Control of Codling Moth and Secondary Pests by Reduced Risk Insecticides

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Abstract: The implementation of the Food Quality Protection Act (FQPA) of 1996 stands to greatly impact established pest management techniques for pears. Changes in the availability and use of current insecticides will require more reduced risk and environmentally benign pest management strategies. Accordingly, trials were conducted in an effort to develop reduced risk control strategies. Field trials were conducted to evaluate new insecticides/miticides for codling moth (CM), twospotted spider mite (TSSM), European red mite (ERM), pear psylla nymph (PP), San Jose scale (SJS), Western predatory mite (WPM) and Western flower thrip (WFT) control. A single tree crop destruct trial was conducted for CM control. This trial showed that Novaluron combined with Assail followed within three weeks by Novaluron alone had very similar CM infestation levels to the grower standard and did not flare-up PP. The high rate of Diamond and both rates of Novaluron also provided acceptable CM control. It should be noted that due to formulation difficulties, Diamond is not yet available for growers. It is hoped that these problems will be solved and it will receive California registration within the next few years. A large plot speed sprayer evaluation of various rates of Diamond, Novaluron and Assail was conducted. This trial showed that Diamond at 6.6 lb had very low CM infestation and the lowest total PP and TSSM populations of all the experimental treatments. Although Novaluron at 80 oz also had low CM, PP and TSSM populations, Novaluron produced unacceptable phytotoxicity. The evaluation of newly registered and unregistered miticides showed that Kanemite at 31 oz without oil and both treatments of Acramite showed good TSSM and ERM control, but they also flared-up PP. The rate of Kanemite seems to be more important than the addition of oil. Two large plot speed sprayer trials of various weights and volumes of Petro-Canada oil showed there to be little difference in fruit finish ratings among the treatments with nearly blemish free fruit. It appears that the Petro-Canada oils provided as good or better control of both TSSM and ERM than Volck Supreme oil or the grower practice. However, it appears that the Petro-Canada oil was not as effective in control of PP as Volck Supreme oil or the grower practice.

Introduction: In the summer of 1996, the U.S. Congress unanimously passed, and the President signed, the FQPA. This piece of legislation will have a significant impact on insecticides used in the U.S. and particularly on those used on agricultural crops consumed by infants and children, such as pears. It is anticipated that many of the current organophosphate (OP) insecticides used on pears may have greatly extended pre-harvest intervals and/or greatly extended worker reentry intervals, or the manufacturers may be forced to terminate their registrations by the EPA. In addition, there is a continuing development of resistance within CM to existing and new insecticide chemistry. Thus, changes in the availability and use of pesticides will require more reduced risk, environmentally benign pest management strategies. Reported here are the results of our 2004 single tree crop destruct evaluation of neonicotinoids and chitin inhibiting insecticides for CM control, a large plot crop destruct evaluation of the phytotoxicity and efficacy of various rates of Diamond and Assail for CM control, a single tree crop destruct evaluation of registered and unregistered miticides for TSSM, ERM and PP control, a large plot

evaluation of the phytotoxicity and efficacy of Petro-Canada oils and an evaluation of insecticide longevity for CM control (reported by C. Ingels).

1. Evaluation of New Insecticides for Codling Moth Control

Methods and Materials: This trial was conducted in a commercial 'Bartlett' pear orchard in Fairfield, CA. This orchard was planted on a 25 ft. x 25 ft. spacing (70 trees/ac). Eight treatments and an untreated control were replicated four times in a randomized complete block (RCB) design. Each replicate was an individual tree. Foliar sprays were applied with a hand-held orchard sprayer operating at 250 psi with a finished spray volume of 200 gal/ac (2.87 gal/tree). Applications were scheduled based on degree-days (DD). DD were calculated with a biofix of 20 March for the first generation and a 5 June biofix for the second generation using a single sine horizontal cutoff model with a lower threshold of 50˚F and an upper threshold of 88˚F. Maximum and minimum air temperatures were obtained from the IMPACT weather station at Cordelia, CA. Flight activity of male CM was monitored with a pheromone trap placed high in the canopy of an untreated tree. The application timings and treatments are shown in Table 1. Control of the CM generations was evaluated at commercial harvest on 21 July by inspecting a maximum of 250 fruit per tree for CM infestation. Control of PP nymphs, motile TSSM, ERM, WFT, WPM and SJS crawlers was evaluated by leaf-brushing 10 exterior and 10 interior leaves collected from each tree weekly from 21 June through 12 July. The plates with the contents from the brushed leaves were counted under magnification (20X) in the laboratory.

Table 1. Treatments and Application Timings for Codling Moth Control, Fairfield, CA – 2004

Treatment	Rate lb(AI)/ac	No. Appl.	Application Dates (Degree-Days from 1st or 2nd Biofix)
1. Diamond 7.5WG[a]	2.5 lb	4	31 March (106 from 1st biofix), 16 April (258 from 1st biofix), 7 June (54 from 2nd biofix) and 21 June (305 from 2nd biofix)
2. Diamond 7.5WG[a]	3.3 lb	4	31 March (106 from 1st biofix), 16 April (258 from 1st biofix), 7 June (54 from 2nd biofix) and 21 June (305 from 2nd biofix)
3. Novaluron 0.83EC[a]	28.9 oz	4	31 March (106 from 1st biofix), 16 April (258 from 1st biofix), 7 June (54 from 2nd biofix) and 21 June (305 from 2nd biofix)
4. Novaluron 0.83EC[a]	40.0 oz	4	31 March (106 from 1st biofix), 16 April (258 from 1st biofix), 7 June (54 from 2nd biofix) and 21 June (305 from 2nd biofix)
5. Novaluron 0.83EC	28.9 oz	2	16 April (258 from 1st biofix) and 18 June (253 from 2nd biofix)
+ Assail 70WP[a]	3.4 oz		
Novaluron 0.83EC[a]	28.9 oz	2	5 May (540 from 1st biofix) and 2 July (506 from 2nd biofix)
6. Agri-Mek 0.15EC[a]	10.0 oz	1	16 April (258 from 1st biofix)
Imidan 70WP[b]	7.0 lb	1	16 April (258 from 1st biofix)
Guthion 50WP	2.0 lb	2	14 May (656 from 1st biofix) and 18 June (253 from 2nd biofix)
Imidan 70WP[b]	6.0 lb	1	9 July (628 from 2nd biofix)
7. GF-968 0.835SC	13.7 oz	4	16 April (258 from 1st biofix), 14 May (656 from 1st biofix), 18 June (253 from 2nd biofix) and 9 July (628 from 2nd biofix)
8. Untreated	——		

[a] Treatments contained 0.25% Volck Supreme oil by volume.
[b] Treatment pH was adjusted to < 6.

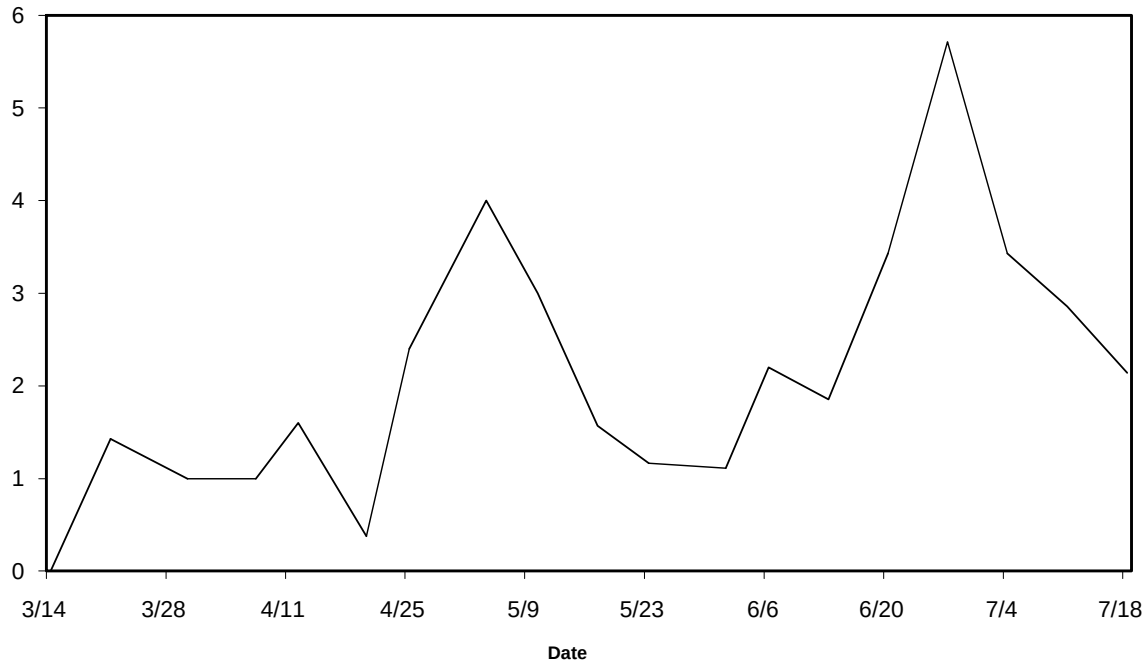
Results and Discussion:

Flight Activity – The overwintering CM flight began 21 March (Fig. 1). Biofix was set on 20 March. CM biofix is set when sunset air temperatures meet or exceed 62˚F and there is a sustained moth flight. This temperature is the minimum required for CM oviposition.

The overwintering flight was not highly bimodal this year. The first peak of the overwintering flight occurred around 13 April at 242 DD. The air temperatures then turned cool and moth

flight decreased. The first peak often occurs at 300 DD after biofix. The second peak of the overwintering flight occurred around 5 May at 540 DD. The second peak often occurs at 650 DD after biofix. The first flight was completed by 4 June at 970 DD. The first flight is usually completed by 1,000 DD. The second biofix was set on 5 June. The first peak of the second CM flight occurred approximately on 7 June at 54 DD while the second peak of the second CM flight occurred approximately on 28 June at 438 DD.

