

Chemical Control/New Products

Codling Moth Control in Pears

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**Methods and Materials**

A study was conducted in a commercial 'Bartlett' pear orchard planted on a 25 ft x 25 ft spacing (70 tree/acre) in Fairfield, CA. Eighteen treatments were replicated four times in a randomized, complete block design. Each replicate was an individual tree. Foliar sprays were applied with a handgun operating at 200 psi with a finished spray volume of 200 gal per acre (2.87 gal/tree). Applications were scheduled based on degree days (DD). DD were calculated with a biofix of 31 March for the first generation and a 17 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 was monitored with a pheromone trap placed high in the tree canopy. Target application timings were: Knack and difenolan at 100 and 500 DD from 1st biofix; CM-001 at 200 and 600 DD from 1st biofix and 200 DD from 2nd biofix; CM-002/X, Brigade and Azinphos-M (grower standard) at 250 and 650 DD from 1st biofix and 250 DD from 2nd biofix. Due to rain on 15 through 18 May and again on 21 May and high winds through 25 May, the 600 DD and 650 DD applications were postponed until 28 May (699 DD). In addition, Knack and difenolan, which were applied on 14 May, were retreated on 28 May. Control of the first CM generation was evaluated on 6 June by inspecting 50 fruit from the bottom of the tree canopy and 50 fruit from the top of the tree canopy per replicate for CM infestation (a total of 400 fruit per treatment). Control of the second generation was evaluated at harvest on 22 July by inspecting a maximum of 125 fruit from the bottom of the tree canopy and 125 fruit from the top of the tree canopy per replicate for CM infestation. Due to the low crop this year, the number of fruit inspected varied by treatment. Control of pear psylla nymphs, motile twospotted spider mites and European red mites was evaluated by sampling 10 exterior and 10 interior leaves per replicate weekly from 18 June through 16 July. Pear psylla nymphs and motile twospotted spider mites and European red mites were brushed from the sampled leaves and counted under magnification (20X).

**Results and Discussion**

**First Generation Evaluation.** There was not a great deal of difference between the percent infestation from fruit high in the tree canopy as compared to fruit from low in the tree canopy in the first generation evaluation (Table 1). The fruit high and low in the tree canopy were combined for the total infestation. All insecticide treatments had significantly lower CM infestation as compared to the untreated control. There was no significant difference in CM infestation among all insecticide treatments except that the CM-001 and Knack at 0.11 lb (AI)/acre treatments had significant higher infestation as compared to the grower standard

(Azinphos-M).

**Harvest Evaluation.** The crop was very low this year and the number of fruit inspected at harvest was less than the desired 250 fruit per replicate (125 low fruit and 125 high fruit). The low crop was the result of a lack of winter chilling which caused an extended bloom period. The extended bloom period coupled with unusually frequent and heavy spring rains resulted in poor pollination and fruit set. In addition, the spring rains caused an increase in the number of fire blight infestations this year which reduced the number of fruit per tree even further. The number of fruit inspected was less than 250 fruit per replicate in all treatments except CM-002/X at 0.0089 lb (AI)/acre. The total CM infestation in the untreated control was extremely high (56%) and was significantly higher than all other treatments (Table 2). There was no significant difference in CM infestation among the grower standard (Azinphos-M), Brigade at 0.06 and 0.1 lb (AI)/acre, Azinphos-M followed by Brigade at 0.06 lb (AI)/acre, CM-002X at 0.0178 lb (AI)/acre, Knack at 0.066 and 0.11 lb (AI)/acre followed by two applications of Azinphos-M, and difenolan at 0.1875 (AI)/acre followed by two applications of Azinphos-M.

**Secondary Pest Evaluations.** The pear psylla, twospotted spider mite and European red mite populations, in general, were higher in those treatments that contained two or more Azinphos-M applications.

### **Conclusions**

This trial was conducted against a very high CM population with over 55% infested fruit at harvest in the untreated control and over 2% infested fruit in the grower standard (three applications of Azinphos-M at 1.5 lb (AI)/acre). The acceptable CM infestation level for growers is less than 0.5%. Thus no treatment approached the grower acceptable level including the grower standard. However, Brigade at 0.06 and 0.1 lb (AI)/acre applied three times, Brigade at 0.06 lb (AI)/acre applied twice with one applications of Azinphos-M, CM-002/X at 0.0178 lb (AI)/acre applied three times, difenolan at 0.1875 (AI)/acre and Knack at 0.066 lb (AI)/acre applied once with two applications of Azinphos-M had CM infestation levels similar to that of the grower standard treatment. It appears that only Brigade and possibly the high rate of CM-002/X could be a direct replacement for Azinphos-M. Difenolan and Knack will have to be used in a combination program with Azinphos-M. However, the combination of CGA-59205 and Knack with Azinphos-M may result in an increase in mite or psylla populations.

