

Pome Fruits—Implementation

Codling Moth in Apple

Larry J. Gut and Jay F. Brunner

Washington State University Tree Fruit Research and Extension Center, Wenatchee, WA

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Study Site Description. Mating disruption (MD) as a control for codling moth (CM) in Washington apple orchards was evaluated for the second consecutive year at five study sites, as well as at seven new locations. Test sites were comprised of one to nine pheromone treated blocks and a conventionally treated block as a control. Forty apple blocks (149.6 acres) were treated with pheromone. Two dispensers, the Isomate-C (Biocontrol Ltd.) "twist-tie type" and the Checkmate-C (Consep Membranes Inc.) "foil type," were evaluated using different rates and number of applications.

Fruit Damage. Levels of CM injury to fruit provided the primary measure of the effectiveness of MD. CM injury to fruit was evaluated at the end of first generation and prior to harvest. A total of 3000 fruit were non-destructively examined in each block. Each sample consisted of inspecting 15 fruit high in the canopy (above 7 feet) and 15 fruit low in the canopy (below 7 feet) from 100 trees.

Direct comparisons of Isomate-C and Checkmate-C were conducted at six sites (Table 1). The initial density of CM within and adjacent to a block appeared to have the greatest effect on the degree of control by MD. In blocks with low pressure (W4 and W9) suppression of CM with Isomate-C or Checkmate-C dispensers, regardless of application rate, resulted in less than 0.3% injury to fruit and control generally equivalent to conventionally treated blocks. Levels of CM injury of 0.2% to 2.1% were recorded in pheromone treated blocks with a history of moderate CM densities (W2 and W5). At these sites, multiple treatments of 120 or 160 Checkmate-C dispensers per acre were less effective than a single treatment of 400 Isomate-C dispensers per acre. High levels of CM injury to fruit occurred in MD blocks where initial densities of this pest were high (W3 and W7). At site W3 this included a block that was treated with Checkmate-C at double the recommended rate (3 times with 240 d/a). The high level of CM injury at harvest in this block (9.0%) was similar to levels in adjacent blocks treated 3 times with Checkmate-C at the standard rate of 120 d/a (6.8%), once with Isomate-C at 400 d/a (5.9%), or not treated for CM (11.8%).

Impact on Non-Target Species. Densities of white apple leafhopper (WALH), western tentiform leafminer (WTLM), green apple aphid, campyloomma, leafrollers, mites and their natural enemies were determined at seven sites. Aphid predators and the parasitoids of WTLM and WALH were abundant in pheromone treated blocks, as well as some conventionally treated blocks. However, in orchards treated several times with OPs for control of CM, densities of natural enemies were substantially greater in the pheromone treated than in the conventionally treated block. Campyloomma was abundant at only two sites (W3 and W7), but at both higher densities were detected in the pheromone treated than in the conventionally treated block. We

suspect that in the latter, a prebloom Lorsban treatment for leafroller control also provided suppression of campyloomma. Increases in leafroller densities from 1991 to 1992 were recorded in three pheromone treated blocks, and in each case leafroller injury to fruit comprised a major portion of the cullage in 1992.

Pheromone Trap Catch. A major effort in 1992 was directed toward determining the effectiveness of pheromone traps baited with 10 mg of codlemone (10 times the normal load) as a tool for monitoring CM populations in MD orchards. Pherocon 1CP traps baited with this high load of codlemone in red septa were placed in pheromone blocks at a density of 1 trap per 2.5 acres. The number of male CM captured was recorded weekly. Septa were changed at three week intervals and trap bottoms were replaced every six weeks, more often if dirty. A strong correlation between trap catch and CM damage indicated that the 10 mg lure was effective for predicting the potential for fruit injury (Figure 1). Modeling the relationship between cumulative trap catch and CM injury at harvest revealed that about 10 moths per season would result in a level of injury below 1%.

