Use of DrapeNet Netting to Manage Codling Moth, 2022

Dr. Alan L. Knight, Instar Biologicals

Uncfencer76@hotmail.com

(509) 910-1570

BACKGROUND: Organic management of codling moth provides a few tools for growers to manage low pest pressure successfully. However, management mistakes and external factors can quickly allow this pest to build-up in some orchards and then the grower is faced with a losing battle. The combination of mating disruption, frequent sprays of oil, virus, Bt, and Spinosad, and cultural practices such as fruit removal and banding are all used to fight this pest. Growing seasons with warm conditions during the first generation and extended heat later in the season are problematic and can dramatically increase the levels of injury. Finally, if an organic orchard is subjected to moth immigration from other sources these tools cannot adequately cope with the build-up of eggs and voracious larvae, and many organic orchards are either pulled or forced to convert to conventional methods. Fortunately, there is one tactic that growers can deploy that essentially eliminates codling moth as a concern: exclusion netting.

During 2019 I was involved in Colorado with an organic grower who after 50% losses of Honey Crisp for two years contacted me and we decided to try netting on a portion of his production. The first year under the single-row DrapeNet system of netting and still using mating disruption and seasonal sprays, the level of fruit injury was reduced to 0.6%. Then, in the 2nd to 4th year he has no longer had codling moth injury and doesn't spray or use mating disruption. In fact, the technology has widely spread to his neighbors and the once fearsome codling moth is no longer a concern for these growers in western Colorado. Therefore, I was eager for Washington State growers to adopt this technology.

METHODOLOGY: I was able to help facilitate the adoption of netting by three growers who have a difficult time managing codling moth. Netting was first placed in the early Zillah HC site in late May and added to additional rows in late June (Table 1). In the early site we placed 14 orange delta traps baited with the Pherocon CMDA 4K lure which catches both moth sexes. on PVC poles inside the netting on every other row. At the same time, we placed four traps on the adjoining rows which were not initially netted. Later when the extra netting was added these traps were removed and only 1 trap was continued under the late netting.

The second site was Cripps Pink also situated near Zillah (Table 1). The grower netted two sets of two rows, 12 contiguous rows, and another four rows. We placed 12 traps under the netting in these four areas. For comparison we had two traps placed in the unnetted rows.

We conducted an experiment to evaluate the influence of netting on the mating success of sterilized moths from Canada in these two sites. Sterilized codling moths were released on 6 June at the Zillah HC site and 13 June at the PL Zillah site. Moths were weighed (22 g = 800 unsexed moths) in a cardboard cup and released around 10 of the traps under the HC netting and around 6 traps in the PL block. In addition, moths were released around four traps outside the netting at the HC block. Sterilized moths have an internal red dye and in both sites, moths caught in traps were grouped based on the presence of this dye, counted, and females dissected.

The third site was near Tieton and included Bartlett pears, Honey Crisp, Ambrosia, and Golden Delicious (Table 1). In both HC and Golds, we set up one long row of netting. In the Ambrosia we had five 4-tree plots, and in pear we had four 4-tree plots and one plot of moderate length (Table 1).

RESULTS:

- In general, very few wild moths were caught under nets in each site (Table 2). Across all blocks male and female catch was 98.4 and 98.6 lower under nets than outside (Table 2).
- The SIT female moths received on two dates were dissected prior to each release and 97.5% were found to be unmated (n = 40).
- Few sterile moths were recaptured either inside or outside nets. All the sterile females were virgin in the PL site, while a third of the females recaptured at Zillah HC were mated under the nets.
- Wild females were mated under nets in two of the locations which also had the highest level of injury the previous year and highest moth counts in traps outside the nets (Tables 2, 3). No females were caught under nets in three trials and only a virgin female was caught under the Zillah Pink Lady.
- The 4K-baited trap at the Zillah HC late site caught 115 males and 30 females prior to net placement and only 1 male and 2 females after the net was applied.
- The pear trees under nets varied significantly in height and breadth. The net was put on by hand and was not well positioned with some openings around the large trees and was much too large for the small trees. We believe this accounted for the number of moths captured and the mating success of females in this site.
- The injury in Ambrosia all occurred in only one replicate 4-tree plot which was positioned near the border which had substantially higher levels of fruit injury in 2021 than in the central portion of the orchard where the other four plots were situated.
- Injury found under nets were all from the first generation.
- Sunburn in the two HC blocks and Goldens appeared to be lower inside than outside the netting. The exception was that fruit positioned just underneath the netting still developed sunburn characteristics. This was particularly seen when the netting was a little small for the canopy and was stretched very tight (Goldens). No sunburn was noticed with the use of Bull horns in the PL.