Fig. 1 – Seasonal Flight Activity of Codling Moth Captured in a Pheromone Trap Placed High in the Tree Canopy at Fairfield, CA - 2004



CM Evaluation – The CM infestation in the untreated control was over 80%. Thus, this trial provided a stringent test of the experimental treatments. The CM infestation in all of the experimental treatments was significantly lower than in the untreated control. Although the grower standard had the least amount of CM infestation, there was no significant difference between the grower standard and both rates of Novaluron, Novaluron combined with Assail and Diamond at 3.3 lb/ac. The treatment of Novaluron combined with Assail applied on the "A" peaks followed by Novaluron for the "B" peaks for both the first and second flights had CM infestations levels most similar to the grower standard. Diamond at 2.5 lb/ac and GF-968 had significantly higher CM infestation compared to the grower standard. The higher infestation in Diamond at 2.5 lb/ac treatment compared to Novaluron at 28.9 oz/ac was unexpected since both treatments contained the same amount of active ingredient (0.1875 lb ai/ac). The higher level of infestation in the GF-968 compared to Diamond or Novaluron may partially be explained by the lack of 0.25% Volck Supreme oil with the GF-968 treatment. In previous research, the inclusion of a Supreme/Superior type narrow range horticultural oil has enhanced the CM efficacy of the experimental insecticides through direct suffocation of the CM eggs or improved distribution of the experimental insecticide on the foliage.

Table 2. Mean Percent Codling Moth-Infested Fruit Inspected at Commercial Harvest in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. Appl.	Mean[a] Percent Infested Fruit at Commercial Harvest
1. Diamond 7.5WG[b]	2.5 lb	4	6.4 c
2. Diamond 7.5WG[b]	3.3 lb	4	2.6 ab
3. Novaluron 0.83EC[b]	28.9 oz	4	2.7 ab
4. Novaluron 0.83EC[b]	40.0 oz	4	2.8 ab
5. Novaluron 0.83EC	28.9 oz	2	2.0 ab
+ Assail 70WP[b]	3.4 oz		
Novaluron 0.83EC[b]	28.9 oz	2	
6. Agri-Mek 0.15EC[b]	10.0 oz	1	1.2 a
Imidan 70WP[c]	7.0 lb	1	
Guthion 50WP	2.0 lb	2	
Imidan 70WP[c]	6.0 lb	1	
7. GF-968 0.835SC	13.7 oz	4	5.0 bc
8. Untreated	–	–	80.9 d

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P \leq 0.05$). Data analyzed using an arcsin transformation.
[b] Treatments contained 0.25% Volck Supreme spray by volume.
[c] pH was adjusted to < 6.

Secondary Pest Evaluations – The summer was exceptionally cool with no day above 100˚F and only nine days above 90˚F recorded at the IMPACT weather station at Cordelia, CA. Because of the cool weather, few TSSM were found and there were no significant differences among the treatments (Table 3). Although few ERM were observed, there were significantly more ERM in GF-968 than in the untreated control (Table 4). Although there was a flare-up of ERM in the GF-968 treatment, the number of ERM would not cause economic injury to the pears. The PP populations were very low this year (Table 5). Although Agri-Mek was included in the grower standard, the grower standard still had significantly more PP than the other experimental treatments. This was unusual since Agri-Mek is normally adequate to suppress the PP population. SJS populations were significantly lower in the GF-968 and grower standard compared to the untreated control and the high rate of Diamond (Table 6). There seems to be a rate response with Diamond and Novaluron as the higher rate of either treatment seems to increase SJS populations. It appears that GF-968 has scale activity. There were significantly more WFT in the Novaluron plus Assail treatment and the GF-968 treatment compared to the untreated control (Table 7). The two rates of both Diamond and Novaluron treatments all had less WFT than the untreated control. All of the experimental treatments suppressed WPM compared to the untreated control (Table 8). The high rate of Novaluron, the Novaluron plus

Assail and the grower standard treatments all had significantly less WPM than the untreated control.

Conclusions: This trial was conducted against a very high CM population with over 80% of the fruit infested at harvest in the untreated control. This trial should be considered a rigorous test of the experimental materials. Novaluron combined with Assail followed within three weeks by Novaluron alone had very similar CM infestation levels to the grower standard. The high rate of Diamond and both rates of Novaluron also provided acceptable CM control. Diamond, Novaluron and Novaluron combined with Assail provided PP control similar to the untreated control and did not flare-up PP like the grower standard. The GF-968 material might perform better with the addition of Volck oil and more frequent applications. Unfortunately TSSM and ERM populations were not high this year due to unusually cool temperatures.

Table 3. Mean Number of Twospotted Spider Mite per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. App.	Mean[a] No. Twospotted Mite per 20 Leaves 6/21	6/28	7/4	7/12	Total
1. Diamond 7.5 WP[b]	2.5 lb	4	0.0 a	0.0 a	0.0 a	0.3 a	0.3 a
2. Diamond 7.5 WP[b]	3.3 lb	4	0.0 a	0.0 a	0.0 a	0.3 a	0.3 a
3. Novaluron 0.83EC[b]	28.9 oz	4	0.0 a	0.0 a	0.0 a	0.5 a	0.5 a
4. Novaluron 0.83EC[b]	40.0 oz	4	0.0 a	0.0 a	0.0 a	0.5 a	0.5 a
5. Novaluron 0.83EC[b]	28.9 oz	2	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
+ Assail 70 WP[b]	3.4 oz						
Novaluron 0.83EC[b]	28.9 oz	2					
6. Agri-Mek 0.15 EC[b]	10.0 oz	1	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Imidan 70WP[c]	7.0 lb	1					
Guthion 50WP	2.0 lb	2					
Imidan 70WP[c]	6.0 lb	1					
7. GF-968 0.835SC	13.7 oz	4	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
8. Untreated	-	-	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Treatments contained 0.25% Omni Supreme oil by volume.

[c] pH was adjusted to < 6.

Table 4. Mean Number of European Red Mite per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. App.	Mean[a] No. European Red Mite per 20 Leaves 6/21	6/28	7/4	7/12	Total
1. Diamond 7.5 WP[b]	2.5 lb	4	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
2. Diamond 7.5 WP[b]	3.3 lb	4	0.3 a	0.0 a	0.8 b	0.0 a	1.0 ab
3. Novaluron 0.83EC[b]	28.9 oz	4	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
4. Novaluron 0.83EC[b]	40.0 oz	4	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
5. Novaluron 0.83EC[b]	28.9 oz	2	0.5 ab	0.0 a	0.3 ab	0.0 a	0.8 ab
+ Assail 70 WP[b]	3.4 oz						
Novaluron 0.83EC[b]	28.9 oz	2					
6. Agri-Mek 0.15 EC[b]	10.0 oz	1	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Imidan 70WP[c]	7.0 lb	1					
Guthion 50WP	2.0 lb	2					
Imidan 70WP[c]	6.0 lb	1					
7. GF-968 0.835SC	13.7 oz	4	1.3 b	0.5 a	0.0 a	0.5 a	2.3 b
8. Untreated	-	-	0.3 a	0.0 a	0.0 a	0.0 a	0.3 a

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Treatments contained 0.25% Omni Supreme oil by volume.

[c] pH was adjusted to < 6.

Table 5. Mean Number of Pear Psylla Nymphs per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. App.	Mean[a] No. Pear Psylla Nymphs per 20 Leaves 6/21	6/28	7/4	7/12	Total
1. Diamond 7.5 WP[b]	2.5 lb	4	4.3 a	1.8 a	5.5 a	3.5 a	15.0 a
2. Diamond 7.5 WP[b]	3.3 lb	4	7.5 ab	3.3 a	4.8 a	3.8 a	19.3 a
3. Novaluron 0.83EC[b]	28.9 oz	4	6.0 ab	3.5 a	5.5 a	4.5 a	19.5 a
4. Novaluron 0.83EC[b]	40.0 oz	4	7.8 ab	3.5 a	3.8 a	5.3 a	20.3 a
5. Novaluron 0.83EC[b]	28.9 oz	2	2.8 a	2.8 a	4.8 a	1.8 a	12.0 a
+ Assail 70 WP[b]	3.4 oz						
Novaluron 0.83EC[b]	28.9 oz	2					
6. Agri-Mek 0.15 EC[b]	10.0 oz	1	11.5 b	14.0 b	16.5 b	32.8 b	74.8 b
Imidan 70WP[c]	7.0 lb	1					
Guthion 50WP	2.0 lb	2					
Imidan 70WP[c]	6.0 lb	1					
7. GF-968 0.835SC	13.7 oz	4	5.0 a	3.3 a	4.3 a	1.8 a	14.3 a
8. Untreated	-	-	5.3 a	2.3 a	12.3 ab	5.3 a	25.0 a

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Treatments contained 0.25% Omni Supreme oil by volume.

[c] pH was adjusted to < 6.

Table 6. Mean Number of San Jose Scale per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. App.	Mean[a] No. San Jose Scale per 20 Leaves 6/21	6/28	7/4	7/12	Total
1. Diamond 7.5 WP[b]	2.5 lb	4	2.5 ab	2.8 ab	3.5 abc	4.0 abc	12.8 ab
2. Diamond 7.5 WP[b]	3.3 lb	4	2.0 ab	0.8 a	6.3 c	7.0 c	16.0 b
3. Novaluron 0.83EC[b]	28.9 oz	4	1.5 a	2.8 ab	1.3 ab	3.0 abc	8.5 ab
4. Novaluron 0.83EC[b]	40.0 oz	4	1.8 ab	1.0 ab	5.5 bc	3.8 abc	12.0 ab
5. Novaluron 0.83EC[b]	28.9 oz	2	1.8 ab	3.5 ab	3.3 abc	1.5 ab	10.0 ab
+ Assail 70 WP[b]	3.4 oz						
Novaluron 0.83EC[b]	28.9 oz	2					
6. Agri-Mek 0.15 EC[b]	10.0 oz	1	1.0 a	0.3 a	1.8 abc	0.5 a	3.5 a
Imidan 70WP[c]	7.0 lb	1					
Guthion 50WP	2.0 lb	2					
Imidan 70WP[c]	6.0 lb	1					
7. GF-968 0.835SC	13.7 oz	4	2.3 ab	0.8 a	0.5 a	0.3 a	3.8 a
8. Untreated	-	-	4.0 b	4.8 b	4.5 abc	5.8 bc	19.0 b

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Treatments contained 0.25% Omni Supreme oil by volume.

