Areawide Management of Codling Moth in Mendocino Orchards

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Abstract

This was the fifth year of an implementation program in the Mendocino pear district aimed at facilitating and broadening the adoption of codling moth mating disruption. This year the acreage under the project (1030 acres) remained approximately the same as last years. Organophosphate use for codling moth control was reduced by 87% from the average of three OP cover sprays per year used from 1991 to 1995. There was an increase in codling moth populations in several blocks and a slight increase in leafroller damage. Boxelder bug damage was observed in the first 10 rows from the Russian River. This was the second year where the management of the project was under the Ukiah Valley IPM Pear Growers Coalition.

Objectives:

1) Implement areawide management of codling moth with pheromone mating disruption in Mendocino County pear orchards.
2) Estimate the impact of individual grower practices on program efficacy and reliability.
3) Implement non-disruptive controls of secondary pests and supplemental codling moth control.

Introduction

An areawide management of codling moth using mating disruption was initiated in Mendocino County in 1996 on 400 contiguous acres of pears. It increased to 550 acres in 1997, to 900 acres in 1998 and to 1050 acres in 1999 (see Table 1).

Mating disruption applied on a regional scale has provided pear and apple growers with an alternative to frequent organophosphate-based management strategies and an improvement in efficacy compared to single-farm approaches. Areawide management appears to reduce the risk associated with pesticide use and increases the ability of natural enemies to regulate populations of secondary orchard insect pests and thus provides a more sustainable and stable pest management program.

The primary insecticides used for codling moth control are the organophosphates Guthion and Imidan. These organophosphates will be affected by the implementation of the Food Quality Protection Act of 1996. New less-disruptive chemicals must be implemented as supplemental control. As new insecticides are implemented for supplemental control in the coming year, monitoring and evaluation will become critical for the success of the program.

Successful adoption of mating disruption is based on acquiring confidence in monitoring

codling moth under mating disruption and determining when further measures are needed. Predicting codling moth damage under mating disruption requires intensive monitoring and experience in assessing trap catches. Major concerns in blocks under pheromone confusion are controlling codling moth in orchard borders, the reliability of trap monitoring, and the appearance of secondary pests such as leafrollers. Organophosphate use for codling moth control was reduced by 66%, 80%, 82% and 95% in 1996 through 1999, respectively (see Table 1D). With an intensive monitoring regimen, we were able to predict and control codling moth "hot spots". There was a slight increase in leafroller damage in 1996 through 1999. Pests of increased concern were various true bugs, including boxelder, lygus and stink bugs. The greatest damage was observed in the rows adjacent to the Russian River, due to boxelder bug. In block that did not receive an OP spray, there was no spider mite or psylla damage. We hypothesize that conditions under mating disruption are more favorable for integrated control of secondary pests, thus lessening the probability that the threshold levels for mite or psylla outbreaks would be exceeded. The reduced need for insecticide applications for secondary pests will offset the higher cost of mating disruption technology. Since the project began in 1996 we were able to eliminate post-harvest clean-up sprays for mites.

Materials and Methods

Pheromone mating disruption was used as the key technique for managing codling moth. One application of BioControl Isomate-C+ dispensers at a rate of 400 dispensers per acre was applied on 30% of the acreage (see Table 1B). The other 70% of the acreage received one application of Concept Checkmate dispensers at a rate of 160 dispensers per acre.

The groundwork for implementing this project was initiated in 1996 with a combination program of mating disruption and azinphosmethyl use to reduce existing population levels. Based on this experience, no supplemental insecticide was applied in orchards with low population levels. Based on trap catches, orchards with high codling moth populations received supplemental sprays.

Program efficacy was determined by fruit evaluations twice during the growing season (preceding 2nd application of pheromone, and at harvests). Forty eight sites were selected within the project based on approximately 20 acres per site. Depending on the site layout, 1000 to 2000 fruit per site (10 per tree from top and bottom) were selected from each site and scored for fruit injury from both codling moth and potential secondary pests. Five percent of the fruit was cut to look for cryptic infestations. Bin samples were performed at harvest. We recorded damage made by codling moth, leafrollers, stink bug/boxelder bug, and Lygus.

Weekly monitoring for codling moth relied on pheromone traps baited with 10 times the normal rate of pheromone and placed high in the tree canopy. Pheromones trap were placed throughout the project at a rate of 3 traps per 10 acres. Extra traps were placed at the borders of the project baited with a 1 mg codlemone lure.

A post harvest evaluation to determine the number of fruit remaining and the percent infestation was made three weeks after harvest. Thirty-seven blocks were sampled. Infestation levels post-harvest give an indication of the population levels for the coming spring. Thus, it provides an early indication of the problem blocks in the following year and an indication of the effectiveness of the program. Five hundred fruit per site were cut open and examined for presence of codling moth damage. Population levels at harvest will be correlated with trap catches the following year.

