APPLES

Insecticides

Monitoring

Pheromone traps, in conjunction with degree-day (DD°) models, can be used to determine the need and timing for treatment. Place pheromone traps prior to bloom at a density of at least one trap per 5 to 8 acres. Check traps twice a week and begin accumulating degree-days (base 50°F) on the day on which the first moth is trapped, provided moths are captured on two successive trapping dates. The start of sustained moth capture is referred to as **biofix**. Inspect traps weekly for the remainder of the season; count and remove captured moths.

Many factors can influence trap performance. To optimize trapping efficiency, place traps in areas of the orchard that are known hot spots. Position traps at midcanopy (5 to 8 ft). If using red septa lures, replace them every 3 weeks (first generation) or every 2 weeks (second generation). Other lure types are available, with some lasting an entire generation. Check with manufacturers to determine replacement intervals. Larger traps, such as the Triangle, Wing and some versions of the Diamond, have proven to be most effective at trapping CM males. Change trap bottoms if dirty or at least every 6 weeks.

Treatment

The DD° model rather than the calendar method should be used to time sprays. If the codling moth egg is the primary target of an insecticide, apply the first spray at 100 DD° after biofix, which coincides with the start of egg laying. Apply the first spray against the second generation between 1100 and 1200 DD°. If the codling moth larva is the primary target of an insecticide, apply the first spray at 250 DD° after biofix, which coincides with the start of egg hatch. Apply the first spray against the second generation between 1250 and 1300 DD°. Timing of additional sprays will depend on the product used. Some insecticides provide 21 days of residual control; others may provide only 10 days. Rainfall in excess of 1 inch will substantially reduce the residual of most materials. The egg hatch period lasts 30 to 45 days, so several treatments may be required for control of each generation.

Thresholds based on cumulative moth catch can be used as a tool to determine the need to apply control treatments. A cumulative catch of 5 to 7 moths during the first generation or 3 to 5 moths during the second generation in any one trap may indicate the need to control the CM population. Do not total captures from more than one trap to attain the threshold (Table 1).

Moth capture in a pheromone trap in conjunction with the DD° model can be used as a basis for codling moth management decisions. Sprays are applied only if catch is over threshold, and they are targeted for the appropriate life stage. Examples of the decision process are presented in Table 2.

Table 1. Example of determining CM cumulative moth catch.

	Number of moths trapped			
	Week 1	**Week 2**	**Week 3**	**Week 4**
Trap 1	0	2	2 4 cumulative	2 6 cumulative
Trap 2	1	1 2 cumulative	1 3 cumulative	0 3 cumulative

Table 2. Decision making for codling moth management.

Timing		Event	Management action		
1st generation	**2nd generation**		**Orchard 1**	**Orchard 2**	**Orchard 3**
0 DD°	1060 DD°	Start of flight	Begin accumulation		
100 DD°	1100-1200 DD°	First egg laying	No established threshold		
250 DD°	1250-1300 DD°	First egg hatch	Over threshold TREAT Reset catch to zero New accumulation	Under threshold DO NOT TREAT Continue accumulation	Under threshold DO NOT TREAT Continue accumulation
350 DD°	1350-1400 DD°	20% egg hatch	Continue accumulation	Over threshold TREAT Reset catch to zero New accumulation	Still under threshold DO NOT TREAT Continue accumulation
10-21 days after treatment		Loss of residual	Over threshold TREAT Reset catch to zero New accumulation	Under threshold DO NOT TREAT Continue accumulation	Under threshold DO NOT TREAT Continue accumulation
10-21 days after treatment		Loss of residual	TREAT if over threshold and model indicates continued egg hatch		
1000 DD°	2100 DD°	End of flight	Visually inspect fruit for CM injury		