[c] pH was adjusted to < 6.

Table 7. Mean Number of Western Flower Thrips per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. App.	Mean[a] No. Western Flower Thrips per 20 Leaves 6/21	6/28	7/4	7/12	Total
1. Diamond 7.5 WP[b]	2.5 lb	4	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
2. Diamond 7.5 WP[b]	3.3 lb	4	0.0 a	0.0 a	0.3 a	0.0 a	0.3 a
3. Novaluron 0.83EC[b]	28.9 oz	4	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
4. Novaluron 0.83EC[b]	40.0 oz	4	0.3 ab	0.0 a	0.0 a	0.3 ab	0.6 a
5. Novaluron 0.83EC[b]	28.9 oz	2	0.5 ab	1.3 ab	0.3 a	1.5 cd	3.6 c
+ Assail 70 WP[b]	3.4 oz						
Novaluron 0.83EC[b]	28.9 oz	2					
6. Agri-Mek 0.15 EC[b]	10.0 oz	1	0.8 b	0.3 ab	0.5 ab	1.3 bc	2.9 bc
Imidan 70WP[c]	7.0 lb	1					
Guthion 50WP	2.0 lb	2					
Imidan 70WP[c]	6.0 lb	1					
7. GF-968 0.835SC	13.7 oz	4	1.8 c	1.5 b	1.0 b	2.5 d	6.8 d
8. Untreated	-	-	0.3 ab	0.0 a	0.5 ab	0.5 abc	1.3 ab

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Treatments contained 0.25% Omni Supreme oil by volume.

[c] pH was adjusted to < 6.

Table 8. Mean Number of Western Predatory Mite per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. App.	Mean[a] No. Western Predatory Mite per 20 Leaves 6/21	6/28	7/4	7/12	Total
1. Diamond 7.5 WP[b]	2.5 lb	4	1.3 a	0.8 a	0.0 a	0.8 b	2.9 bc
2. Diamond 7.5 WP[b]	3.3 lb	4	1.5 a	0.0 a	0.0 a	0.8 b	2.3 abc
3. Novaluron 0.83EC[b]	28.9 oz	4	1.3 a	0.0 a	0.3 a	0.0 a	1.6 abc
4. Novaluron 0.83EC[b]	40.0 oz	4	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
5. Novaluron 0.83EC[b]	28.9 oz	2	0.3 a	0.3 a	0.0 a	0.0 a	0.6 ab
+ Assail 70 WP[b]	3.4 oz						
Novaluron 0.83EC[b]	28.9 oz	2					
6. Agri-Mek 0.15 EC[b]	10.0 oz	1	0.5 a	0.0 a	0.3 a	0.0 a	0.8 ab
Imidan 70WP[c]	7.0 lb	1					
Guthion 50WP	2.0 lb	2					
Imidan 70WP[c]	6.0 lb	1					
7. GF-968 0.835SC	13.7 oz	4	0.3 a	0.5 a	0.5 ab	0.0 a	1.3 abc
8. Untreated	-	-	1.3 a	0.5 a	1.0 b	0.8 b	3.6 c

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Treatments contained 0.25% Omni Supreme oil by volume.

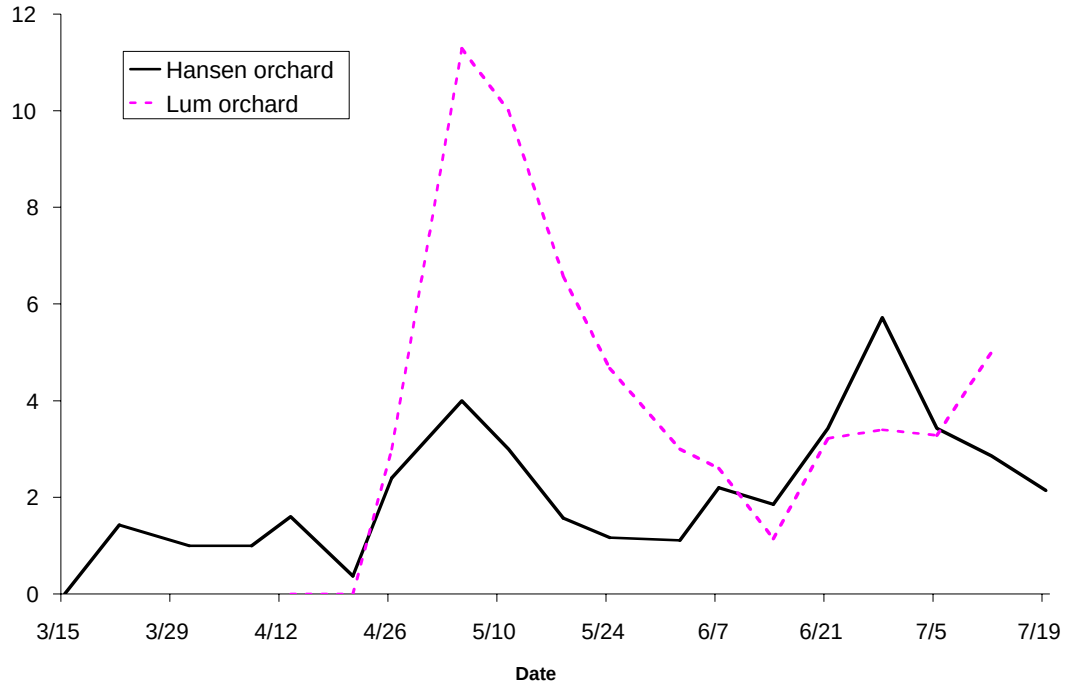
[c] pH was adjusted to < 6.

2. Large Plot Phytotoxicity and Efficacy Study for Codling Moth Control

Methods and Materials: This trial was conducted in a commercial 'Bartlett' pear orchard in Fairfield, CA. This orchard was planted on a 20 ft. x 20 ft. spacing (109 trees/ac). Seven treatments were replicated three times in a RCB design. Each replicate was three trees long by three rows wide (about 0.25 acres/treatment). Foliar sprays were applied with an air-blast speed sprayer operating at 3 mph with a finished spray volume of 100 gal/ac. Flight activity of male CM was monitored weekly from 14 April through 12 July with a pheromone trap placed high in the canopy of an untreated tree. Flight activity was also monitored in an orchard about 1/2 mile from the study orchard (Fig 2). In this orchard, the trap was placed on 15 March and inspected weekly through 19 July. Control of CM was evaluated at the same time as commercial harvest on 21 July by inspecting a maximum of 333 fruit per tree for CM infestation. Just prior to

harvest, one typical fruit per tree was removed from each replicate. The fruit finish was evaluated by 20 members of the pear community (growers, packers, pest control advisors, government and University workers, etc.) in a blind comparison. The evaluations were subjective and the subjective rating was categorized, where a rating of 1 was fruit with no blemishes "perfect finish," 2 was fruit with some blemishes, limb rub, slight darkening of fruit lenticels and slight phytotoxicity and 3 was fruit with definite fruit marking, darkening of fruit lenticels, phytotoxicity and/or disfigurement. The control of PP nymphs, motile TSSM, ERM, WFT, WPM and SJS crawlers was evaluated by leaf-brushing 10 exterior and 10 interior leaves collected from each tree weekly from 23 June through 12 July. The plates with the contents from the brushed leaves were counted under magnification (20X) in the laboratory.

Fig. 2 – Seasonal Flight Activity of Codling Moth Captured in a Pheromone Trap Placed High in the Tree Canopy at Fairfield, CA - 2004



Results and Discussion:

CM Infestation – All of the experimental treatments had significantly less CM infestation at harvest than the untreated control (Table 9). Diamond at 6.6 lb had the least amount of CM infestation of all the experimental treatments. There was a strong rate response between Diamond at 6.6 lb and Diamond at 2.5 lb. Novaluron at 80 oz also had very low CM infestation. Novaluron at 28.9 oz applied four times had very similar CM infestation to Novaluron at 28.9 oz combined with Assail applied only twice. Thus Assail enhanced the efficacy of the Novaluron.

Phytotoxicity – All rates of Novaluron produced unacceptable fruit finish with extreme phytotoxicity at the 80 oz Novaluron rate (Table 10). Novaluron also showed a rate response with the phytotoxicity. The evaluations from the 20 members of the pear panel for Novaluron at 80 oz ranged from a simple "phyto - similar to Lorsban burn," "Icky Stuff on the bottom,"

"extreme phyto - brown splotches" to "would not buy." The evaluations were less negative as the rate of Novaluron was reduced. However, the evaluations were still above the minimum threshold of 1.5 for the 28.9 oz rate. Thus it is apparent that Novaluron should not be used on commercial pears. No adverse phytotoxic effects were noted for Diamond.

Secondary Pests – All of the experimental treatments had less total PP than the untreated control (Table 11). However, only Diamond at 6.6 lb had significantly less total PP than the untreated control and there was a rate response with Diamond at 2.5 lb. Novaluron at 80 oz also had very low PP and showed a strong rate response with Novaluron at 40 oz and Novaluron at 28.9 oz. Novaluron at 28.9 oz had similar PP populations to the untreated control. There were no significant differences among the treatments in the TSSM populations (Table 12). Diamond at 6.6 lb had the lowest TSSM population of all the treatments and there was a rate response between Diamond at 6.6 lb and Diamond at 2.5 lb. Novaluron at 80 oz also had very low total TSSM populations and there was also a rate response among the various rates of Novaluron. There were no ERM observed in this experiment. All of the experimental treatments had greater total SJS populations than the untreated control (Table 13). Novaluron at 28.9 oz applied four times had significantly greater total SJS population than the untreated control. Novaluron at 28.9 oz combined with Assail applied two times had significantly greater total WFT populations than the untreated control (Table 14). Only the high rate of Diamond at 6.6 lbs and the high rate of Novaluron at 80 oz had less total WFT populations than the untreated control. Although there was no significant difference among the treatments for total WPM populations, treatments 1 through 5 all suppressed WPM populations compared to the untreated control (Table 15). Only Novaluron at 28.9 oz combined with Assail applied twice had total WPM populations similar to the untreated control.