Results and Discussion

The area under mating disruption remained approximately the same as last year at a total of 1030 acres (see Table 1A). Organophosphate use for codling moth control was reduced by 88% assuming three cover sprays, the average number of cover sprays on orchards under organophosphate control in the Ukiah Valley in 1991 through 1995. Of the 1030 acres under pheromone confusion, 74% (762 acres) received no cover sprays, 18% (186 acres) received 1 cover spray, 7% (70 acres) received two cover sprays and 1% (10 acres) received 3 cover sprays (see Table 1C). A first cover spray was applied where traps baited with 10X lures exceeded 10 moths/trap/week. Spays were applied only in areas where there was a consistent trap catch. In this fifth year we exceeded the target of 75% reduction based on other areawide (see Table 1D).

In the year 2000 we saw a substantial increase in codling moth populations (see Table 2), with 5 orchards having unacceptable levels. Preliminary studies in a replicated side by side comparison of orchards under Isomate C+ versus Checkmate showed that trap suppression was twice as high in the orchard under Isomate C+. It is unclear if the increase in populations we experienced during the 2000 season was due to the shift in dispenser brands. The increase in populations may also be attributed to not having used any OP for two and in some cases three years. But since the decision to not spray was based on threshold levels developed under Isomate C+, it is possible that orchard under checkmate require lower threshold levels. Thus orchards were not sprayed when they should have been due to the shift in dispenser product. Total trap catches decreased from 1996 to 1997. In 1998 we observed an increase in the total trap catches due to high populations in the new acreage entering the project that year (350 acres of 900, see Farm 8 and 9 Table 2). Trap catches for the entire project decreased again during 1999 as compared to 1998.

We detected codling moth damage in only one block when fruit was sampled after the first codling moth generation. There was a substantial increase in codling moth damage as compared with previous years with 50 % of the acreage with damage at harvest that ranged from 0.1 to 0.9 % and 9% of the acreage with higher than 1% damage.

Low levels of oblique-banded leafroller infestation (0.1 to 1.5%) were detected in 96% of the acreage. This is an increase from 1996 when no damage was detected; 1997 when one block had 1% infestation; 1998 when 32% of the blocks sampled had less than 1% infestation and 9% of the blocks had between 1 and 5% damage; and 1999 when 48% of the blocks sampled had between 0.1-3.2% damage. As in previous years Boxelder damage was restricted to the first 10 rows from the riparian area. The greatest damage was observed in the rows adjacent to the Russian River with up to 2.1% damage.

Of the 37 blocks sampled post-harvest, 11 blocks (30%) had no codling moth infestation. Eight blocks (22%) had less than 1% infestation, seventeen blocks (46%) had between 1 to 10% infestation and one block had 27% infestation. Infestation levels post-harvest give an indication of the population levels for the coming spring. It provides an early indication of the problem blocks in the coming year and an indication of the effectiveness of the program. Percent infestation less than 1% is not of concern, greater than 5% is of concern and between 1 and 5% should be monitored carefully in the coming year. Population levels at harvest will be correlated with trap catches the following year.

Table 1 - Mendocino areawide pheromone mating disruption project description (1996-2000)

A) Acres under codling moth mating disruption

	1996	1997	1998	1999	2000
Acres	400	550	900	1050	1030

B) Pheromone dispensers applied

	Ties/acre				
	1996	1997	1998	1999/2000	
	Isomate-C+	Isomate-C+	Isomate-C+	Isomate-C+[2]	Checkmate[3]
At biofix	400	400	400	400	160
At 900 dd	400	200	200[1]		160

[1] In 550 acres (350 acres received only one application at biofix)
[2] In 30% of the acreage (310 acres)
[3] In 70% of the acreage (740 acres)

C) Supplemental organophosphate cover sprays

	% Total acreage (No. acres)									
	1996		1997		1998		1999		2000	
No spray			66	(360)	61	(552)	73	(770)	74	(762)
1 spray	70	(282)	16	(90)	22	(196)	26	(270)	18	(186)
2 sprays	17	(68)	18	(100)	17	(152)	1	(10)	7	(70)
3 sprays	5	(20)							1	(10)
4 sprays	8	(30)								

D) Percent Organophosphate reduction

	1996	1997	1998	1999	2000
% OP reduction	66	80	82	95	88

Table 2 - Cumulative codling moth male trap catches (1996-2000)

	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5	Farm 6	Farm 7	Farm 8	Farm 9
1996	1.87	2.07	4.82	n/a	17.49	26.29	n/a	n/a	n/a
1997	1.62	4.49	3.22	n/a	13.37	10.86	16.03	n/a	n/a
1998	7.65	5.62	4.32	4.83	5.66	8.27	7.20	32.93	11.22
1999	3.88	2.20	3.09	1.86	3.06	5.74	5.23	18.80	7.33
2000	3.94	1.46	8.40	11.57	10.09	40.66	20.27	98.78	31.07

n/a = Not applicable. Farms were not in the project that year.

Table 3 – Percent acreage with codling moth, oblique-banded leafroller and true bug damage during the 2000 season harvest

Damage caused by:	% acreage (acres) affected		
	No damage	0.1 to 0.9 % damage	⊐ 1 % damage
Codling moth	41 (412)	50 (509)	9 (86)
Oblique-banded leafroller	7 (73)(	89 (895)	4 (40)
True bug	1 (11)	85 (857)	14 (139)