Insecticides for codling moth management

Common Name (Trade Name)	Manufacturer	EPA Registration Number	Rate/A	PHI	REI
phosmet (Imidan 50 WP)	Gowan	10163 - 169	2.25 - 3 lb	7 days	24 hr
	For susceptible CM populations, Imidan provides excellent control of CM with a residual action of 10 - 14 days. For organophosphate-resistant populations, alternatives with a different mode of action should be used for codling moth management. Imidan is generally considered of low toxicity to predaceous mites.				
carbaryl	Bayer	264 - 316	5 lb	3 days	12 hr
(Sevin 80 S)	Bayer	264 - 333	2 - 3 qt	3 days	12 hr
(Sevin XLR Plus)					
	Sevin provides good control of CM with a residual action of 7 days. This material is highly toxic to mite preda tors and should be used carefully to prevent mite population buildup. Sevin is a fruit-thinning agent if used within 30 days after bloom.				
Pyrethroids					
esfenvalerate (Asana XL 0.66 EC)	DuPont	352 - 515	4.8 - 14.5 oz	21 - 28 days	12 hr
lambda-cyhalothrin (Warrior 1 CS)	Syngenta	100 - 1112	3.4 - 5.12 oz.	21 days	24 hr
fenpropathrin (Danitol 2.4 EC)	Valent	59639 - 35	16 - 21.34 oz.	14 days	24 hr
cyfluthrin (Baythroid XL)	Bayer	264-745	1.4 - 2.8 oz.	7 days	12 hr
deltamethrin (Battalion 0.2 EC)	Arysta	264-1007-66330	7 - 14.1 oz.	21 days	12 hr
	Pyrethroid insecticides provide good control of CM with a residual action of around 7 days. They are more effective in the spring than in summer. Pyrethroids are highly toxic to mite predators and should be used carefully to avoid outbreaks of phytophagous mites.				
novaluron (Rimon 0.83 EC)	Chemtura	66222 - 35 - 400	20 - 40 oz	14 days	12 hr
	Rimon provides good to excellent control of CM with a residual action of 14-17 days. This material is an insect growth regulator that acts primarily by impeding normal development of the egg. Therefore, it must be applied prior to egg laying or shortly thereafter. In Michigan, it appears to be most effective when used early in the season, with the first application made around 100 degrees after biofix. Rimon 0.83 EC is restricted to 4 applications per season and 150 fl oz per acre per year.				
methoxyfenozide (Intrepid 2 F)	DowAgrosciences	707 - 277	16 oz	14 days	4 hr
	Intrepid provides good control of CM with a residual action of 10-14 days. Excellent timing and coverage are required to achieve control. Intrepid must be ingested by the larvae and may take several days to cause mortality. The addition of an agricultural adjuvant is recommended to improve initial spray deposition. This material is an insect growth regulator that primarily affects lepidopterous larvae but is also active against adults and eggs. It is not harmful to most beneficial insects. The maximum yearly amount of Intrepid 2F to be applied on apple and pear is 64 oz per acre.				

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Insecticides for codling moth management (continued)