Conclusions: This experiment was conducted against a moderate to high CM population with 29% of the fruit infested at harvest in the untreated control. An adjacent orchard was removed the previous winter and CM adult dispersed into the experimental plot. Diamond at 6.6 lb performed very well as it had the least amount of CM infestation and the lowest total PP and TSSM populations of all the experimental treatments. Diamond at 6.6 lb also had the lowest total WPM population which might be due to its low TSSM population. Novaluron at 80 oz had the second lowest CM, PP and TSSM populations of all the experimental treatments. However, Novaluron produced unacceptable phytotoxicity. The Novaluron treatments also showed a rate response with the phytotoxicity. Thus it is apparent that Novaluron should not be used on commercial pears.

Table 9. Mean Percent Codling Moth-Infested Fruit Inspected at Commercial Harvest in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. Appl.	Mean[a] Percent Infested Fruit at Commercial Harvest
1. Diamond 7.5WG[b]	2.5 lb	1	5.1 a
+ Assail 70WP	3.4 oz		
Diamond 7.5WG[b]	2.5 lb	3	
2. Diamond 7.5WG[b]	6.6 lb	1	1.6 a
+ Assail 70WP	3.4 oz		
Diamond 7.5WG[b]	6.6 lb	3	
3. Novaluron 0.83EC[b]	28.9 oz	1	3.7 a
+ Assail 70WP	3.4 oz		
Novaluron 0.83EC[b]	28.9 oz	3	
4. Novaluron 0.83EC[b]	40.0 oz	1	4.7 a
+ Assail 70WP	3.4 oz		
Novaluron 0.83EC[b]	40.0 oz	3	
5. Novaluron 0.83EC[b]	80.0 oz	1	2.1 a
+ Assail 70WP	3.4 oz		
Novaluron 0.83EC[b]	80.0 oz	3	
6. Novaluron 0.83EC[b]	28.9 oz	2	3.5 a
+ Assail 70WP	3.4 oz		
7. Untreated	---	---	29.0 b

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P \leq 0.05$).

[b] Treatments contained 0.25% Volck Supreme oil by volume.

Table 10. Mean Fruit Finish Rating at Commercial Harvest in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. Appl.	Mean[a, b] Fruit Finish Rating at Commercial Harvest
1. Diamond 7.5WG[c]	2.5 lb	1	1.0 a
+ Assail 70WP	3.4 oz		
Diamond 7.5WG[c]	2.5 lb	3	
2. Diamond 7.5WG[c]	6.6 lb	1	1.2 ab
+ Assail 70WP	3.4 oz		
Diamond 7.5WG[c]	6.6 lb	3	
3. Novaluron 0.83EC[c]	28.9 oz	1	1.6 abc
+ Assail 70WP	3.4 oz		
Novaluron 0.83EC[c]	28.9 oz	3	
4. Novaluron 0.83EC[c]	40.0 oz	1	1.8 bc
+ Assail 70WP	3.4 oz		
Novaluron 0.83EC[c]	40.0 oz	3	
5. Novaluron 0.83EC[c]	80.0 oz	1	2.1 c
+ Assail 70WP	3.4 oz		
Novaluron 0.83EC[c]	80.0 oz	3	
6. Novaluron 0.83EC[c]	28.9 oz	2	1.2 ab
+ Assail 70WP	3.4 oz		
7. Untreated	---	---	1.1 ab

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P \leq 0.05$).

[b] A rating of 1 was fruit with no blemishes “perfect finish,” 2 was fruit with some blemishes, limb rub, darkening of fruit lenticels and slight phytotoxicity, and 3 was fruit with definite fruit marking, darkening of fruit lenticels, phytotoxicity and/or disfigurement. Fruit with a rating over 1.5 was judged to be unsatisfactory and unsellable in the fresh market.

[c] Treatments contained 0.25% Volck Supreme oil by volume.

Table 11. Mean Number of Pear Psylla Nymphs per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. App.	Mean[a] No. Pear Psylla Nymphs per 20 Leaves 6/23	6/28	7/4	7/12	Total
1. Diamond 7.5 WP[b]	2.5 lb	1	17.3 a	17.7 a	24.7 ab	32.0 ab	91.7 ab
+ Assail 70 WP	3.4 oz						
Diamond 7.5 WP[b]	2.5 lb	3					
2. Diamond 7.5 WP[b]	6.6 lb	1	14.0 a	8.0 a	12.3 a	14.3 a	48.7 a
+ Assail 70 WP	3.4 oz						
Diamond 7.5 WP[b]	6.6 lb	3					
3. Novaluron 0.83EC[b]	28.9 oz	1	21.0 a	14.7 a	33.3 ab	78.3 b	147.3 ab
+ Assail 70 WP	3.4 oz						
Novaluron 0.83EC[b]	28.9 oz	3					
4. Novaluron 0.83EC[b]	40.0 oz	1	16.7 a	24.0 a	24.0 a	26.7 a	91.3 ab
+ Assail 70 WP	3.4 oz						
Novaluron 0.83EC[b]	40.0 oz	3					
5. Novaluron 0.83EC[b]	80.0 oz	1	27.7 a	10.7 a	12.7 a	27.0 a	78.0 ab
+ Assail 70 WP	3.4 oz						
Novaluron 0.83EC[b]	80.0 oz	3					
6. Novaluron 0.83EC[b]	28.9 oz	2	18.3 a	34.3 a	40.3 ab	32.3 ab	125.3 ab
+ Assail 70 WP	3.4 oz						
7. Untreated	-	-	20.3 a	26.3 a	55.3 b	61.0 ab	163.0 b

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Treatments contained 0.25% Volck Supreme oil by volume.

Table 12. Mean Number of Twospotted Spider Mite per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. App.	Mean[a] No. Twospotted Spider Mite per 20 Leaves 6/23	6/28	7/4	7/12	Total
1. Diamond 7.5 WP[b]	2.5 lb	1	0.3 a	0.3 a	9.0 a	0.0 a	9.7 a
+ Assail 70 WP	3.4 oz						
Diamond 7.5 WP[b]	2.5 lb	3					
2. Diamond 7.5 WP[b]	6.6 lb	1	0.0 a	0.3 a	0.0 a	0.0 a	0.3 a
+ Assail 70 WP	3.4 oz						
Diamond 7.5 WP[b]	6.6 lb	3					
3. Novaluron 0.83EC[b]	28.9 oz	1	0.0 a	0.3 a	0.3 a	2.0 b	2.7 a
+ Assail 70 WP	3.4 oz						
Novaluron 0.83EC[b]	28.9 oz	3					
4. Novaluron 0.83EC[b]	40.0 oz	1	0.0 a	0.3 a	1.7 a	0.0 a	2.0 a
+ Assail 70 WP	3.4 oz						
Novaluron 0.83EC[b]	40.0 oz	3					
5. Novaluron 0.83EC[b]	80.0 oz	1	0.0 a	0.0 a	0.3 a	0.7 a	1.0 a
+ Assail 70 WP	3.4 oz						
Novaluron 0.83EC[b]	80.0 oz	3					
6. Novaluron 0.83EC[b]	28.9 oz	2	0.0 a	0.0 a	3.7 a	0.0 a	3.7 a
+ Assail 70 WP	3.4 oz						
7. Untreated	-	-	0.7 a	0.0 a	0.0 a	0.0 a	0.7 a

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Treatments contained 0.25% Volck Supreme oil by volume.

Table 13. Mean Number of San Jose Scale per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. App.	Mean[a] No. San Jose Scale per 20 Leaves 6/23	6/28	7/4	7/12	Total
1. Diamond 7.5 WP[b]	2.5 lb	1	4.7 a	4.7 a	3.3 a	6.7 ab	19.3 ab
+ Assail 70 WP	3.4 oz						
Diamond 7.5 WP[b]	2.5 lb	3					
2. Diamond 7.5 WP[b]	6.6 lb	1	4.0 a	3.7 a	5.0 a	3.3 ab	16.0 ab
+ Assail 70 WP	3.4 oz						
Diamond 7.5 WP[b]	6.6 lb	3					
3. Novaluron 0.83EC[b]	28.9 oz	1	6.3 a	8.0 a	5.3 a	8.3 b	28.0 b
+ Assail 70 WP	3.4 oz						
Novaluron 0.83EC[b]	28.9 oz	3					
4. Novaluron 0.83EC[b]	40.0 oz	1	3.3 a	4.3 a	3.3 a	2.0 a	13.0 ab
+ Assail 70 WP	3.4 oz						
Novaluron 0.83EC[b]	40.0 oz	3					
5. Novaluron 0.83EC[b]	80.0 oz	1	4.0 a	2.7 a	3.0 a	6.3 ab	16.0 ab
+ Assail 70 WP	3.4 oz						
Novaluron 0.83EC[b]	80.0 oz	3					
6. Novaluron 0.83EC[b]	28.9 oz	2	3.3 a	3.0 a	3.0 a	1.7 a	11.0 ab
+ Assail 70 WP	3.4 oz						
7. Untreated	-	-	2.0 a	1.7 a	1.7 a	1.3 a	6.7 a

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Treatments contained 0.25% Volck Supreme oil by volume.

