 pesticide efficacy trial.

## Materials and Methods

To develop a list of pesticides for evaluation, we searched the 1997 Issue of "Arthropod Management Tests" and made a list of all miticides evaluated on various crops. From this list, 8 miticides were chosen for evaluation (Table 1) and manufacturers were contacted to supply materials and suggest rates for evaluation (because both clofentezine and hexythiazox are strictly ovicides, manufacturers suggested adding abamectin+oil to these treatments). We then contacted a number of independent pest control advisors for assistance in locating a trial site and settled on Field 114 at the Irvine Ranch Co., Irvine, CA which was a 6.4 acre grove of 5-7 year-old Hass avocado trees grafted on Duke 7 rootstock. Trees were approximately 8 feet in height and 14 feet in diameter. Tree spacing was 12 feet within and 24 feet across rows and tree rows ran east - west (151 trees/ acre).

**Table 1.** Pesticide treatments used in the 1998 Persea Mite efficacy trial.

| Common Name | Trade Name | Source Company | Rate per acre |
|---|---|---|---|
| Water control | — | — | — |
| abamectin + oil | Agri-Mek0.15EC + NR-415 Oil | Syngenta, Greensboro, NC | 10 fl. oz+ 1% |
| milbemectin + oil | GWN-1725 1%EC + NR-415 Oil | Gowan Co., Yuma, AZ | 20 fl. oz+ 1% |
| chlorfenapyr | Alert 2 EC | BASF Corp., Mount Olive, NJ | 0.25 Ib ai |
| clofentezine + abamectin + oil | Apollo 42 SC + Agri-Mek0.15EC + NR-415 Oil | Aventis CropScience, Research Triangle Park, NC | 8 fl. oz+ 10 fl. oz+ 1% |
| hexythiazox + abamectin + oil | Savey 50 WP + Agri-Mek0.15EC + NR-415 Oil | Gowan Co., Yuma, AZ | 0.1875 lb ai + 10 fl. oz+ 1% |
| bifenazate | UC-D234150WP | Uniroyal Chemical, Middlebury, CT | 1.0 lb ai |
| oil | NR-415 Oil | Leffingwell, Pace International LLC, Seattle, WA | 10% |
| pyridaben | Nexter75WP | BASF Corp., Mount Olive, NJ | 0.67 Ib ai |

To sample persea mite levels on leaves both before and after treatment, we decided to use the "half second vein" method developed by Machlitt (1998). Field 114 was initially surveyed and 82 trees in the northwest end of the block were chosen for the study based on tree uniformity and presence of persea mite populations on leaves. On 21 July

1998, a pre-count was taken by randomly selecting 10 fully expanded mature leaves from around the periphery of each tree and counting the number of motile persea mites within the viewing area of a 10X hand lens as it was run down the second major vein from the basal portion of one side of the bottom surf ace of each leaf (see Fig. 1 in Machlitt 1998). We used a randomized complete block design with 8 replicates. Because 72 of the 82 sampled trees were needed (8 treatments plus an untreated control times 8 single tree replicates per treatment), we eliminated 10 trees with the highest and lowest levels of persea mite from the study. Trees were ranked from highest to lowest, in terms of persea mite levels, the top 9 were assigned to block 1, the next 9 to block 2, etc., and one tree from each block was then randomly assigned to each treatment.

Treatments were applied 24 July 1998 using a Pacific Stihl model SR-400 low-volume backpack mistsprayer (L&M Fertilizer, Temecula, CA). The sprayer was used at setting #4 which resulted in delivery of 0.33 gallons of spray solution per minute. In mixing pesticides, we used a dilution rate of 100 gallons of water per acre but because the trees were quite small (they had recently been topped), actual spray solution delivered on a per acre basis was approximately 18.9 gallons per acre. Water pH was 7.7.

Post-counts were taken 4 days after treatment and approximately weekly thereafter, using methods identical to those used in the pre-count, until persea mite levels in most plots reached levels observed in the water control plot (120 d post-treatment). Mite-days over the period between two successive sampling dates were calculated by averaging levels observed on the two dates and multiplying by the number of days over the period.