Table 1. Capture of codling moth in pheromone (Isomate-C or Checkmate-C), insecticide and untreated apple blocks and fruit injury during 1992.

Site	Block size (acres)	Treatment		Avg. trap catch (moth/trap) ²	Adjusted fruit injury (%)		
		Dispenser	Rate (d/acre) ¹		Interior	Border ³	Total
W2	5.9	Isomate-C	400	4.0	0.6	0.9	0.8
	5.8	Checkmate-C	160 x 3	6.0	1.0	2.0	1.5
	7.6	Conventional		30.6	0.5	1.5	1.0
	0.2	Untreated		27.0			6.2
W3	5.3	Isomate-C	400	47.0	4.1	7.6	5.9
	2.5	Checkmate-C	240 x 3	107.0	8.8	9.0	9.0
	2.5	Checkmate-C	120 x 3	65.0	7.1	6.4	6.8
	4.0	Conventional		23.5	0.3	0.4	0.4
	0.2	Untreated		107.0			11.8
W4	4.2	Isomate-C	250	1.0	0.1	0.2	0.1
	4.2	Checkmate-C	120 x 2	2.0	0.1	0.1	0.1
	4.0	Organic		7.0	0.2	0.2	0.2
	5.0	Conventional		1.0	<0.1	0.0	<0.1
W5	2.2	Isomate-C	400	0.0	0.3	0.3	0.3
	2.3	Isomate-C	250 + 150	3.0	0.2	0.1	0.1
	2.3	Checkmate-C	160 x 3	11.0	1.2	2.9	2.1
	10.0	Conventional		172.8	0.0	0.1	0.1
W7	1.7	Isomate-C	400 + 200	81.8	4.6	10.2	7.5
	1.7	Checkmate-C	160 x 3	65.0	72.7	11.3	9.5
	5.0	Conventional		34.5	0.6	0.6	0.6
W9	4.0	Isomate-C	400	1.0	0.4	0.2	0.3
	4.0	Checkmate-C	160 x 2	0.0	0.1	0.1	0.1
	3.5	Isomate-C	400	0.0	0.3	0.1	0.2
	3.5	Checkmate-C	160 x 2	0.0	0.2	0.1	0.2
	8.0	Untreated		2.0	0.1	0.2	0.1

¹d/a=dispensers per acre, multiple applications indicated by an addition (+) or multiplication (x) symbol.

²Capture of moths in Pherocon 1CP traps baited with codlemone at a dosage of 10 mg (pheromone treated orchards) or 1 mg (non-pheromone treated orchards) and placed within the fruiting canopy of the tree, 1.5 to 2 m.

³Border consists of an area ca. 30 m wide around the perimeter of the orchard.

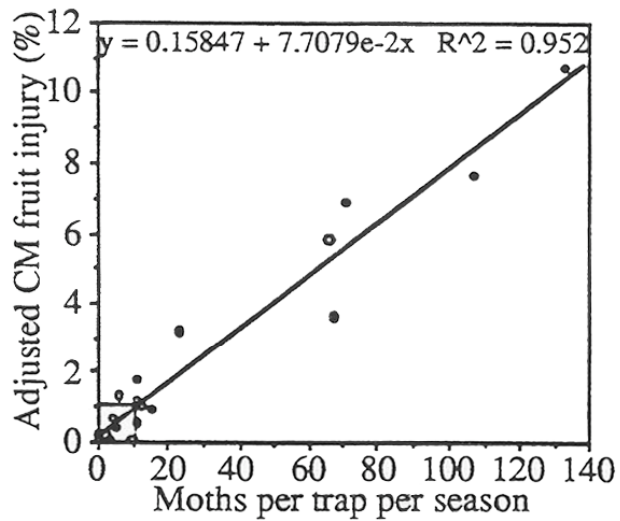


Figure 1. The relationship between CM catch in traps baited with 10mg lures and fruit injury in MD treated apple blocks.