Table 14. Mean Number of Western Flower Thrips per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. App.	Mean[a] No. Western Flower Thrips per 20 Leaves 6/23	6/28	7/4	7/12	Total
1. Diamond 7.5 WP[b] + Assail 70 WP	2.5 lb 3.4 oz	1	0.0 a	0.3 ab	1.0 a	1.0 a	2.3 a
Diamond 7.5 WP[b]	2.5 lb	3					
2. Diamond 7.5 WP[b] + Assail 70 WP	6.6 lb 3.4 oz	1	0.3 a	1.0 ab	0.3 a	0.3 a	2.0 a
Diamond 7.5 WP[b]	6.6 lb	3					
3. Novaluron 0.83EC[b] + Assail 70 WP	28.9 oz 3.4 oz	1	0.3 a	0.7 ab	1.3 a	0.3 a	2.7 a
Novaluron 0.83EC[b]	28.9 oz	3					
4. Novaluron 0.83EC[b] + Assail 70 WP	40.0 oz 3.4 oz	1	0.3 a	1.0 ab	0.3 a	1.0 a	2.7 a
Novaluron 0.83EC[b]	40.0 oz	3					
5. Novaluron 0.83EC[b] + Assail 70 WP	80.0 oz 3.4 oz	1	0.0 a	0.0 a	0.0 a	1.0 a	1.0 a
Novaluron 0.83EC[b]	80.0 oz	3					
6. Novaluron 0.83EC[b] + Assail 70 WP	28.9 oz 3.4 oz	2	0.7 a	1.3 b	6.3 b	2.0 a	10.3 b
7. Untreated	-	-	0.7 a	0.0 a	0.7 a	1.0 a	2.3 a

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Treatments contained 0.25% Volck Supreme oil by volume.

Table 15. Mean Number of Western Predatory Mite per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate Form/ac	No. App.	Mean[a] No. Western Predatory Mite per 20 Leaves 6/23	6/28	7/4	7/12	Total
1. Diamond 7.5 WP[b]	2.5 lb	1	0.0 a	0.7 ab	0.3 a	0.3 a	1.3 a
+ Assail 70 WP	3.4 oz						
Diamond 7.5 WP[b]	2.5 lb	3					
2. Diamond 7.5 WP[b]	6.6 lb	1	0.0 a	0.0 a	0.3 a	0.0 a	0.3 a
+ Assail 70 WP	3.4 oz						
Diamond 7.5 WP[b]	6.6 lb	3					
3. Novaluron 0.83EC[b]	28.9 oz	1	0.3 ab	0.0 a	0.3 a	0.0 a	0.7 a
+ Assail 70 WP	3.4 oz						
Novaluron 0.83EC[b]	28.9 oz	3					
4. Novaluron 0.83EC[b]	40.0 oz	1	0.0 a	1.0 ab	0.0 a	0.0 a	1.0 a
+ Assail 70 WP	3.4 oz						
Novaluron 0.83EC[b]	40.0 oz	3					
5. Novaluron 0.83EC[b]	80.0 oz	1	0.0 a	0.3 ab	0.3 a	0.0 a	0.7 a
+ Assail 70 WP	3.4 oz						
Novaluron 0.83EC[b]	80.0 oz	3					
6. Novaluron 0.83EC[b]	28.9 oz	2	1.0 ab	1.7 b	1.3 b	0.7 a	4.7 a
+ Assail 70 WP	3.4 oz						
7. Untreated	-	-	2.0 b	1.0 ab	0.7 ab	0.7 a	4.3 a

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Treatments contained 0.25% Volck Supreme oil by volume.

3. Evaluation of New Miticides

Methods and Materials: A trial was conducted in a commercial 'Bartlett' pear orchard in Fairfield, CA. Nine treatments were replicated six times in a RCB design. Each replicate was an individual tree and the trees were planted on a 20 ft. by 20 ft. spacing (109 trees/ac). Foliar sprays were applied with a hand-held orchard sprayer operating at 250 psi with a finished spray volume of 200 gal/ac (2.87 gal/tree). The miticides were applied post-harvest on 31 August.

Control of PP nymphs, motile TSSM, ERM, SJS crawlers, WFT and WPM was evaluated by leaf-brushing 10 exterior and 10 interior leaves collected from each tree weekly from 3 September through 28 September. The plates with the contents from the brushed leaves were counted under magnification (20X) in the laboratory.

Results and Discussion: Although all of the experimental treatments had significantly less mean total TSSM populations compared to the untreated control, there was no significant difference among the experimental treatments (Table 16). Kanemite at 31 oz and both Acramite treatments provided excellent control of TSSM. Kanemite at 31 oz also had about half as many mean total TSSM than Kanemite at 21 oz plus oil. The Envidor treatments had about two to four times higher mean total TSSM populations compared to the rest of the experimental treatments. The Envidor treatments, and to some extent Agri-Mek, were slow in suppressing the mite population and resulted in higher mean total mites per 20 leaves. These treatments required about seven days after the spray application to cause the TSSM populations to decrease. There was no significant difference between any of the experimental treatments and the untreated control for the mean total ERM populations (Table 17). Kanemite at 31 oz and Agri-Mek had the least mean total ERM while the Envidor treatments and Pyramite had higher mean total ERM populations than the untreated control. Kanemite at 31 oz also had about half as many mean total ERM than Kanemite at 21 oz plus oil. The high number of ERM found in the mean total Pyramite treatment resulted from one exceptionally high count on 21 September. There was no significant difference between any of the treatments and the untreated control for the mean total PP populations (Table 18). Only Agri-Mek had less total PP populations than the untreated control. Kanemite at 31 oz and Acramite 75WG had more mean total PP populations than the other treatments. All of the experimental treatments had numerically higher mean total SJS populations than the untreated control (Table 19). However, Envidor at 14 oz was the only treatment to have significantly more mean total SJS than the untreated control. There was no significant difference between any of the treatments and the untreated control for the mean total WFT populations (Table 20). The Envidor treatments showed a rate response as they suppressed the WFT populations the greatest, compared to the other experimental treatments. Only Acramite 50WS and Pyramite had more mean total WFT populations than the untreated control. Although there was no significant difference among the treatments for WPM populations, all of the experimental treatments had less mean total WPM than the untreated control (Table 21). This is likely due to the reduced populations of TSSM in the experimental treatments.

Conclusions: Kanemite at 31 oz without oil and both treatments of Acramite showed good TSSM and ERM control. Kanemite at 31 oz had about half as many mean total TSSM and ERM as Kanemite at 21 oz plus oil. It seems as though the rate of Kanemite is more important than the addition of oil. Envidor was slowest acting and least effective in the control of both TSSM and ERM.

Although these experimental treatments were designed to control TSSM and ERM, it is interesting to note their effects on other important secondary insects compared to an untreated control. None of the experimental treatments significantly suppressed PP, SJS or WFT populations. Only Agri-Mek suppressed PP populations slightly.

Table 16. Mean Number of Twospotted Spider Mites per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate form/ac	Mean[a] No. Twospotted Spider Mites per 20 Leaves 8/31[b]	9/3	9/7	9/14	9/21	9/28	Total
1. Envidor 2SC	14.0 oz	197.7 b	282.7 b	35.3 a	16.0 a	12.7 a	7.3 a	354.0 a
2. Envidor 2SC	18.0 oz	128.0 ab	258.7 b	38.7 a	14.0 a	16.3 a	7.7 a	335.3 a
3. Kanemite 15SC[c]	21.0 oz	107.0 ab	51.7 a	28.0 a	34.3 a	33.7 a	5.0 a	152.7 a
4. Kanemite 15SC	31.0 oz	90.3 ab	29.7 a	26.7 a	5.3 a	7.0 a	9.7 ab	78.3 a
5. Acramite 75 WG[d]	10.7 oz	105.0 ab	40.0 a	20.7 a	13.7 a	6.3 a	7.3 a	88.0 a
6. Acramite 50 WS[d]	16.0 oz	179.7 ab	60.7 a	17.3 a	7.7 a	2.0 a	0.0 a	87.7 a
7. Pyramite 60W	13.2 oz	114.5 ab	41.0 a	10.4 a	25.7 a	18.3 a	10.0 ab	105.4 a
8. Agri-Mek 0.15EC[c]	12.0 oz	65.7 a	93.3 a	44.0 a	14.0 a	5.0 a	3.3 a	159.7 a
9. Untreated	---	119.7 ab	262.7 b	340.7 b	121.0 b	100.7 b	20.7 b	845.7 b

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Pre-spray count. Not included in mean total analysis.

[c] Treatments contained 0.25% Volck Supreme oil.

[d] Treatments contained 0.025% Silwet L-77.

Table 17. Mean Number of European Red Mites per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate form/ac	Mean[a] No. European Red Mites per 20 Leaves 8/31[b]	9/3	9/7	9/14	9/21	9/28	Total
1. Envidor 2SC	14.0 oz	42.0 ab	36.3 b	22.7 ab	12.3 a	6.0 ab	6.7 b	84.0 a
2. Envidor 2SC	18.0 oz	32.7 ab	32.0 b	32.0 b	3.3 a	11.3 ab	1.3 ab	80.0 a
3. Kanemite 15SC[c]	21.0 oz	84.3 b	9.3 a	22.0 ab	15.3 a	12.7 ab	1.7 ab	61.0 a
4. Kanemite 15SC	31.0 oz	55.0 ab	11.0 a	13.3 ab	3.7 a	4.0 a	2.7 ab	34.7 a
5. Acramite 75 WG[d]	10.7 oz	37.7 ab	9.7 a	21.3 ab	9.7 a	8.3 ab	0.7 a	49.7 a
6. Acramite 50 WS[d]	16.0 oz	29.3 ab	11.0 a	19.3 ab	14.7 a	7.3 ab	1.0 a	53.3 a
7. Pyramite 60W	13.2 oz	33.8 ab	4.3 a	8.0 a	8.0 a	60.3 b	2.0 ab	82.7 a
8. Agri-Mek 0.15EC[c]	12.0 oz	13.7 a	7.0 a	5.3 a	4.3 a	8.7 ab	4.0 ab	29.3 a
9. Untreated	---	27.0 a	10.0 a	24.0 ab	11.3 a	25.7 ab	2.0 ab	73.0 a

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Pre-spray count. Not included in mean total analysis.

[c] Treatments contained 0.25% Volck Supreme oil.

[d] Treatments contained 0.025% Silwet L-77.

