

The Effectiveness of New Homeowner Products and Techniques for Controlling Codling Moth Larvae in Backyard Grown Apples

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Situation Statement:

Many homeowners in Box Elder County and the state of Utah enjoy raising their own apples for fresh eating, baking, and preservation. One of the last things they want to find is that most of apples have worms (codling moth larvae) in them. To prevent this from happening, they want to know when to spray their apples and what to spray them with in order to keep them worm free. In the process, they are always looking for better and easier ways and sometimes none chemical ways to minimize the damage from this insects.

To successfully control codling moth in apple trees, larvae must be prevented from entering the fruit. In commercial orchards, pheromone traps are placed in the orchard to monitor for the presence of adult insects. Commercial orchardists or other agencies will collect high/low temperatures determine the period of time required for the eggs to hatch and know exactly when controls must be applied prior to a specific degree day. This degree day information is vital to applying fruit protection and must be made for each of the 3 to 4 generations of codling moth per year in Utah.

Most USU Extension offices give out recommendations for cover sprays or fruit protection to the homeowners based on information they receive from University specialists and their pest alerts. Many times we do not have experience with the recommendations we give out for controlling codling moth. We need to be able to give home owners information about products that are more effective, easier to apply or sometimes none chemical ways to minimize the damage from codling moth.

Objective:

Test effectiveness of new homeowner products and techniques for controlling Codling Moth Larvae in backyard grown apples.

Methods:

We found a commercial grower in Honeyville with an established apple orchard for our main research site. We also had 3 smaller home orchards that applied one or two of the treatments.

We purchased codling moth pheromone insect traps and placed them in the orchards in mid April. May 14 was the biofix date for the site based on adult moth catches. We used minimum/maximum thermometers to collect the high and low temperatures at the location and to figure the degree day totals. Degree-days were collected and insect monitoring was checked by the Extension office staff on a weekly basis. When the biofix and the required degree day units were met, the homeowners applied the treatments in their orchards and we applied the treatments in the Honeyville orchard.

The orchard in Honeyville was setup in a complete randomized block design with 4 replications and 6 treatments (see attached sheet). Three trees were used for each treatment in each replication. The number of trees treated in the homeowner orchards was based on how many trees they had. Treatments in the commercial orchard were applied with a 25 gallon sprayer that was mounted on the rack of an ATV and had a hand wand for making the applications. The sprayer was selected based on what a homeowner would use.

Treatments included Cyd-X which is a codling moth virus and listed as a certified organic product. The second insecticide was a product called Fertilome Fruit Tree Spray which is a disease/insect combination product that contains 7.5% active ingredient Malathion and 9.78% active ingredient Captan fungicide. Other insecticides included Sevin which was 23.7% active ingredient Carbaryl, Malathion 55% active ingredient, Japanese Apple Bags, and the control. With the exception of Cyd-X and the apple bags, all of the products can be readily purchase from a local nursery or garden center store.

The first application of each treatment was made on May 28 which was later than normal by about two and half weeks due to the cool wet spring weather we had. The products were mixed according to the manufactures recommendations on the product label. The Last Call product was applied on May 16, June 16, July 16 and August 16. Malathion and Cyd-X were applied on May 28, June 13 and 24 during the first generation and on July 19 August 3 and 18 of the second generation. The Fruit Tree Spray and Sevin were applied on May 28, June 13 and 24 during the first generation time period and July 19 and 27, August 9 and 18 in the second generation. We maintained coverage throughout each generation with each product based on the labels recommended spray interval.

Because the apple bag instructions directed us to apply the bags when the apples are 5/8" to an inch in diameter we applied two cover sprays until the apples were large enough to be covered with the bags.

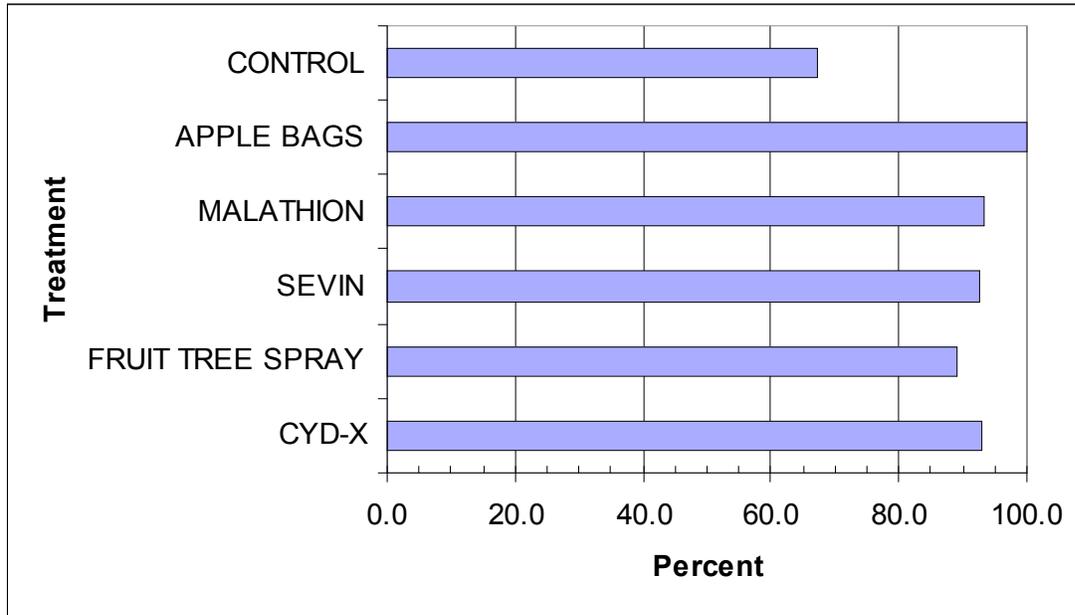
In the end, we added an additional treatment to the project by looking at the percent control received by applying the two cover sprays of Sevin prior to bagging the apples during the first generation and then not receiving additional treatment the rest of the time.