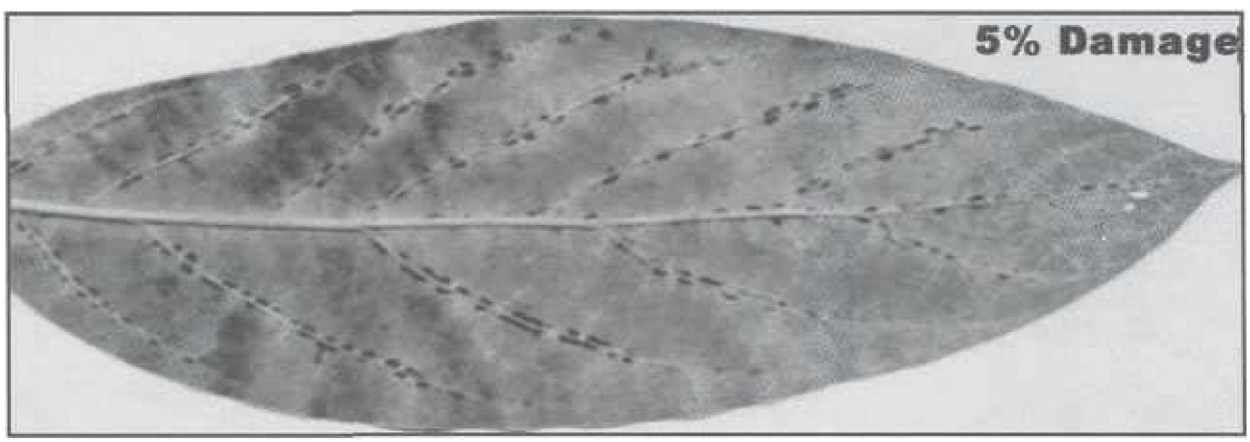


Figure 1. Symptoms of persea mite damage viewed from the upper surface of an avocado leaf.

## Results and Discussion

Two trees scheduled to receive the pyridaben treatment were sprayed with the wrong treatment and thus were deleted from the trial, leaving 6 of the 8 single tree replicates. Pre-count levels of persea mite ranged from 18.4 to 18.5 motile mites per half-vein for all treatments except pyridaben and averaged 20.2 for pyridaben treated trees. Machlitt (1998) correlated half second vein persea mite counts on fully expanded avocado leaves, obtained a regression coefficient of 0.92, and calculated a regression correlation of 11.35 (mite levels on the whole leaf are approximately equal to levels counted on the half second vein * 11.35). Using this correlation, pre-count levels varied from 208.8 to 210.0 (229.3 in the pyridaben plot) motile persea mites per leaf which is about twice what is generally considered to be an economic threshold (pest control advisors typically treat at 100 motiles per leaf, Dave Machlitt, Consulting Entomology Services, personal communication).

Persea mite population trends following treatment are shown in comparison to the Water Control in Figure 1. Two trees were blown over by heavy winds mid-way through the trial and thus were removed from the study (one tree receiving the bifenazate treatment prior to the +46 day count and one from the clofentezine+abamectin+oil treatment prior to the +74 day count; n = 7 for both treatments after these dates). Relatively few persea mite predators were observed on counted leaves throughout the trial (although the half vein method of monitoring is not especially conducive to observing predators). All treatments with the exception of bifenazate were effective in initially suppressing persea mite levels but treatments varied considerably in how persistent control was. In order to numerically compare treatment efficacy, cumulative mite days were calculated out to 74 days post-treatment (when the weaker treatments approached levels seen in the Control) and were compared to each other as a percentage of cumulative mite-days observed in the Control. We consider this to be a reasonable criteria in assessing treatment efficacy because one assumes that cumulative mite damage would likely be proportional to the number of mites present multiplied by the number of days they are present feeding on leaves. Using this criterion, the most effective miticides were milbemectin+oil (4% of the mite-days observed in the Control) and abamectin+oil (9%). The high efficacy of abamectin+oil is consistent with an earlier study by Phillips and Faber (1996). It is interesting that addition of the ovi-cides clofentezine or hexythiazox to abamectin+oil did not appear to increase efficacy over that seen with abamectin+oil alone.

Because abamectin+oil has been used for the past 3 years (1999-2001) for avocado thrips *(Scirothrips perseae* Nakahara) control on avocado in California under a Section 18 Emergency Exemption, and because both thrips and tetranychid mites are notorious for their ability to develop pesticide resistance, we suggest it might be worthwhile trying to register milbemectin for persea mite control on avocados. Whether cross-resistance might later develop between these two materials is unknown although they do have similar chemistries. Research on abamectin susceptible and resistant two-spotted spider mites,

*Tetranychus urticae* (Koch), collected from strawberries indicates little if any cross resistance to milbemectin (Frank Zalom, Univ. of California, Davis, personal communication). Hopefully a similar lack of cross resistance would result if milbemectin were registered for persea mite control and abamectin use was limited to control of avocado thrips.