Table 18. Mean Number of Pear Psylla Nymphs per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate form/ac	Mean[a] No. Pear Psylla Nymphs per 20 Leaves						
		8/31[b]	9/3	9/7	9/14	9/21	9/28	Total
1. Envidor 2SC	14.0 oz	39.7 a	56.3 a	61.3 a	54.3 a	64.3 a	55.0 a	291.3 a
2. Envidor 2SC	18.0 oz	50.7 a	56.7 a	38.0 a	68.0 a	71.0 a	57.7 a	291.3 a
3. Kanemite 15SC[c]	21.0 oz	40.7 a	64.7 a	54.7 a	87.0 a	53.3 a	54.3 a	314.0 a
4. Kanemite 15SC	31.0 oz	71.3 a	60.7 a	56.0 a	85.3 a	76.3 a	82.7 a	361.0 a
5. Acramite 75 WG[d]	10.7 oz	57.7 a	61.3 a	62.7 a	83.3 a	74.0 a	60.3 a	341.7 a
6. Acramite 50 WS[d]	16.0 oz	44.3 a	38.7 a	70.3 a	68.3 a	64.3 a	42.0 a	283.7 a
7. Pyramite 60W	13.2 oz	34.8 a	58.3 a	39.2 a	58.7 a	57.7 a	52.7 a	266.5 a
8. Agri-Mek 0.15EC[c]	12.0 oz	52.0 a	40.0 a	38.7 a	58.0 a	53.3 a	33.3 a	223.3 a
9. Untreated	---	37.7 a	42.0 a	48.0 a	56.7 a	38.3 a	55.7 a	240.7 a

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Pre-spray count. Not included in mean total analysis.

[c] Treatments contained 0.25% Volck Supreme oil.

[d] Treatments contained 0.025% Silwet L-77.

Table 19. Mean Number of San Jose Scale per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate form/ac	Mean[a] No. San Jose Scale per 20 Leaves 8/31[b]	9/3	9/7	9/14	9/21	9/28	Total
1. Envidor 2SC	14.0 oz	8.7 ab	6.0 ab	13.3 b	18.3 b	8.0 abc	9.0 b	54.7 b
2. Envidor 2SC	18.0 oz	9.3 ab	6.3 ab	4.7 a	6.7 a	3.3 a	5.7 ab	26.7 a
3. Kanemite 15SC[c]	21.0 oz	4.0 a	9.0 b	7.3 ab	7.7 ab	10.3 bc	6.3 ab	40.7 ab
4. Kanemite 15SC	31.0 oz	8.0 ab	5.3 ab	5.3 a	7.0 ab	11.3 c	2.0 a	31.0 ab
5. Acramite 75 WG[d]	10.7 oz	6.7 ab	6.0 ab	5.3 a	7.7 ab	5.7 abc	4.7 ab	29.3 a
6. Acramite 50 WS[d]	16.0 oz	5.3 ab	6.0 ab	7.3 ab	11.0 ab	10.3 bc	3.7 ab	38.3 ab
7. Pyramite 60W	13.2 oz	14.3 b	6.3 ab	4.0 a	10.0 ab	9.3 abc	5.0 ab	34.7 ab
8. Agri-Mek 0.15EC[c]	12.0 oz	12.0 ab	2.7 ab	8.0 ab	8.0 ab	10.0 abc	4.3 ab	33.0 ab
9. Untreated	---	6.7 ab	2.3 a	3.3 a	2.3 a	4.0 ab	5.0 ab	17.0 a

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Pre-spray count. Not included in mean total analysis.

[c] Treatments contained 0.25% Volck Supreme oil.

[d] Treatments contained 0.025% Silwet L-77.

Table 20. Mean Number of Western Flower Thrips per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate form/ac	Mean[a] No. Western Flower Thrips per 20 Leaves 8/31[b]	9/3	9/7	9/14	9/21	9/28	Total
1. Envidor 2SC	14.0 oz	2.7 a	4.0 ab	3.3 a	3.0 a	4.7 a	1.7 a	16.7 a
2. Envidor 2SC	18.0 oz	6.7 ab	0.7 a	2.0 a	2.7 a	1.7 a	2.7 ab	9.7 a
3. Kanemite 15SC[c]	21.0 oz	7.3 b	2.7 ab	3.3 a	6.3 ab	2.7 a	2.7 ab	17.7 a
4. Kanemite 15SC	31.0 oz	3.0 ab	2.7 ab	4.0 a	4.0 a	5.0 a	6.0 ab	21.7 a
5. Acramite 75 WG[d]	10.7 oz	5.7 ab	1.7 a	6.0 a	5.0 a	3.7 a	2.3 ab	18.7 a
6. Acramite 50 WS[d]	16.0 oz	4.0 ab	3.7 ab	4.3 a	12.3 b	2.0 a	1.8 a	24.2 a
7. Pyramite 60W	13.2 oz	4.8 ab	4.3 ab	3.2 a	5.0 a	5.0 a	6.7 b	24.2 a
8. Agri-Mek 0.15EC[c]	12.0 oz	6.7 ab	2.5 ab	4.0 a	4.0 a	5.7 a	3.7 ab	19.8 a
9. Untreated	---	6.0 ab	6.7 b	4.0 a	2.0 a	5.7 a	3.3 ab	21.7 a

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Pre-spray count. Not included in mean total analysis.

[c] Treatments contained 0.25% Volck Supreme oil.

[d] Treatments contained 0.025% Silwet L-77.

Table 21. Mean No. of Western Predatory Mites per 20 Leaves in Fairfield, CA – 2004

Treatment	Rate form/ac	Mean[a] No. Western Predatory Mites per 20 Leaves 8/31[b]	9/3	9/7	9/14	9/21	9/28	Total
1. Envidor 2SC	14.0 oz	1.3 ab	4.0 a	8.0 a	2.0 a	6.0 ab	1.7 ab	21.7 a
2. Envidor 2SC	18.0 oz	0.7 a	4.7 a	2.7 a	0.7 a	1.3 a	0.0 a	9.3 a
3. Kanemite 15SC[c]	21.0 oz	4.7 b	3.3 a	6.0 a	6.0 a	6.0 ab	4.7 bc	26.0 a
4. Kanemite 15SC	31.0 oz	1.0 ab	1.7 a	3.3 a	1.7 a	2.3 ab	3.0 abc	12.0 a
5. Acramite 75 WG[d]	10.7 oz	0.3 a	1.3 a	4.0 a	1.3 a	2.3 ab	0.0 a	9.0 a
6. Acramite 50 WS[d]	16.0 oz	0.0 a	1.3 a	3.3 a	5.3 a	1.0 a	1.2 ab	12.2 a
7. Pyramite 60W	13.2 oz	2.8 ab	3.7 a	0.8 a	6.7 a	6.7 ab	2.7 abc	20.5 a
8. Agri-Mek 0.15EC[c]	12.0 oz	0.7 a	1.7 a	2.0 a	3.0 a	0.7 a	1.7 ab	9.0 a
9. Untreated	---	0.7 a	6.0 a	4.7 a	4.0 a	8.0 b	6.7 c	29.3 a

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P < 0.05$).

[b] Pre-spray count. Not included in mean total analysis.

[c] Treatments contained 0.25% Volck Supreme oil.

[d] Treatments contained 0.025% Silwet L-77.

4. Phytotoxicity and Efficacy of Petro-Canada Oil

Methods and Materials: Two trials were conducted in two commercial pear orchards in the Sacramento Delta. In each trial, five treatments were replicated three times. Each replicate was 1.67 acres.

Trial A consisted of Petro-Canada oil treatments of carbon length C-23, C-25 and C-27 compared with Volck Supreme oil and the grower practice. All of the oil treatments were applied at a rate of 0.50% volume by volume (V/V). All of the treatments contained 10 oz Agri-Mek/ac and 2 oz Flint/ac for the first application on 18 April (10 mm fruit timing), 3 lb Guthion/ac for the second application on 15 May (1B CM timing) and 1 lb Diazinon/ac for the third application on 26 Oct (fall clean up timing). In addition, the grower practice received 1.0% (V/V) Volck Supreme oil at the first and third timings. Foliar sprays were applied with an air-blast speed sprayer operating with a finished spray volume of approximately 125 gal/ac at the 10 mm fruit and 1B CM timings while a finished spray volume of 400 gal/ac was used at the fall clean up timing.

Trial B consisted of C-25 Petro-Canada oil at 0.25%, 0.50% and 1.0% (V/V), Volck Supreme oil at 0.50% (V/V) and the grower practice. All of the treatments contained 10 oz Agri-Mek/ac and 28 oz Agri-Mycin 17/ac for the first application on 20 April (10 mm fruit timing) and 2.5 lbs Diazinon/ac for the third application on 5 November (fall clean up timing). In addition, the grower practice received 1.0% (V/V) Volck Supreme oil at the first and third applications. Foliar sprays were applied with an air-blast speed sprayer operating with a finished spray volume of approximately 100 gal/ac at the at the 10 mm fruit and 1B CM timings while a finished spray volume of 500 gal/ac was used at the fall clean up timing.

Control of CM was evaluated at the same time as commercial harvest on 13 July by inspecting a maximum of 333 fruit per replicate for CM infestation. Just prior to harvest, one typical fruit/tree was removed from each replicate. The fruit finish was evaluated by 20 members of the pear community (growers, packers, pest control advisors, government workers, etc.). The evaluations were subjectively rated and categorized. The fruit was rated in three categories where 1 was fruit with no blemishes "perfect finish," 2 was fruit with some blemishes, limb rub or darkening of fruit lenticels, and 3 was fruit with definite fruit marking, phytotoxicity and/or disfigurement. The control of PP, motile TSSM, ERM, WPM and SJS crawlers was evaluated by leaf-brushing 10 exterior and 10 interior leaves collected from trees within each replicate every other week from 12 July through 14 Nov. The plates with the contents from the brushed leaves were counted under magnification (20X) in the laboratory.