Two homeowners applied a product known as Last Call CM which is pheromone based product that attracts the male codling moths to it. A small pea sized drop was applied to 6-8 branches on the tree each time. The droplets contain both the pheromone and the insecticide to kill the adult male codling moths. This treatment was only applied in the home orchard and not at the Honeyville orchard because of the potential it has to draw codling moths to the orchard with the pheromone.

Results:

After the first generation of codling moth had passed, we made a visual count of 100 apples per tree (2 separate random counts of 50) of the number of stings and injuries to the apples while the apples were on the trees to give a percent control for each product (see Chart #1).

Chart #1. Percentage of Fruit Without Codling Moth Injury After 1st Generation



At the end of the growing season, we were to harvest 100 apples per treatment per replication and compared them to the various treatments to come up with an end of the year percent control for each treatment. However, we were unable to harvest 100 apples per treatment per replication like we had planned to do but we were still able to harvest 2,321 of the 2,800 apples to evaluate (see Chart #2). This was because the owners harvested some of the apples prior to us collecting the data and the fact that some trees did not have a sufficient number of apples to randomly sample from.

Two things that became obvious during this experiment was that if home owners desire worm free apples, it is critical that they make their first cover spray application at the proper time related to the degree day accumulated (between 200 – 250 DD’s) and not the calendar date each year. Secondly, they need to achieve uniform spray coverage on the apples each time they make an application. In the study, we found many injuries to apples where they were touching each other and uniform coverage was not possible due to improper thinning of the apples.

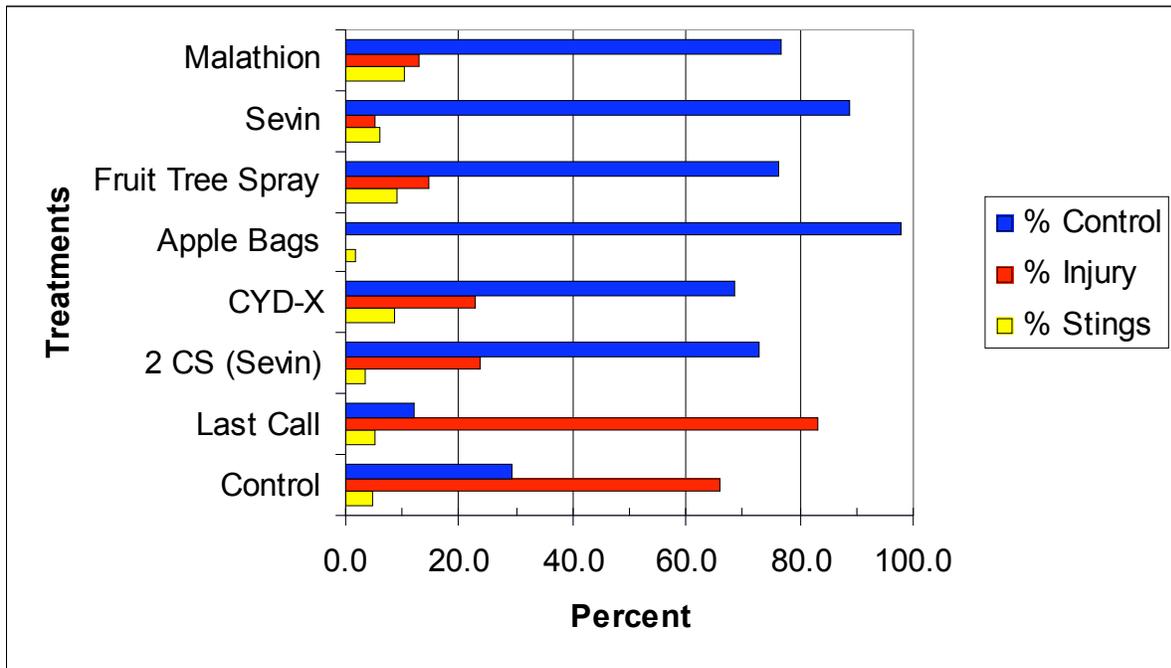
Chart #2. Number of Apples Harvested per Treatment.