Common Name (Trade Name)	Manufacturer	EPA Registration Number	Rate/A	PHI	REI
spinosad	DowAgrosciences	62719 - 294	7.5 oz	7 days	4 hr
(SpinTor 2 SC)		62719 - 621	6-10 oz.	7 days	4 hr
(Entrust 2 SC)	SpinTor provides fair to good control of CM with a residual action of 7-10 days. Good control requires excellent timing and coverage. SpinTor must be ingested by the larvae and may take several days to cause mortality. The addition of an agricultural adjuvant is recommended to improve initial spray deposition. Avoid use when bees are actively foraging — this material is highly toxic to bees exposed to direct spray. Dried residues have minimal effects. The maximum yearly amount of SpinTor 2SC to be applied on apple and pear is 29 oz per acre. Entrust is the OMRI-approved formulation for spinosad. The maximum yearly amount of Entrust to be applied on pome fruits is .45 lb ai (29 fl oz) oz per acre.				
narrow range oil	Sun	862 - 23	1 - 2 gal	1 days	4 hr
(Sunspray Ultra-fine)	Narrow range oils provide fair control of CM. Oils affect CM by smothering eggs. Applications should be repeated every 7-14 days during the egg-laying period. The effectiveness of oil treatments may be enhanced with more dilute applications. Oils may be phytotoxic if used within a few weeks of a sulfur spray or if applied at higher rates during hot weather (90F°+).				
acetamiprid	United Phosphorus	264 - 609	4 - 8 oz	7 days	12 hr
(Assail 30 SG)	Assail provides good control of CM with a residual action of 10-14 days at the high rate. Excellent timing and coverage are required to achieve control. Assail is the most active when ingested by larvae but also has limited adult and egg toxicity. Field trials have indicated that use of Assail can cause outbreaks of phytophagous mites. The maximum yearly amount of Assail 30SG to be applied on apple and pear is 32 oz per acre.				
thiacloprid	Bayer	264 - 806	6 - 8 oz	30 days	12 hr
(Calypso 480 SC)	Calypso provides good control of CM with a residual action of 10-14 days. Excellent timing and coverage are required to achieve control. Apply higher rates where CM densities are high or for prolonged control. The maximum yearly amount of Calypso to be applied on apple and pear is 16 oz per acre.				
clothianidin	Valent	59639 - 150	6 - 12 oz	7 days	12 hr
(Belay 2.13 SC)	Clutch provides good control of first generation codling moth and is most effective at the high label rate of 6 oz per acre. It appears to be much less efficacious against later generations. Excellent timing and coverage are required to achieve control. Clutch 50 WDG is restricted to a total of 6.4 per acre per season.				
granulosis virus					
(Cyd-X)	Certis	70051 - 44	4 - 6 oz	4 hr	4 hr
(Carpovirusine)	Arysta	49911	13.5 oz	4 hr	4 hr
(ViroSoft)	BioTEPP Inc.	72898	3.2 oz	4 hr	4 hr
	CM granulosis virus is a biological insecticide that is specific to codling moth. It provides fair to good control of this pest. The virus must be ingested by larvae and may take several days to cause mortality. Apply in sufficient water for thorough coverage of tree canopy. Repeat as necessary to maintain control. Do not tank mix with lime sulfur, copper or Bt products. All formulations are approved for organic use.				
spinetoram	Dow Agrosciences	62719 - 541	4.5 - 7 oz	7 d	4 hr
(Delegate 25WG)	Delegate provides good to excellent control of CM with a residual action of 14 days. Delegate is most active when ingested by the larvae but has limited activity on eggs. The maximum yearly amount of Delegate 25WG to be applied on apple and pear is 28 oz per acre. Delegate is moderately toxic to predacious mites.				
Emamectin benzoate	Syngenta	100-904	4.8 oz	14 d	48 hr
(Proclaim 5 SG)	Proclaim provides good control of first-generation codling moth and is most effective at the high label rate. It appears to be much less efficacious against later generations. Proclaim is the most active when ingested by larvae. Excellent timing and coverage are required to achieve control. Proclaim 5SG is restricted to a total of 14.4 oz per acre per season.				

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Insecticides for codling moth management (continued)

Common Name (Trade Name)	Manufacturer	EPA Registration Number	Rate/A	PHI	REI
chlorantraniliprole (Altacor 35 WDG)	DuPont	352-730	2.5-4.5 oz	14 d	4 hr
	Altacor provides excellent control of CM with a residual action of 10-14 days. Altacor is most active when ingested by the larvae. Apply higher rates against second generation CM and where pest density is high. The maximum yearly amount of Altacor 35 WDG to be applied on apple and pear is 9 oz per acre.				
flubendiamide (Belt 4 SC)	Bayer	264-1025	3-5 oz	14 d	12 hr
	Belt provides good to excellent control of CM with a residual action of 10-14 days. Belt is most active when ingested by the larvae. Apply higher rates against second generation CM and where pest density is high. The maximum yearly amount of Belt 4 SC to be applied on apple and pear is 15 oz per acre.				
thiamethoxam + chlorantraniliprole (Voliam flexi 40 WDG)	Syngenta	100-1319	4-7 oz	35 d	12 hr
	Voliam flexi provides excellent control of CM with a residual action of 10-14 days. Voliam flexi is most active when ingested by the larvae. Apply higher rates against second generation CM and where pest density is high. The maximum yearly amount of Voliam flexi to be applied on apple and pear is 16 oz per acre.				