

Section 4

Resistance Management

Apple Pest Management Transition Project

Tree Fruit Research & Extension Center

Insecticide Resistance Management



Resistance Management

Washington growers now have a number of new products available for codling moth and leafroller control. The key to conserving the efficacy of these new products will be to avoid their overuse. The use of codling moth mating disruption has been, and will continue to be, a very important means of reducing the needs for insecticide input and is, therefore, a valuable tool in a resistance management program.

In most orchards using codling moth mating disruption, insecticides will be necessary to supplement control. In choosing these supplemental controls, it is important for growers to conscientiously avoid using insecticides with the same mode of action against successive generations of a pest.

It can become a challenge to keep track of which insecticide class has already been used in the growing season and should, therefore, be avoided later in the growing season.

One method that may help keep track of insecticide use is to adopt a resistance management checklist such as the one that follows. Here, the growing season is divided into two parts, based on the development cycles of codling moth and leafrollers.

If a product is used in the first part of the season, it is marked “X.” It is possible to use a product from the same class, or even the same product, more than one time in the first part of the season, because only one generation of a pest is exposed to the chemical class.

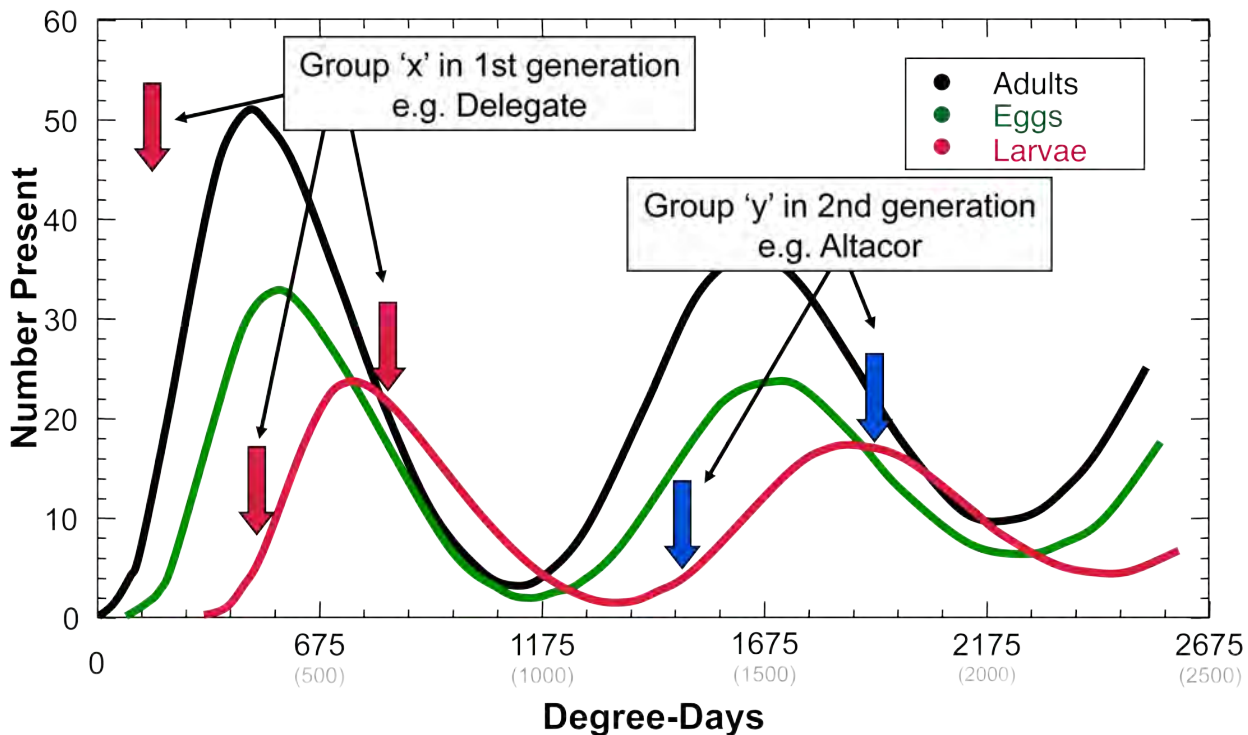
The early-season choices limit what products can be used in the second part of the season if a sound resistance management program is being followed.