Treatment	# of Apples Harvested
CYD-X	296
FRUIT TREE SPRAY	286
SEVIN	400
MALATHION	350
APPLE BAGS	252
CONTROL	367
2 COVER SPRAYS (CS) SEVIN	370
Total	2321

The research shows that apple bags were the most effective at controlling codling moth (98%, in Chart #3) in the end but they also cost the most (\$.20 per bag) and are very time consuming to

put on (1-2 minutes per bag) and take off the bags. Also, they do not work well on apple varieties that do not have a long stem as you tend to separate the apple from the tree when placing the bag over it on the shorter stemmed varieties. However, once the bags were on, you never had to put on another cover spray or touch the apples until right before they are harvested. Windy conditions played a large role on the 400 bags applied in the study. Only 252 of the bags were all that were left on the trees at the end of the study. Apples inside the bags, in some cases, were smaller or larger than surrounding apples. It was also noted that earwigs, spiders, wasps and other insects had made the bags their home.

Chart #3 Percentage of Fruit Without Codling Moth Injury After 1st and 2nd Generation



Sevin was the most effective chemical we used and gave us 89% control rate but had to be applied every 7 to 10 days during the egg hatch period. Malathion and Fruit Tree Spray provided 77% and 76% control respectively and needed to be applied every 10-14 days for Malathion and every 7-10 days for the Fruit Tree Spray. Chart #4 shows that all three of the chemicals could be applied for under \$12 per tree including labor.

Two of the softer chemicals we used in the experiment were CYD-X codling moth virus and Last Call CM. CYD-X provided 69 percent control while the Last Call CM only provided 12 percent control. In the location where we used the Last Call, there was very low codling moth pressure but the apples still received severe damage. It was the easiest product to apply of the group with an application consisting of 6 to 8 pea sized droplets per tree every 30 to 40 days. The CYD-X product was applied every 14 days and should soon be available to the homeowner. Currently it is only available to commercial growers and is applied 1-6 fl oz per acre with an average of 2-3 fl oz per acre. A quart of this product cost about \$300 but it goes a long way.

If time and money is a constraint but some useable apples are desired, it would be recommended to make 2-3 applications of any of the products during the first generation to keep the

populations suppressed for the second and possible third generation. Two early applications of Sevin provided 73% control in our project.

In chart #4 we compared the number of applications made, the cost of the insecticides per tree per application, the total costs per tree with the application cost figured into this price and the percent control we achieved with the various products. To figure the total cost per tree, we took the number of applications X by the cost of the insecticide per tree per application. We then took the time it required to mix and apply the product to the tree (an average of about 5 minutes in most cases) X by the number of applications X by \$10 per hour for labor divided by 60 minutes. This number plus the first number equals the total cost per tree.

Chart #4. Summary Table of Number of Applications, Insecticide Costs and Percent Control.

Insecticide/Treatment	Number Of Applications	Insecticide Cost per Tree/apps.	Total Cost per Tree	Percent Control
CYD-X	6	\$ 0.75	\$ 9.50	69%
FRUIT TREE SPRAY	7	\$ 0.83	\$ 11.64	76%
SEVIN	7	\$ 0.83	\$ 11.64	89%
MALATHION	6	\$ 1.08	\$ 11.48	77%
APPLE BAGS	1.5	\$ 0.20	\$ 109.58	98%
LAST CALL	4	\$ 0.28	\$ 3.12	12%
CONTROL	0			29%
2 COVER SPRAYS (Sevin)	2	\$ 0.85	\$ 3.37	73%

Summary

This was a great project to evaluate the effectiveness of new homeowner products and techniques for controlling codling moth larvae. This information will be presented at state association meetings, best practice sessions, Master Gardener conferences and trainings and similar horticulture meetings. We will also use this information in our horticulture and gardening classes each year and put it on our home orchard hotline and webpage and give it out in our verbal recommendations from the office. Summary recap:

- All products provided some degree of effectiveness over the control.
- Two cover sprays of Sevin performed similarly to 6 or 7 cover sprays of Malathion or Cyd-X.
- Covering the fruit with bags or 7 cover sprays of Sevin provided the best control of codling moth (98% and 89% clean fruit, respectively), but the time required to apply and remove the bags this control treatment very costly if you consider the cost of the labor.
- It is critical that homeowners know when to apply (a calendar date each year) their cover sprays based on degree day model and how often to apply the cover spray based on the product they use.
- Uniform cover spray coverage on each apple is critical.
- Apples need to be properly thinned in order to obtain uniform coverage.