

Codling moth: *timing* sprays in *organic orchards*

*Oregon Sustainable Agriculture Land Trust (OSALT) and Home Orchard Society fact sheet
February 2011*

In the Pacific Northwest, codling moths – with their fruit tunnels to the core of apples and pears – are the worst pest in organic orchards. Untreated, these moths can reach high density, breeding two generations per season, and rendering greater than ninety percent of fruit unsalable.

Fortunately scientists working in Mexico have given organic farmers a strong tool to control codling moth – a granulosis virus specific to codling moth and harmless to bees, spiders, farm workers and farm customers. Two commercial products containing the virus - CYD-X (Certis) and Carpovirusine (Arysta LifeScience) – are both OMRI listed and approved for use on organic farms.

Timing of the virus application is critical however, and can be hard to determine for the new farmer. This fact sheet will explain, step-by-step, how to pinpoint when to spray.

Background: For the granulosis virus to be effective, codling moth larvae must ingest (eat) the virus. Larvae already inside an apple are largely immune, since the virus spray will not penetrate the fruit.

The insect is most vulnerable when the larvae emerge from eggs laid on the fruit. If the eggs have been inoculated with the virus, the larvae will ingest this, and die within three to four days.

The virus itself breaks down in sunlight (maintaining potency for only a few days), consequently it is critical to spray precisely as the larvae are emerging from their eggs. The eggs hatch over a period of weeks, in two generations, and for effective control, multiple sprays must be applied.



Codling moth in apples

Step-by-step: when to spray

- 1 Go to this **website**: <http://uspest.org/cgi-bin/ddmodel.pl>
- 2 Under “**degree day model**” drop down menu, select “codling moth [apple and pear] Brunner and Hoyt (1987)”. See screenshot to the right.
- 3 For **temperature thresholds**, use 50 and 88 degrees F.
- 4 Select a **biofix date**. The biofix date is the first consistent appearance of codling moth adults in pheromone traps. Put traps out one per 2.5 acres. In 2010, the biofix date for our farm south of Portland, Oregon, was April 24th. The end date is less important – pick a date at the end of the season.
- 5 Select a **location** from one of the drop down menus. The internet tool will pull weather data on your specific farm area. Our farm is very near the small towns of Canby and Aurora.
- 6 Enter the **zip code** of the farm area in the forecasts section.
- 7 Select a site for **historical weather averages**. Preferably this is the same site as selected above, but in our case “Aurora” was not included in the historical averages database, so we selected nearby Oregon City.
- 8 Select “**table**” and “**graph**”
- 9 Hit **calculate**

codling moth [apple & pear] Brunner and Hoyt (1987) - Degree Day Models from OSU - version 4.21 - Windows Internet Exp

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http://uspest.org/cgi-bin/ddmodel.pl?clm

codling moth [apple & pear] Brunner and Hoyt (...)

Online Phenology and Degree-day Models

for agricultural and pest management decision making in the US

codling moth [apple & pear] insect model of Brunner and Hoyt (1987)

Select degree-day model list or calculator mode instructions:
codling moth [apple & pear] Brunner and Hoyt (1987)
(hint: after selecting all form options, click here: [input type=checkbox] then make a [bookmark](#) for future use)

For calculator mode, enter thresholds in °F (or celsius °C: [input type=checkbox]) and calculation method:
lower: 50 upper: 88
single sine

Select starting [Apr] [24] [2010] and ending [Aug] [31] [2010] dates
Starting date/BIOFIX instructions: first consistent capture of moths in pheromone traps

Select location: Only one column should display a location, otherwise "None"

Oregon, Canada, Alaska	Washington, Idaho	Montana, Wyoming
Canby cw5416 or aprs	None	None

Or upload your own weather data file to calculate: (see [format description](#) or [example file](#))
Browse...