Results and Discussion:

CM Flight Activity – The timing of applications for CM and secondary pests was determined by the growers and their PCAs using both 1 mg and 10 mg CM pheromone traps and foliage inspections. Both orchards used pheromone mating disruption for CM control. In trial A, CM control was supplemented by an application of Guthion during the "B" peak timing of the first CM generation. In trial B, very few moths were captured during the season and only oil was

applied during the "B" peak timing. This treatment in this orchard was more directed for control of PP and mites.

Fruit Finish Evaluations – There was no significant difference among the fruit finish ratings of all the treatments for both Trial A and Trial B (Tables 22 & 23). The mean fruit finish rating for all the pears was 1.1 in Trial A was 1.2 in Trial B which is considered fruit with almost no blemishes. Thus none of the Petro-Canada oils should be considered phytotoxic at the rates tested.

CM Evaluations – There was no significant difference for CM infestation among all the treatments for both Trial A and Trial B (Tables 24 & 25). The CM infestation was very low in Trial A. The Petro-Canada oil treatments had slightly less CM infestation than the Volck treatment and the grower practice but the difference was not significant at $P \leq 0.05$. The CM infestation was completely absent for Trial B.

Secondary Pest Evaluations – Low populations of PP, TSSM and ERM were found in Trial A compared to Trial B. The efficacy of the experimental treatments in Trial A was difficult to interpret because of the low numbers. In Trial A, there was significantly greater mean total PP in the C-23 oil treatment than the remainder of the treatments (Table 26). This might be due to the C-23 being a lighter weight oil that had less suffocating effect on the PP nymphs. The medium weight C-25 oil was similar to the Volck oil treatment in PP control while the heavier C-27 oil suppressed PP population. The Petro-Canada oil treatments had less mean total TSSM than the other treatments (Table 27). The C-27 treatment also had significantly less mean total TSSM compared to the Volck oil treatment. The Petro-Canada oil treatments also showed a weight response in their ability to suppress TSSM., i.e. the heavy weight oils were more effective than the light weight oil. While there was no significant difference among the treatments for ERM control, the C-23 treatment had the highest mean total ERM population while the C-25 treatment had the lowest mean total ERM population (Table 28). There was no significant difference among the treatments for SJS control (Table 29). The Volck oil treatment had the lowest mean total SJS population while the grower practice had the highest mean total SJS population. All of the oil treatments seemed to suppress SJS populations compared to the grower practice. The C-27 treatment had significantly less mean total WPM than the grower practice (Table 30). However, the lower WPM population in the C-27 oil may be reflective of the low number of TSSM in the treatment.

In Trial B, there was significantly greater mean total PP in the 0.5% V/V rate of C-25 than in the grower practice (Table 31). There was also a large number of PP found in the 1.0% V/V rate. The 0.25% V/V rate had similar populations of PP to the Volck treatment. Based on trial A, the 0.5% V/V rate of C-25 should have had similar PP numbers to the Volck and grower treatments. All of the Petro-Canada oil treatments had significantly less mean total TSSM compared to the Volck treatment and the grower practice (Table 32). All the Petro-Canada oil treatments had significantly less mean total ERM compared to the grower practice (Table 33). The 0.25% V/V rate also had significantly less mean total ERM compared to the Volck treatment. The C-25 oil treatment showed a volume response in control of ERM. There was no difference among the treatments in SJS density (Table 34). However, higher numbers of SJS were found in the Petro-Canada oil treatments compared to the Volck and the grower practice treatments. There were significantly less mean total WPM populations in the C-25 treatments compared to the grower

practice (Table 35). Again this may simply reflect the low number of mites found in the Petro-Canada oil treatments.

Conclusions: These trials were conducted against low CM populations. There was also little difference in fruit finish ratings among the treatments with nearly blemish free fruit. It appears that the Petro-Canada oils provided as good or better control of both TSSM and ERM than Volck Supreme oil or the grower practice. However, it appears that the Petro-Canada oils was not as effective in control of PP as Volck Supreme oil or the grower practice.

Table 22. Mean Fruit Finish Rating at Commercial Harvest for Trial A in Sacramento, CA – 2004

Treatment[a]	Rate % Volume	No. Appl.	Mean[b] Fruit Finish Rating at Commercial Harvest
1. C-23 Petro-Canada Oil	0.5	3	1.2 a
2. C-25 Petro-Canada Oil	0.5	3	1.0 a
3. C-27 Petro-Canada Oil	0.5	3	1.1 a
4. Volck Supreme Oil	0.5	3	1.2 a
5. Grower Practice	----	3	1.1 a

[a] All treatments contained 10 oz Agri-Mek/ac and 2 oz Flint/ac for the first application, 3 lb Guthion/ac for the second application and 1 lb Diazinon/ac for the third application. In addition, the grower practice received 1.0% Volck Supreme oil for the first and third applications.

[b] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P \leq 0.05$).

Table 23. Mean Fruit Finish Rating at Commercial Harvest for Trial B in Sacramento, CA – 2004

Treatment[a]	Rate % Volume	No. Appl.	Mean[b] Fruit Finish Rating at Commercial Harvest
1. C-25 Petro-Canada Oil	0.25	3	1.3 a
2. C-25 Petro-Canada Oil	0.5	3	1.4 a
3. C-25 Petro-Canada Oil	1.0	3	1.1 a
4. Volck Supreme Oil	0.5	3	1.1 a
5. Grower Practice	----	3	1.1 a

[a] All treatments contained 10 oz Agri-Mek/ac and 28 oz Agri-Mycin 17/ac for the first application and 2.5 lbs Diazinon/ac for the third application. In addition, the grower practice received 1.0% Volck Supreme oil for the first and third applications.

[b] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P \leq 0.05$).

Table 24. Mean Percent Codling Moth-Infested Fruit Inspected at Commercial Harvest for Trial A in Sacramento Delta, CA – 2004

Treatment[a]	Rate % Volume	No. Appl.	Mean[b] Percent Infested Fruit at Commercial Harvest
1. C-23 Petro-Canada Oil	0.5	3	0.0 a
2. C-25 Petro-Canada Oil	0.5	3	0.0 a
3. C-27 Petro-Canada Oil	0.5	3	0.0 a
4. Volck Supreme Oil	0.5	3	0.1 a
5. Grower Practice	----	3	0.2 a

[a] All treatments contained 10 oz Agri-Mek/ac and 2 oz Flint/ac for the first application, 3 lb Guthion/ac for the second application and 1 lb Diazinon/ac for the third application. In addition, the grower practice received 1.0% Volck Supreme oil for the first and third applications.

[b] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P \leq 0.05$).

Table 25. Mean Percent Codling Moth-Infested Fruit Inspected at Commercial Harvest for Trial B in Sacramento Delta, CA – 2004

Treatment[a]	Rate % Volume	No. Appl.	Mean[b] Percent Infested Fruit at Commercial Harvest
1. C-25 Petro-Canada Oil	0.25	3	0.0 a
2. C-25 Petro-Canada Oil	0.5	3	0.0 a
3. C-25 Petro-Canada Oil	1.0	3	0.0 a
4. Volck Supreme Oil	0.5	3	0.0 a
5. Grower Practice	----	3	0.0 a

[a] All treatments contained 10 oz Agri-Mek/ac and 28 oz Agri-Mycin 17/ac for the first application and 2.5 lbs Diazinon/ac for the third application. In addition, the grower practice received 1.0% Volck Supreme oil for the first and third applications.

[b] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, $P \leq 0.05$).

Table 26. Mean Number of Pear Psylla Nymphs per 20 leaves for Trial A in Sacramento, CA – 2004

Treatments	Rate % Vol.	Mean[a] No. Pear Psylla Nymphs per 20 Leaves 12-Jul	24-Jul	8-Aug	22-Aug	7-Sep	20-Sep	3-Oct	17-Oct	31-Oct	14-
1. C-23 Petro-Canada Oil	0.5	1.3 a	0.0 a	0.3 a	0.7 a	0.0 a	0.7 a	2.3 a	2.3 a	2.0 b	10.
2. C-25 Petro-Canada Oil	0.5	0.0 a	0.0 a	0.3 a	0.0 a	0.3 a	0.0 a	0.3 a	0.0 a	0.7 ab	5.
3. C-27 Petro-Canada Oil	0.5	0.0 a	0.0 a	0.3 a	0.0 a	0.0 a	0.7 a	1.0 a	0.7 a	0.0 a	0.
4. Volck Supreme Oil	0.5	0.0 a	1.3 a	0.0 a	0.0 a	0.3 a	0.3 a	1.7 a	1.3 a	0.7 ab	0.
5. Grower Practice	—	0.0 a	0.7 a	0.3 a	0.0 a	0.0 a	1.0 a	0.0 a	0.7 a	1.3 ab	1.

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, P < 0

Table 27. Mean Number of Twospotted Spider Mites per 20 leaves for Trial A in Sacramento, CA – 2004

Treatments	Rate % Vol.	Mean[a] No. Twospotted Spider Mites per 20 Leaves 12-Jul	24-Jul	8-Aug	22-Aug	7-Sep	20-Sep	3-Oct	17-Oct	31-Oct	14-
1. C-23 Petro-Canada Oil	0.5	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.3 a	3.3 a	1.3 a	2.5 b	0.
2. C-25 Petro-Canada Oil	0.5	0.0 a	0.0 a	0.0 a	0.0 a	0.7 a	0.3 a	2.7 a	1.7 a	0.0 a	0.
3. C-27 Petro-Canada Oil	0.5	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.3 a	1.3 a	0.0 a	0.
4. Volck Supreme Oil	0.5	0.0 a	0.0 a	0.0 a	0.7 a	0.0 a	2.0 a	1.3 a	3.3 a	1.0 ab	1.
5. Grower Practice	—	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	2.7 a	1.3 a	1.3 a	2.0 ab	1.

