Mating Disruption/SIR

Mating Disruption Product Evaluations Against Codling Moth

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Five mating disruption (MD) products were evaluated for their ability to control codling moth (CM) in apple. Three registered products, Isomate C (Pacific Biocontrol, Inc.), Isomate C+ (Pacific Biocontrol, Inc.) and Checkmate-CM (Consep, Inc.) and two experimental products, Checkmate CM 160/1 (Consep, Inc.) and TNO (Trécé, Inc.) were evaluated using different rates and numbers of applications. The experimental design consisted of large unreplicated blocks either with pheromone plus insecticides as needed or insecticides only. Tests were conducted in nine central Washington and two northeast Oregon locations. In total, 32 apple blocks (138.5 acres) were treated with pheromone.

Capture of males in pheromone traps and levels of fruit injury were used to evaluate the effectiveness of CM control in test orchards. Pherocon 1CP traps (Trécé, Inc.) were placed in pheromone and conventional orchards at a density of 1 trap per 2.5 acres. Traps in conventional orchards were baited with lures containing 1 mg of codlemone, while traps in pheromone orchards were baited with lures containing 10 mg of codlemone. CM injury to fruit at the end of the first generation and at harvest was evaluated by nondestructively examining 1500 apples in each test block. An equal number of apples from high (above 7 feet) and low (below 7 feet) in the canopy was inspected on 50 trees in each block.

Checkmate-CM. Checkmate-CM dispensers were evaluated in Howard Flat, an apple growing region north of Chelan, Washington. Two products were tested, Checkmate-CM which contained 105 mg of codlemone and Checkmate-CM 160/1 which contained 150 mg of codlemone. Codling moth pressure at the three Checkmate-CM test sites, as indicated by moth catch in the conventional orchards, was low (HF2 and HF3) or moderate (HF1) (Table 1). No CM injury to fruit was observed in conventionally treated orchards. Checkmate-CM 160/1 applied twice and combined with one or two organophosphate (OP) insecticide sprays had no or low levels of fruit injury at harvest. All three orchards treated with a single application of Checkmate-CM plus insecticides had fruit damage at harvest. The highest level of injury, 1.12%, was recorded in the orchard that received only a single OP spray. However, based on previous experience, 1st generation moth catch in pheromone traps indicated that mating disruption in all three Checkmate-CM treated orchards was not sufficient to provide CM control.

Since all Checkmate treated orchards received one or more supplemental applications of OP insecticides, it is difficult to assess the efficacy of the pheromone treatments. This evaluation is further confounded by placement of dispensers. The first applications of dispensers were consistently placed in the middle third of the canopy. Control of CM by mating disruption is most effective when dispensers are placed high in the canopy. Given the moth pressure and poor

application of dispensers, results indicate that an application of 160 Checkmate-CM dispensers was not sufficient for CM control. The experimental dispenser, Checkmate-CM 160/1, applied at a rate of 110 to 160 dispensers per acre (d/a) appeared to be more effective than Checkmate-CM. Moth catch in 10 mg baited pheromone traps was relatively low in Checkmate-CM 160/1 treated orchards, and fruit injury was kept at low levels when combined with one or two OP sprays. Further testing, particularly under low and moderate CM pressure and without the masking effects of OP insecticides, is required to make an unbiased assessment of this new Checkmate product for CM control.

Isomate C+ and TNO. The effectiveness of Isomate C+ and TNO for CM control was directly compared at two sites (Table 2). Dispensers were applied at the manufacturers' suggested rates of 400 Isomate C+ d/a and 200 TNO d/a. Both sites have a history of moderate CM pressure, and 1993 fruit injury records indicated that overwintering densities of CM were probably similar in all of the pheromone treated orchards. The same level of suppression of moth catch in pheromone traps was achieved with the two pheromone treatments (Table 2). No catch was recorded at site W2, but high moth catches occurred during the second generation at site W8. Both pheromone treatments failed to prevent CM males from locating 10 mg baited pheromone traps beginning at peak flight of the second generation. This corresponded to about 100 days after dispenser placement. Low levels of CM fruit injury at harvest were recorded in conventional and pheromone treated orchards at site W2, but CM injury was higher in pheromone treated orchards than in the conventionally treated orchard at site W8. A second application of Isomate C+ or TNO was required at this location. It is suspected that higher levels of CM fruit injury would have occurred in both pheromone treated orchards if they had not received supplemental treatments of ryania.