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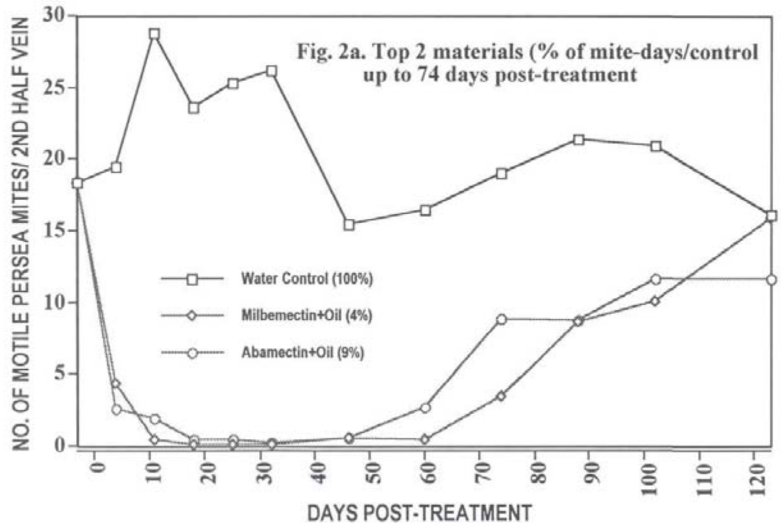
Fig. 2a. Top 2 materials (% of mite-days/control up to 74 days post-treatment
Water Control (100%)
Milbemectin+Oil (4%)
Abamectin+Oil (9%)
NO. OF MOTILE PERSEA MITES/ 2ND HALF VEIN
DAYS POST-TREATMENT

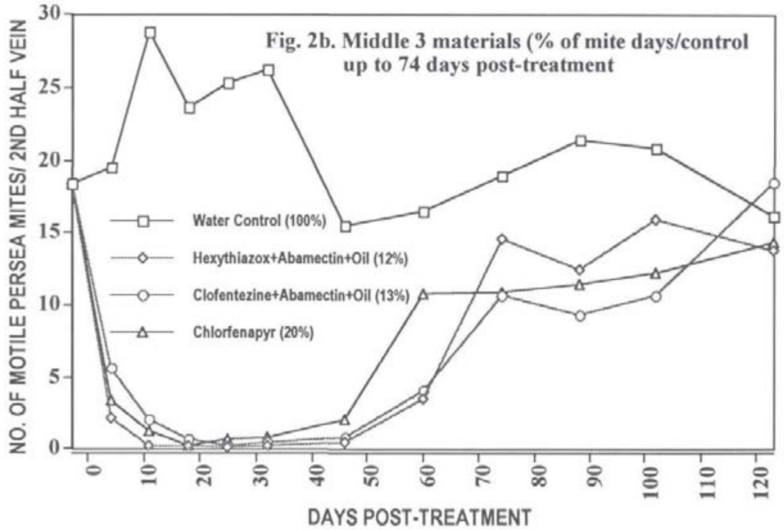
Fig. 2b. Middle 3 materials (% of mite days/control up to 74 days post-treatment
Water Control (100%)
Hexythiazox+Abamectin+Oil (12%)
Clofentezine+Abamectin+Oil (13%)
Chlorfenapyr (20%)
NO. OF MOTILE PERSEA MITES/ 2ND HALF VEIN
DAYS POST-TREATMENT

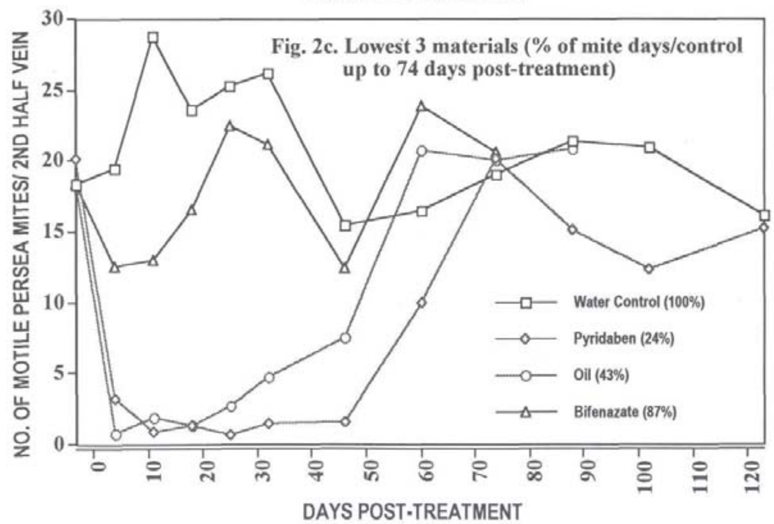
Fig. 2c. Lowest 3 materials (% of mite days/control up to 74 days post-treatment)
Water Control (100%)
Pyridaben (24%)
Oil (43%)
Bifenazate (87%)
NO. OF MOTILE PERSEA MITES/ 2ND HALF VEIN
DAYS POST-TREATMENT