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, P < 0

Table 28. Mean Number of European Red Mites per 20 leaves for Trial A in Sacramento, CA – 2004

Treatments	Rate % Vol.	Mean[a] No. European Red Mites per 20 Leaves									
		12-Jul	24-Jul	8-Aug	22-Aug	7-Sep	20-Sep	3-Oct	17-Oct	31-Oct	14-
1. C-23 Petro-Canada Oil	0.5	0.3 a	0.0 a	0.0 a	0.7 a	4.0 a	2.0 a	2.7 a	0.0 a	0.0 a	0.
2. C-25 Petro-Canada Oil	0.5	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	1.7 a	0.7 a	1.0 a	0.0 a	0.
3. C-27 Petro-Canada Oil	0.5	0.0 a	0.0 a	0.0 a	2.7 a	2.0 a	0.0 a	0.0 a	0.3 a	0.0 a	0.
4. Volck Supreme Oil	0.5	0.0 a	0.0 a	0.0 a	0.7 a	0.0 a	3.3 a	0.7 a	1.3 a	0.3 a	0.
5. Grower Practice	—	0.0 a	0.0 a	0.0 a	0.2 a	0.0 a	1.0 a	1.0 a	1.0 a	0.7 a	0.

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, P < 0

Table 29. Mean Number of San Jose Scales per 20 leaves for Trial A in Sacramento, CA – 2004

Treatments[b]	Rate % Vol.	Mean[a] No. San Jose Scales per 20 Leaves									
		12-Jul	24-Jul	8-Aug	22-Aug	7-Sep	20-Sep	3-Oct	17-Oct	31-Oct	14-
1. C-23 Petro-Canada Oil	0.5	20.0 a	17.3 a	12.3 a	5.3 a	5.0 a	4.0 a	9.3 a	2.3 a	5.0 ab	3.
2. C-25 Petro-Canada Oil	0.5	19.7 a	25.3 a	8.0 a	4.0 a	5.0 a	6.0 a	4.0 a	4.0 a	1.0 a	2.
3. C-27 Petro-Canada Oil	0.5	26.7 a	17.3 a	12.3 a	4.0 a	4.7 a	5.3 a	2.7 a	12.3 b	2.0 a	4.
4. Volck Supreme Oil	0.5	22.0 a	12.0 a	17.0 a	2.0 a	5.7 a	2.7 a	1.7 a	4.7 a	1.7 a	3.
5. Grower Practice	—	24.0 a	21.3 a	21.0 a	6.0 a	14.7 b	8.3 a	5.0 a	7.7 ab	8.3 b	8.

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, P < 0

Table 30. Mean Number of Western Predatory Mites per 20 leaves for Trial A in Sacramento, CA – 2004

Treatments	Rate	Mean[a] No. Western Predatory Mites per 20 Leaves									
	% Vol.	12-Jul	24-Jul	8-Aug	22-Aug	7-Sep	20-Sep	3-Oct	17-Oct	31-Oct	14-
1. C-23 Petro-Canada Oil	0.5	2.0 a	2.0 a	8.0 ab	16.0 b	4.3 a	3.7 a	3.0 a	2.0 a	0.5 a	0.7
2. C-25 Petro-Canada Oil	0.5	2.0 a	6.7 b	15.7 c	8.7 ab	9.0 a	1.0 a	4.3 a	2.7 a	1.0 a	0.3
3. C-27 Petro-Canada Oil	0.5	2.0 a	4.7 ab	3.0 a	8.7 ab	11.0 a	1.3 a	4.3 a	2.3 a	0.3 a	1.7
4. Volck Supreme Oil	0.5	1.0 a	3.3 ab	12.3 bc	4.0 a	13.3 a	3.3 a	3.0 a	2.7 a	0.7 a	2.0
5. Grower Practice	—	1.7 a	4.7 ab	11.3 bc	12.4 b	12.3 a	4.3 a	5.7 a	5.0 a	1.7 a	1.3

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, P < 0

Table 31. Mean Number of Pear Psylla Nymphs per 20 leaves for Trial B in Sacramento, CA – 2004

Treatments	Rate	Mean[a] No. Pear Psylla Nymphs per 20 Leaves									
	% Vol.	12-Jul	24-Jul	8-Aug	22-Aug	7-Sep	20-Sep	3-Oct	17-Oct	31-Oct	14-
1. C-25 Petro-Canada Oil	0.25	0.0 a	0.0 a	0.7 a	1.3 a	1.3 ab	1.7 a	7.0 a	5.0 a	9.0 a	23.
2. C-25 Petro-Canada Oil	0.5	0.3 a	0.7 a	1.3 a	0.0 a	3.7 b	4.7 b	9.3 a	23.3 a	19.3 b	23.
3. C-25 Petro-Canada Oil	1.0	0.0 a	4.7 b	0.0 a	2.0 a	0.3 a	0.3 a	10.0 a	6.0 a	11.7 ab	35.
4. Volck Supreme Oil	0.5	0.3 a	0.0 a	0.0 a	2.0 a	1.7 ab	5.0 b	10.7 a	13.7 a	6.7 a	6.
5. Grower Practice	—	0.0 a	0.7 a	0.0 a	2.0 a	1.0 a	1.0 a	9.0 a	3.0 a	6.3 a	8.

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, P < 0

Table 32. Mean Number of Twospotted Spider Mites per 20 leaves for Trial B in Sacramento, CA – 2004

Treatments	Rate	Mean[a] No. Twospotted Spider Mites per 20 Leaves									
	% Vol.	12-Jul	24-Jul	8-Aug	22-Aug	7-Sep	20-Sep	3-Oct	17-Oct	31-Oct	14
1. C-25 Petro-Canada Oil	0.25	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.0 a	0.0 a	0.0 a	0.0 a	0.
2. C-25 Petro-Canada Oil	0.5	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.0 a	0.0 a	0.0 a	0.0 a	0.
3. C-25 Petro-Canada Oil	1.0	0.0 a	0.0 a	0.0 a	0.0 a	0.7 a	0.0 a	0.0 a	0.0 a	0.0 a	0.
4. Volck Supreme Oil	0.5	0.0 a	0.0 a	0.0 a	2.0 a	4.3 a	2.0 a	1.0 a	0.3 a	0.0 a	0.
5. Grower Practice	—	0.0 a	0.0 a	0.0 a	0.7 a	4.7 a	2.3 a	1.7 a	0.7 a	0.3 a	0.

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, P < 0

Table 33. Mean Number of European Red Mites per 20 leaves for Trial B in Sacramento, CA – 2004

Treatments	Rate	Mean[a] No. European Red Mites per 20 Leaves									
	% Vol.	12-Jul	24-Jul	8-Aug	22-Aug	7-Sep	20-Sep	3-Oct	17-Oct	31-Oct	14-
1. C-25 Petro-Canada Oil	0.25	0.0 a	0.0 a	0.0 a	0.7 a	0.0 a	0.0 a	0.0 a	0.7 a	0.0 a	0.
2. C-25 Petro-Canada Oil	0.5	0.0 a	0.0 a	2.0 ab	4.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.
3. C-25 Petro-Canada Oil	1.0	0.0 a	0.0 a	1.3 ab	3.3 a	0.7 a	0.0 a	0.3 a	0.7 a	1.3 a	0.
4. Volck Supreme Oil	0.5	0.0 a	2.0 a	7.3 bc	2.0 a	4.3 ab	8.3 a	21.0 a	8.7 a	0.3 a	0.
5. Grower Practice	—	0.0 a	1.3 a	9.3 c	12.0 b	11.0 b	1.0 a	17.3 a	20.7 a	4.0 b	0.

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, P < 0

Table 34. Mean Number of San Jose Scales per 20 leaves for Trial B in Sacramento, CA. – 2004.

Treatments	Rate % Vol.	Mean[a] No. San Jose Scales per 20 Leaves 12-Jul	24-Jul	8-Aug	22-Aug	7-Sep	20-Sep	3-Oct	17-Oct	31-Oct	14-
1. C-25 Petro-Canada Oil	0.25	13.3 a	14.7 a	10.0 a	4.7 a	2.7 a	2.7 ab	2.7 a	1.7 a	2.3 a	2.
2. C-25 Petro-Canada Oil	0.5	19.0 a	14.0 a	19.3 ab	14.7 b	1.0 a	2.3 ab	1.7 a	3.0 a	2.7 a	4.
3. C-25 Petro-Canada Oil	1.0	25.0 a	17.3 a	38.0 b	6.7 a	2.0 a	3.7 b	3.7 a	2.7 a	2.7 a	3.
4. Volck Supreme Oil	0.5	12.7 a	7.3 a	8.7 a	1.3 a	2.3 a	3.7 b	4.3 a	1.3 a	1.3 a	0.
5. Grower Practice	—	25.0 a	3.3 a	2.7 a	2.7 a	1.0 a	0.3 a	2.0 a	2.3 a	4.7 a	1.

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, P < 0

Table 35. Mean Number of Western Predatory Mites per 20 leaves for Trial B in Sacramento, CA. – 2004.

Treatments[b]	Rate % Vol.	Mean[a] No. Western Predatory Mites per 20 Leaves 12-Jul	24-Jul	8-Aug	22-Aug	7-Sep	20-Sep	3-Oct	17-Oct	31-Oct	14-
1. C-25 Petro-Canada Oil	0.25	1.7 a	4.7 a	20.7 a	2.0 a	3.3 a	0.7 a	2.0 a	0.7 a	0.3 a	0.
2. C-25 Petro-Canada Oil	0.5	3.3 a	5.3 a	24.7 a	6.7 a	5.7 ab	2.7 ab	1.7 a	0.0 a	0.7 a	0.
3. C-25 Petro-Canada Oil	1.0	3.7 a	2.7 a	17.3 a	6.7 a	3.0 a	1.0 a	0.7 a	0.3 a	1.3 a	1.
4. Volck Supreme Oil	0.5	6.3 a	6.0 a	20.7 a	4.7 a	7.7 ab	5.3 bc	5.7 ab	2.7 ab	3.3 a	0.
5. Grower Practice	—	4.0 a	5.3 a	30.7 a	8.7 a	10.7 b	6.7 c	8.3 b	6.7 b	2.7 a	1.

[a] Means followed by the same letter within a column are not significantly different (Fisher's protected LSD, P < 0

5. Insecticide Longevity Evaluation for Codling Moth Control in Pears

Please see Chuck Ingel's report.

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