Table 1. Mean percent CM infestation at first generation in Fairfield, CA, 1996.

Treatment	Rate lb (AI)/acre	Mean* percent codling moth infested fruit		
		High	Low	Total
1) Brigade 10WP	0.06	1.0a	0.5a	0.8ab
2) Brigade 10WP	0.10	0.0a	0.0a	0.0a
3) Azinphos-M 50WP	1.5			
Brigade 10WP (2X)	0.06	0.0a	0.5a	0.3a
4) CM-001 5%SC	0.045	6.0cd	5.0c	5.5d
5) CM-001 5%SC	0.089	2.5ab	3.5bc	3.0cd
6) CM-001 5%EC	0.045	1.5ab	3.0bc	2.3bc
7) CM-001 5%EC	0.089	0.5a	5.0c	2.8cd
8) CM-002/X 0.5%EC	0.0045	1.5ab	2.0ab	1.8abc
9) CM-002/X 0.5%EC	0.0089	2.0ab	0.0 a	1.0abc
10) CM-002/X 0.5%EC	0.0178	0.0a	0.0 a	0.0a
11) Difenolan 35WP (2X)	0.125			
Azinphos-M 50WP	1.5	2.0ab	2.5abc	2.3bc
12) Difenolan 35WP	0.1875			
Azinphos-M 50WP (2X)	1.5	2.0ab	2.5abc	2.3bc
13) Knack 0.86EC (2X)	0.066			
Azinphos-M 50WP	1.5	1.5ab	0.0 a	0.8ab
14) Knack 0.86EC	0.066			
Azinphos-M 50WP (2X)	1.5	0.5a	1.5ab	1.0abc
15) Knack 0.86EC (2X)	0.11			
Azinphos-M 50WP	1.5	4.5bc	1.5ab	3.0cd
16) Knack 0.86EC	0.11			
Azinphos-M 50WP (2X)	1.5	2.5ab	1.5ab	2.0abc
17) Azinphos-M 50WP	1.5	1.0a	0.0a	0.5ab
18) Untreated	---	13.0d	13.0d	13.0e

\*Means followed by the same letter within a column are not significantly different (Fisher's Protected LSD,  $P < 0.05$ ). Data analyzed using an arcsine transformation.

Table 2. Mean percent codling moth infestation at harvest in Fairfield, CA, 1996.

Treatment	Rate lb (AI)/acre	Mean* percent codling moth infested fruit		
		Low	High	Total
1) Brigade 10WP	0.06	4.4bcd	2.6ab	3.5abcd
2) Brigade 10WP	0.10	0.6a	3.4abc	2.1ab
3) Azinphos-M 50WP	1.5			
Brigade 10WP (2X)	0.06	1.8ab	2.7ab	2.0a
4) CM-001 5%SC	0.045	17.8hi	21.1e	19.6i
5) CM-001 5%SC	0.089	14.8ghi	7.8bcd	11.9h
6) CM-001 5%EC	0.045	22.2i	20.2e	21.4i
7) CM-001 5%EC	0.089	11.8fgh	6.0abcd	9.8fgh
8) CM-002/X 0.5%EC	0.0045	7.8def	9.4cd	8.6efgh
9) CM-002/X 0.5%EC	0.0089	9.6efg	12.2de	11.0gh
10) CM-002/X 0.5%EC	0.0178	4.4bcde	4.5abc	4.6bcde
11) Difenolan 35WP (2X)	0.125			
Azinphos-M 50WP	1.5	3.7bcd	9.9cd	6.5defg
12) Difenolan 35WP	0.1875			
Azinphos-M 50WP (2X)	1.5	3.0bcd	2.7ab	2.9abcd
13) Knack 0.86EC (2X)	0.066			
Azinphos-M 50WP	1.5	5.2cde	5.3abcd	5.5cdef
14) Knack 0.86EC	0.066			
Azinphos-M 50WP (2X)	1.5	2.4abc	3.2ab	3.1abcd
15) Knack 0.86EC (2X)	0.11			
Azinphos-M 50WP	1.5	6.1cdef	6.6abcd	6.4defg
16) Knack 0.86EC	0.11			
Azinphos-M 50WP (2X)	1.5	5.5cde	5.2abcd	5.3bcdef
17) Azinphos-M 50WP	1.5	2.2abc	1.9a	2.1ab
18) Untreated	---	56.1j	55.3f	55.7j

\*Means followed by the same letter within a column are not significantly different (Fisher's Protected LSD,  $P < 0.05$ ). Data analyzed using an arcsine transformation.