Report on Pest-Out
Kris Godfrey
May 23, 2013

Product Tested: Pest-Out; OMRI certified; label can be found in the Appendix A.

Methods:

Nymphs: Individual plants were each caged with 10 Asian citrus psyllid adults and allowed to oviposit for 10 days. The adults were then removed and the number of nymphs and eggs found on the flush growth recorded. The plants were then sprayed with one of the following products: Pest-Out (1.5 fl. oz per gallon), water, or fenpropathrin (0.213 fl. oz. per gallon). The number of live and dead nymphs and eggs were recorded at 24 hours, 48 hours, and 1 week after treatment. The mean percent mortality for nymphs was calculated for each product and time period. Analysis of variance was conducted to compare the mortality imparted by each product for each time period. Percent mortality was transformed with an arcsine transformation prior to analysis. Egg mortality and egg hatch were noted when found.

Adults: Plants were sprayed with one of the following products: Pest-Out (1.5 fl. oz. per gallon), Summit Year-Round Spray Oil (2 fl. oz. per gallon; OMRI certified; EPA Reg. No. 6218-71), water, or fenpropathrin (0.213 fl. oz. per gallon). The plants were allowed to dry and then each plant was caged with 10 adult Asian citrus psyllids. The number of live adults and oviposition events were recorded at 24 hours, 48 hours, and 1 week after treatment. The mean number of live adults was calculated for each product and time period. Analysis of variance was conducted to compare the survival of adults among the products for each time period. Oviposition events were noted when found.

Results:

Nymphs: The mean percent nymphal mortality varied with product applied with fenpropathrin imparting the most mortality, followed by Pest-Out, then water (Table 1). Fenpropathrin caused 100% mortality of all nymphs and eggs in the first 24 hours of the study. Analysis of variance revealed statistically significant differences among the mortality imparted by the three products for each time period: 24 hours after treatment – $F = 55.74$, $P < 0.05$, degrees of freedom = 2, 23; 48 hours after treatment – $F = 71.15$, $P < 0.05$, degrees of freedom = 2, 23; and 1 week after treatment – $F = 30.41$, $P < 0.01$, degrees of freedom = 2, 23. For each time period, the mean mortality imparted by fenpropathrin and Pest-Out did not differ statistically. The mean mortality imparted by fenpropathrin and Pest-Out was statistically greater than the mean mortality imparted by water (Table 1). Good coverage with either the Pest-Out or the fenpropathrin was key to imparting mortality.

During the course of the experiments, it was noted that eggs that were exposed (not tucked into feather flush) would not hatch after treatment with Pest-Out. If the eggs were inside

the feather flush and protected, the Pest-Out would not kill the eggs. This is not surprising considering that this product works by smothering the insect.

Adults: The mean number of adults surviving varied with product applied with the greatest survival in the water treatment, followed by the Pest-Out treatment, the Year-Round Spray Oil treatment, and then the fenpropathrin treatment (Table 2). Fenpropathrin caused 100% mortality of adults in the first 24 hours of the study. Analysis of variance revealed statistically significant differences among survivorship of the adults among the treatments for each time period: 24 hours after treatment – $F = 102.97$, $P < 0.05$, degrees of freedom = 3, 13; 48 hours after treatment – $F = 53.61$, $P < 0.05$, degrees of freedom = 3, 13; 1 week after treatment – $F = 4.74$, $P < 0.05$; degrees of freedom = 3, 13. For all time periods, mean mortality imparted by the fenpropathrin was greater than the other treatments (Table 2). Pest-Out had a mortality rate that was not statistically different than the water control. This is not surprising considering that the product was sprayed onto a plant and allowed to dry, rather than treating the adults themselves. This product is designed to coat and smother insects.

During the course of the study, it was noted that the Asian citrus psyllid adults did not like to land and rest on or oviposit on Pest-Out treated plants. To determine if this was insect preference or an artifact of the cage that was used in the study, a Bugdorm cage was set up that contained 2 citrus plants that had been sprayed with Pest-Out and 2 citrus plants that had been sprayed with water. Fifty adult psyllids were released in the center of the cage and the number of psyllids on each plant was recorded at 24 hours, 48 hours, and 1 week after introduction. Oviposition events during these times were also recorded. For the 24 and 48 hours after introduction time period, statistically more psyllids were found on the water treated plants than the Pest-Out treated plants (24 hours - $\chi^2 = 6.36$, $P < 0.05$, degrees of freedom = 1; 48 hours – $\chi^2 = 4.17$, $P < 0.05$, degrees of freedom = 1). By one week after introduction, there were no statistically significant differences between the numbers of psyllids found on water or Pest-Out treated plants.

Oviposition events were recorded in both studies (adult mortality study and preference study). Oviposition events occurred on water treated plants from 2 - 7 days of the adults being confined on the plants with a 2 day delay in the onset of oviposition being the most common situation. For Pest-Out treated plants, the oviposition occurred from 3 – 15 days after the adults were confined on the plants with 7 day delay in the onset of oviposition being the most common situation. The difference in the onset of oviposition is most likely a reflection of the fact that the adult psyllids do not like to land or rest on Pest-Out treated plants.

Conclusions: Pest-Out provides good mortality when sprayed on nymphs and exposed eggs and could be used in a rotation with other products in an organic orchard. Good coverage is key to the high levels of nymphal and egg mortality. This product does not directly kill adults once it has dried on a plant, but the adults do not like to rest on the treated plants and oviposition may be delayed on treated plants compared to untreated plants.

Table 1. The mean nymphal percent mortality (standard error of the mean), the total number of plants, and the total number of nymphs exposed for Pest-Out, fenpropathrin, and water treatments at each time period.