Forecasts: [input type=checkbox] NWS zipcode/city, state: 97013 or weather.com site: Aurora Or

Select historical average forecast location: Should line up with selected location above

oregon city or	Washington, Idaho	Montana, Wyoming
oregon city or	None	None

Output: [input type=checkbox] Simple header [checked] Table [checked] Graph [input type=checkbox] Include precipitation in graph

Click here to run the model: Calc Reset: Clear all values

Model output: timing of first spray

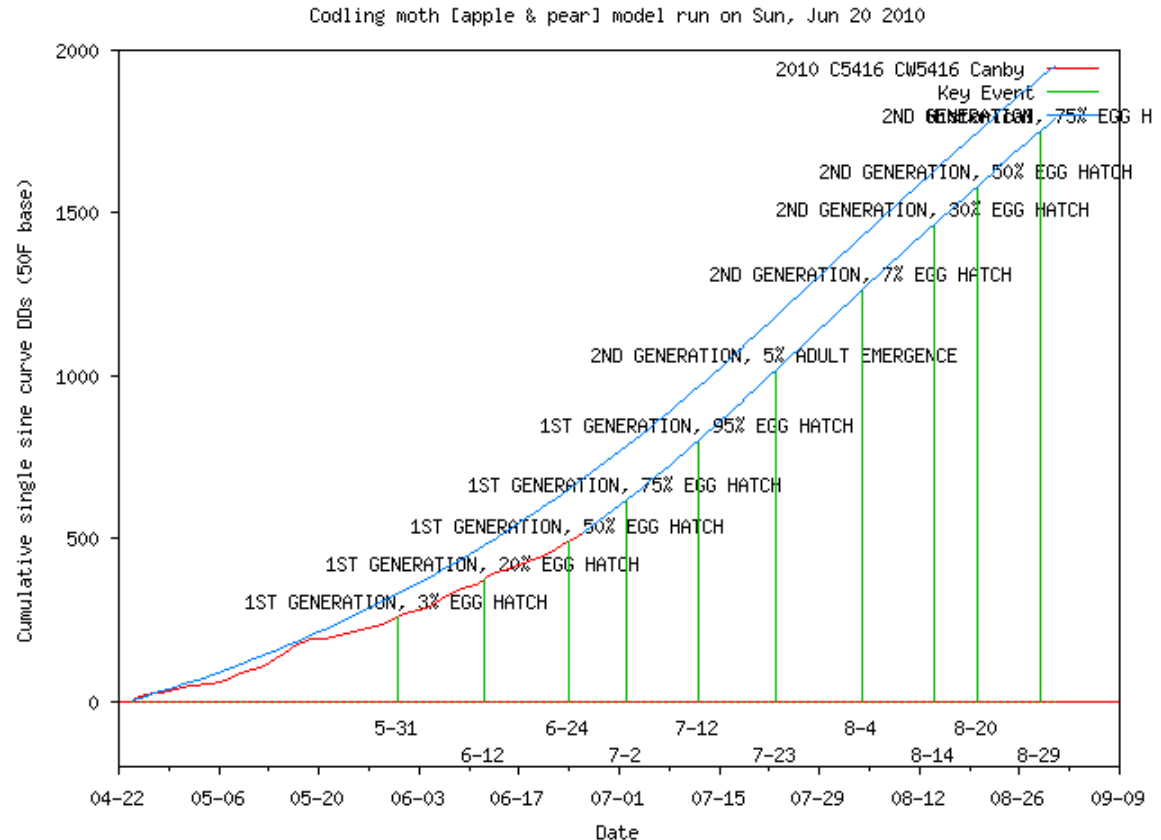
- The model output will show cumulative degree days (“CUMDD50” column at right) – which is the total number of hours that the temperature has been between 50 and 88 degrees F.
- The first spray should happen at 250 hours. In the example to the right, the orchard should be sprayed on May 30th or 31st to infect the first larvae emerging from their eggs.
- Because the model uses actual and forecasted weather data, you should re-run the model frequently as the 250-hour mark nears. This will ensure your first spray is at exactly the right time.
- Target the young fruit when spraying, since this is where eggs are laid. Spray all pear and apple trees in the area (nearby unsprayed fruit trees can serve as codling moth breeding zones.)