Planning is an important part of resistance management program. Advanced planning will lead to better management decisions in pest control and help to ensure that Washington growers will retain the use of new pest control products in their pest management programs.



Resistance Management Strategies

- * Avoid using the same class of insecticide against successive generations.
- * Use the group number developed by the Insecticide Resistance Action Committee (IRAC) to identify the class of insecticide to which each product belongs.
- * Using the same class of insecticide multiple times against one generation is acceptable. Choose a different class of insecticide to target the next generation to avoid developing resistant populations.





Most labels will show the ***insecticide group number***.

This number identifies the class of insecticide. Avoid using the same class of insecticide against successive generations. Planning is an important part of implementing a sound ***resistance management strategy***.

Calypso is a ***group 4A*** insecticide.

Delegate is a ***group 5*** insecticide.

These products could be used against successive generations as part of a sound resistance management strategy.

	<table border="1" style="margin: auto;"> <tr> <td style="padding: 2px;">GROUP</td> <td style="padding: 2px;">4A</td> <td style="padding: 2px;">INSECTICIDE</td> </tr> </table>	GROUP	4A	INSECTICIDE	
GROUP	4A	INSECTICIDE			
<h2 style="margin: 0;">Calypso® 4 Flowable Insecticide</h2> <p style="margin: 0;">FOR CONTROL OF CERTAIN INSECTS INFESTING VARIOUS CROPS</p> <p style="margin: 0;">SHAKE WELL BEFORE USING</p>					
<p>ACTIVE INGREDIENT: Thiacloprid [3-[(6-chloro-3-pyridinyl)methyl]-2-thiazolidinylidene]cyanamide 40.4%</p> <p>INERT INGREDIENTS: 59.6%</p> <p>Contains 4 pounds of thiacloprid per gallon.</p>					
EPA Reg. No. 264-806		EPA Est. No. 264-MO-002			
KEEP OUT OF REACH OF CHILDREN					