CONCLUSION:

The use of netting was highly successful in reducing levels of fruit injury by codling moth and birds. In orchards with high levels of fruit injury the previous year it was possible to capture a few moths under the nets and a few injured fruits were noted. Interestingly, no injury occurred under nets after the first generation. The orchard with the most serious problem with netting was the Zillah HC block which had a V-trellis. This architecture created a 4' wide pathway down the middle of each net which would likely increase the flight of moths and the opportunity for mating. The late application of netting on a portion of this orchard roughly demonstrated the pressure these trees faced and the importance of installing the netting prior to the start of moth flight. Netting has been considered as a possible tool to manage crop load thus it may be compatible to install the netting right at or before full bloom. The most successful system was the application on PL in Zillah which used the Bull horns and covered a slender spindle canopy. Under this system sunburn was not a factor. Many of the netted blocks also used mating disruption and seasonal sprays which should be recommended for the first year that netting is deployed. ***For organic growers use of mating disruption, releases of sterile moths, weekly sprays of virus and oil, and four applications of Entrust can't solve the threat from female moths flying into your orchard. Only netting can guarantee protection for your crop from codling moth.***

Table 1. Physical description of plots covered with Drape Net.

Orchard	**Tree Row spacing, canopy architecture**	**Tree Canopy Size**	**Number of trees under net**
Tieton Pear	12’ x 12’ , central leader	2.0-3.5 m tall, 1.5-2.5 m wide	1 plot with 12 trees, 4 plots with 4 trees.
Tieton Honey Crisp	8’ x 16’, central leader	3.0 – 3.5 m tall, 2.5 m wide	1 plot with 40 trees along one row
Tieton Ambrosia	9’ x 13’, central leader	3.5 m tall, 2.0 m wide	5 plots with 4 trees
Tieton Golds	9’ x 16’, central leader	3.0 – 3.5 m tall, 2.5 m wide	1 plot with 30 trees along one row
Zillah Pink Lady	4’ x 10’, spindle	12’ tall, 4’ or 7’ wide	191 trees per row. Four plots: two 2-row, one 4-row, and one 12-row.
Zillah Honey Crisp	8’ x 14’ early plot and 6’ x 14’ late plot, Y-trellis with 4-leaders.	10-11’ tall in both and 4.5 wide in early and 3.5’ wide in late plot	51-68 trees per row with 29 rows in early and 29 rows in late plot

Table 2. Summary of codling moth catch in orange delta traps baited with the bisexual 4K lure placed either inside or nearby outside netting.

Orchard	Number of traps	Under Drape Net			Number of traps	No Netting		
		Mean catch per trap		Proportion Virgin Females		Mean catch per trap		Proportion Virgin Females
		Males	Females			Males	Females	
Pear	5	1.2	1.4	0.57	2	67.5	72.5	0.43
Honey Crisp	1	0.0	0.0	-	2	12.5	16.5	0.30
Ambrosia	5	0.0	0.0	-	2	11.5	16.5	0.29
Golds	1	0.3	0.0	-	2	16.5	15.0	0.31
Pink Lady	14	Wild: 0.2 Sterile: 2.0	Wild: 0.1 Sterile: 1.8	Wild: 1.00 Sterile: 1.0	2	25.5	19.0	0.24
Honey Crisp: Early Late	 14 1	 Wild:0.9 Sterile: 3.1	 Wild: 0.9 Sterile: 1.7	 Wild: 0.27 Sterile: 0.63	4	 Wild: 130.0 Sterile: 5.5	 Wild: 50.0 Sterile: 1.7	 Wild: 0.31 Sterile: 0.34

Table 3. Summary of codling moth catch in orange delta traps baited with the bisexual 4K lure placed either inside or nearby and outside netting.

	Mean % fruit injury by					
	Under Drape Net			No Netting		2021 No Netting
Orchard	Codling moth	Birds		Codling moth	Birds	Codling moth
Pear	0.3	-		9.8	-	ca. 50.0
Honey Crisp	0.0	0.0		1.3	2.8	23.2
Ambrosia	0.3	-		21.3	-	27.3
Golds	0.3	0.0		23.0	1.9	19.4
Pink Lady	0.0	-		0.2	-	ca. 1.0
Honey Crisp: Early Late	 0.7 2.5	 - -		14.0	-	ca. 50.0