=====MODEL OUTPUT=====							
Weather station: 2010 C5416 APRSWXNET CW5416 Canby OR Lat45.2792 Long:-122.6875 Elev:144							
mn	day	max	min	precip	DD50	CUMDD50	event
4	24	63.02	43.02	0.00	4.84	4.8	* START *
4	25	69.02	51.02	0.00	10.02	14.9	
4	26	64.02	52.02	0.51	8.02	22.9	
4	27	57.02	45.02	0.35	2.45	25.3	
4	28	58.02	42.02	0.16	2.56	27.9	
4	29	64.02	42.02	0.00	5.14	33.0	
4	30	63.02	44.02	0.00	4.99	38.0	
5	1	62.02	44.02	0.00	4.54	42.6	
5	2	64.02	44.02	0.20	5.45	48.0	
5	3	60.02	40.02	0.04	3.19	51.2	
5	4	55.02	37.02	0.35	1.16	52.4	
5	5	56.02	38.02	0.08	1.53	53.9	
5	6	63.02	35.02	0.00	3.98	57.9	
5	7	72.02	40.02	0.00	8.47	66.3	
5	8	73.02	40.02	0.00	8.93	75.3	
5	9	76.02	37.02	0.16	9.82	85.1	
5	10	67.02	46.02	0.12	7.27	92.4	
5	11	62.02	47.02	0.00	5.10	97.5	
5	12	69.02	49.02	0.00	9.11	106.6	
5	13	77.02	40.02	0.00	10.78	117.3	
5	14	82.02	42.02	0.00	13.56	130.9	
5	15	77.02	46.02	0.00	12.13	143.0	
5	16	77.02	54.02	0.12	15.52	158.6	
5	17	77.02	53.02	0.43	15.02	173.6	
5	18	65.02	51.02	0.08	8.02	181.6	
5	19	71.02	48.02	0.39	9.77	191.4	
5	20	55.02	44.02	0.55	1.52	192.9	
5	21	57.02	44.02	0.94	2.34	195.2	
5	22	58.02	42.02	0.47	2.56	197.8	
5	23	60.02	39.02	0.08	3.11	200.9	
5	24	65.02	43.02	0.04	5.75	206.6	
5	25	68.02	49.02	0.28	8.61	215.3	
5	26	61.02	49.02	0.04	5.14	220.4	
5	27	68.02	44.02	0.28	7.32	227.7	
5	28	59.02	49.02	0.31	4.15	231.9	
5	29	66.02	48.02	0.12	7.30	239.2	
5	30	60.02	57.02	0.12	8.52	247.7	
5	31	68.02	55.02	0.08	11.52	259.2	1ST GENERATION, 3% EGG HATCH
6	1	66.02	52.02	0.79	9.02	268.2	
6	2	64.02	50.02	0.43	7.02	275.2	



Model output: *spraying through the season*

- Codling moth larvae hatch through the full summer season, typically in two generations in the Pacific Northwest. If you check “graph” on the initial screen, the model will produce output similar to the one at the right – with cumulative degree days and egg hatch projections.
- The granulosis virus is effective for about four days before breaking down in sunlight, although there may be buildup of the virus in an orchard as more larvae become infected. Spraying will need to be repeated weekly during key first and second generation hatch timings to effectively prevent moth damage.
- The virus itself is harmless to humans, and can be used right up to the day of harvest.



Our experience at Natural Harvest Farm



- At Natural Harvest Farm, near Canby, Oregon, we used CYD-X mixed with Thern X70 Yucca extract spreader/sticker and Eco-Nereo kelp fertilizer (for leaf health).
- Research on the granulosis virus suggests that multiple sprays in low dosages can be very effective, and our own sprays were more dilute than recommended by Certis. We have approximately 150 apple and pear trees, and we sprayed six times during the season. Each spray was made by mixing ½ ounce of CYD-X virus with 12 gallons of water (plus spreader sticker and kelp emulsion). We used two 1.5 ounce bottles of CYD-X during the season. The cost was \$39 per CYD-X bottle, for \$78 total (from Peaceful Valley Supply).
- In 2009, we didn't spray for codling moth, and infection rates in our apples and pears were depressingly high - greater than 90%. In 2010, with the treatment described above, about 14% of our apples and pears had codling moth damage. A change from 90% to 14% is a remarkable improvement, and with lighter starting populations, we are hoping for even better results in 2011.

- **Sources used:**

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