Isomate C and Isomate C+. The effectiveness of Isomate C, Isomate C+ and conventional insecticides for CM control was directly compared at five sites (Table 3 and W2 in Table 2). Dispensers were applied at rates of 400 to 1200 d/a. In blocks with low pressure (MF3, W2, and W4), suppression of CM with Isomate C or Isomate C+ applied at 400 d/a resulted in less than 0.1% injury to fruit and control equivalent to conventional programs. Similar levels of damage were also recorded in Isomate C or Isomate C+ treated blocks at sites with a history of moderate to high CM population levels (W5 and W11). However, conventional insecticides consistently provided better CM control than pheromone treatments.

Table 1. Comparison of codling moth catch and fruit injury in apple orchards treated with Checkmate pheromone dispensers[1] or conventional insecticides, northcentral Washington, 1994.

	Treatment		Average moth catch[2] per generation		% fruit injury end of generation	
Site	Dispenser	Rate (d/a)	First	Second	First	Second
HF1	Checkmate-160/1	100, 160	5.0	0.5	0.0	0.0
	Checkmate-CM	160	9.0	4.0	0.0	0.23
	Checkmate-CM	160	36.0	3.0	0.0	1.12
	Checkmate-CM	160	34.0	2.0	0.14	0.33
	Conventional		17.0	34.0	0.0	0.0
HF2	Checkmate-160/1	110, 160	0.3	0.5	0.0	0.05
	Conventional		5.0	7.5	0.0	0.0
HF3	Checkmate-160/1	160, 160	4.0	3.0	0.0	0.23
	Conventional		3.0	2.0	0.0	0.0

[1]All pheromone treatments were supplemented with at least one application of azinphosmethyl.
[2]Capture 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.

Table 2. Comparison of codling moth catch and fruit injury in apple orchards treated with Isomate, TNO or conventional insecticides, northcentral Washington, 1994.

	Treatment		Average moth catch[2] per generation		% fruit injury end of generation	
Site	Dispenser	Rate (d/a)[1]	First	Second	First	Second
W2	Isomate C	400	3.5	1.0	0.09	0.09
	Isomate C+	400	0.0	0.0	0.05	0.05
	TNO	200	0.0	0.0	0.05	0.05
	Conventional		15.5	4.5	0.0	0.0
W8	Isomate C+	400[3]	3.0 (18)	10.0 (21)	0.23	0.28
	TNO	200[3]	2.0 (6)	10.0 (6)	0.0	0.56
	Conventional		11.0	18.0	0.0	0.0

[1]d/a=dispensers per acre.
[2]Capture 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. In some blocks, additional 10 mg baited traps were placed in the upper canopy (within 1 m of the top of the canopy). Moth catch high in the canopy is shown in parentheses.
[3]Pheromone treatment was supplemented with multiple applications of ryania.

Table 3. Comparison of codling moth catch and fruit injury in apple orchards treated with Isomate pheromone dispensers or conventional insecticides, northcentral Washington, 1994.

	Treatment		Average moth catch[2] per generation		% fruit injury end of generation	
Site	Dispenser	Rate (d/a)[1]	First	Second	First	Second
MF3	Isomate C	400	1.5	0.0	0.0	0.0
	Isomate C+	400	3.0	0.0	0.0	0.0
	Conventional		21.5	0.0	0.0	0.0
MF4	Isomate C+	400[3]	11.0	0.0	0.0	0.20
	Conventional		25.5	0.0	0.0	0.13
W4	Isomate C	400	0.0	0.0	0.0	0.0
	Isomate C+	400	0.0	0.0	0.0	0.0
	Isomate C+	400	1.0 (2)	0.0 (0)	0.0	0.0
	Isomate C+	400	8.0	0.0	0.13	0.13
W5	Isomate C	800, 400[4]	11.0 (16)	4.0 (3)	0.56	0.33
	Isomate C+	800, 400[4]	20.0 (87)	1.0 (3)	0.42	0.56
	Isomate C+	800, 400	6.0	1.0	0.14	0.23
	Isomate C	800, 400[4]	9.0 (29)	2.0 (2)	0.88	0.22
	Isomate C+	800, 400[4]	22.0	10.5	0.09	0.15
	Isomate C	400, 200	1.0 (6)	0.0 (1)	0.09	0.14
	Isomate C+	400, 200	4.0 (1)	0.0 (0)	0.14	0.23
	Conventional		59.3	38.3	0.0	0.09
W11	Isomate C	400	8.0 (23)	2.0 (10)	0.19	2.29
	Isomate C+	400	9.0 (48)	3.0 (22)	0.89	3.07
	Conventional		22.0	19.0	0.0	0.09

[1]d/a=dispensers per acre.

[2]Capture 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. In some blocks, additional 10 mg baited traps were placed in the upper canopy (within 1 m of the top of the canopy). Moth catch high in the canopy is shown in parentheses.

[3]Pheromone treatment was supplemented with at least one application of azinphosmethyl.

[4]Pheromone treatment was supplemented with multiple applications of ryania.