Product	24 Hours AT[a,b]	48 hours AT[a,b]	1 week AT[a,b]
Pest-Out			
Mean percent mortality	83%b	93.07%a	93.87%a
(standard error)	(5.19)	(2.56)	(2.571)
Total No. of Plants	15		
Total No. of Nymphs	234		
Fenpropathrin			
Mean percent mortality	100%a	100%a	100%a
Total No. of Plants	3		
Total No. of Nymphs	182		
Water			
Mean percent mortality	4.13%c	10.38%b	16.63%b
(standard error)	(4.13)	(6.98)	(12.59)
Total No. of Plants	8		
Total No. of Nymphs	158		

[a]AT = after treatment

[b]Means in the same column followed by the same letter are not statistically different ($P < 0.05$) using least squares comparisons with the Tukey-Kramer adjustment (SAS, PROC GLM).

Table 2. The mean number of adults surviving (standard error of the mean), the total number of plants, and the total number of adults exposed for Pest-Out, fenpropathrin, Year-Round Spray Oil, and water treatments at each time period.

Product	24 Hours AT[a,b]	48 hours AT[a,b]	1 week AT[a,b]
Pest-Out			
Mean No. Surviving	9.4c	9.4c	1.4b
(standard error)	(0.6)	(0.4)	(0.6)
Total No. of Plants	5		
Total No. of Adults	50		
Fenpropathrin			
Mean No. Surviving	0a	0a	0a
Total No. of Plants	5		
Total No. of Adults	50		
Year-Round Spray Oil			
Mean No. Surviving	6b	4b	0ab
(standard error)	(0.99)	(2.0)	(-)
Total No. of Plants	2		
Total No. of Adults	20		

Product	24 Hours AT[a,b]	48 hours AT[a,b]	1 week AT[a,b]
Water			
Mean No. Surviving	9.4c	9.2c	1.8b
(standard error)	(0.4)	(0.8)	(0.37)
Total No. of Plants	5		
Total No. of Adults	50		

[a]AT = after treatment

[b]Means in the same column followed by the same letter are not statistically different ($P < 0.05$) using least squares comparisons with the Tukey-Kramer adjustment (SAS, PROC GLM).

Appendix A

PEST OUT®

Broad Spectrum Miticide / Insecticide
Control Mites, Thrips And Aphids

Product Information

For control of various mites and insects on many types of crops such as melons, squash, tomatoes, tree crops, grapes, cucumbers and all sorts of flowers. **PEST OUT** is applied as a foliar spray and should be a great addition to a well managed IPM program. It is made from 100% organic components.

ACTIVE INGREDIENTS

Cottonseed Oil	40%
Clove Oil	20%
Garlic Oil	10%
INERT INGREDIENTS:	30%
Sodium Bicarbonate, Oleic Acid, Lauric Acid, Water	
TOTAL	**100%**

KEEP OUT OF REACH OF CHILDREN

SHAKE WELL BEFORE USE

MANUFACTURING UNDER U.S PATENT.

This product is exempt from registration with the Federal EPA under section 25 (b) of FIFRA. **PEST OUT** has not been registered with the Environmental Protection Agency. JH Biotech, Inc. represents that this product qualifies for exemption from registration under the Federal Insecticide, Fungicide and Rodenticide Act.

NET CONTENTS: 2.5 Gallons (9.45 liters)
Weight per Gallon: 8.4 lbs. (3.8 kgs) @ 68°F
Lot #:

Directions and General Recommendations

APPLICATION RATE TABLE

Mix 1 gallon of **PEST OUT** concentrate per 100 gallons of spray water. Apply enough to cover the entire surface of infested tissues.

FINAL MIX VOLUME	FL. OZ.
1 Gallon	1.5
5 Gallons	7
10 Gallons	14
25 Gallons	32

Apply no more than once in a 7 day period. Repeat application as necessary. Coverage is essential to establish control. The use of a spreader/sticker may increase contact and efficacy of treatment.

Check compatibility by spraying a small number of plants before initial applications.

PRECAUTIONARY STATEMENTS

Avoid contact with skin, eyes or clothing. In case of contact, immediately flush eyes or skin with plenty of water. Get medical attention if irritation persists.

PERSONAL PROTECTIVE WORK CLOTHING: Applicators and other handlers of this product must wear: Long sleeved shirt and pants, shoes and socks, protective eyewear and gloves.

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED
- ► Call a Physician or Poison Control Center.
- ► Drink one or two glasses of water.
- ► Do not induce vomiting.
- ► If person is unconscious, do not give anything by mouth or induce vomiting.

IF IN EYES
- ► Hold eyelids open and flush with a steady, gentle stream of water for 15 minutes.
- ► Get medical attention if irritation persists.

IF ON SKIN
- ► Wash with plenty of soap and water.
- ► Get medical attention if irritation persists.

CAUTION: PEST OUT CONTAINS OIL AND MAY LEAVE MARKS ON SOME FRUITS, ESPECIALLY PEARS. TEST THE PRODUCT IN SMALL AREA BEFORE SPRAYING LARGE AREAS.

LIMITED WARRANTY

Manufacturer or seller makes no warranty, whether expressed or implied, concerning the use of this product other than for the purposes indicated on the label. Neither manufacturer nor seller shall be liable for any injury or damage caused by this product due to misuse, mishandling or any application not specifically described on the label.

OMRI Listed

0218-D-B-1

JH Biotech Inc.

MANUFACTURED BY: JH BIOTECH, INC. P.O. Box 3538 , Ventura, CA 93006 U.S.A. Phone: 805-650-8933 Website: www.jhbiotech.com