<p>Specimen Label</p> <p style="text-align: center;">Dow AgroSciences</p> <div style="text-align: center;"> </div> <p style="text-align: center;">Insecticide</p> <p style="font-size: small;">™Trademark of Dow AgroSciences LLC</p> <p>For control or suppression of lepidopterous larvae (worms, caterpillars), dipterous leafminers, thrips, and certain psyllids in banana and plantain, bushberries, caneberries, citrus, cranberry, fig, grape, pome fruits, stone fruits, tobacco, and tropical fruits.</p> <table border="1" style="margin: auto;"> <tr> <td style="padding: 2px;">Group</td> <td style="padding: 2px;">5</td> <td style="padding: 2px;">INSECTICIDE</td> </tr> </table> <p style="font-size: x-small;"> Active ingredient: azelaenetriol, 2-[[[2R,5S,8R]-5-(dimethylamino) tetrahydro-6-methyl-2H-pyran-2-yl]oxy]-13-[[[2R,5S,8R]-5-(dimethylamino) tetrahydro-6-methyl-2H-pyran-2-yl]oxy]-9-ethyl-2,3,3a,4,5,5a,5b,6,9,10,11,12,13,14,16a,16b-hexadecahydro-14-methyl-, (2R,3aR,5aR,5bS,9S,13S,14R,16aS,16bR) and 11H-aa-indolizino[3,2-d]pyrazolo[4,3-b]pyridine-7,15-dione, 2-[(6-deoxy-3-O-ethyl-2,4-di-O-methyl-a-L-mannopyranosyl)oxy]-13-[[[2R,5S,8R]-5-(dimethylamino) tetrahydro-6-methyl-2H-pyran-2-yl]oxy]-9-ethyl-2,3,3a,5a,5b,6,9,10,11,12,13,14,16a,16b-tetradecahydro-4,14-dimethyl-, (2S,3aR,5aS,5bS,9S,13S,14R,16aS,16bS) 25.0% Other ingredients 75.0% Total 100.0% </p> <p style="font-size: x-small;">Contains 25% active ingredient on a weight basis (250 g ai/kg) EPA Reg. No. 62719-541</p> <p>Keep Out of Reach of Children CAUTION</p> <p>Precautionary Statements Hazards to Humans and Domestic Animals</p> <p style="font-size: x-small;">Causes Moderate Eye Irritation</p> <p style="font-size: x-small;">Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco.</p>	Group	5	INSECTICIDE	<p>Personal Protective Equipment (PPE) Applicators and other handlers must wear:</p> <ul style="list-style-type: none"> • Long-sleeved shirt and long pants • Shoes plus socks <p>Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.</p> <p>User Safety Recommendations Users should:</p> <ul style="list-style-type: none"> • Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. <p>First Aid If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.</p> <p>Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-992-5994 for emergency medical treatment information.</p> <p>Environmental Hazards This product is toxic to aquatic invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from treated areas. Drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Apply this product only as specified on the label.</p> <p>This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area.</p> <p>Notice: Read the entire label. Use only according to label directions. Before using this product, read Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies elsewhere on this label. If terms are unacceptable, return at once unopened.</p> <p>In case of emergency endangering health or the environment involving this product, call 1-800-992-5994. If you wish to obtain additional product information, visit our web site at www.dowagro.com.</p> <p>Directions for Use It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Read all Directions for Use carefully before applying.</p> <p>Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your state or tribe, consult the state or tribal agency responsible for pesticide regulation.</p>
Group	5	INSECTICIDE		

Apple Pest Management Transition Project

Tree Fruit Research & Extension Center

Resistance Management Planning Check list



Sample

Dormant - 1st CM generation (March - June)

Summer generations CM/LR - harvest (July-Sep.)

Insecticide	Chemical Name*	Group	Dormant - 1st CM generation (March - June)								Summer generations CM/LR - harvest (July-Sep.)							
			CM	LR	CAM	RAA	WAA	SB	SJS	LAC	CM	LR	CAM	RAA	WAA	SB	SJS	LAC
Danitol	fenpropathrin	3														X		
Warrior	lambda-cyhalothrin	3																
Assail	acetamiprid	4	X									---	---	---	---	---	---	---
Calypso	thiacloprid	4										---	---	---	---	---	---	---
Provado	imidacloprid	4				X						---	---	---	---	---	---	---
Success	spinosad	5																
Delegate	spinetoram	5										X						
Agrimek	abamectin	6																
Proclaim	emamectin benzoate	6																
Esteem	pyriproxyfen	7C							X			---	---	---	---	---	---	---
Rimon	novaluron	15																
Intrepid	methoxyfenozide	18A										X	X					
Avaunt	indoxacarb	22																
Movento	spirotetramat	23																
Altacor	rynaxypyr	28	X	X								---	---	---	---	---	---	---
Belt	flubendiamide	28										---	---	---	---	---	---	---

CM = Codling moth; LR = leafroller; CAM = campyloomma; RAA = Rosy apple aphid; WAA = Woolly apple aphid; SB = Stink bug; SJS = San Jose scale; LAC = Lacanobia fruitworm

*This is only a partial list of insecticides that are available for apple IPM programs. This type of check list could be developed for each situation to help plan a resistance management strategy.

Apple Pest Management Transition Project

Tree Fruit Research & Extension Center

Resistance Management Planning Check list



Dormant - 1st CM generation (March - June)

Summer generations CM/LR - harvest (July-Sep.)

Insecticide	Chemical Name	Group	Dormant - 1st CM generation (March - June)								Summer generations CM/LR - harvest (July-Sep.)								
			CM	LR	CAM	RAA	WAA	SB	SJS	LAC	CM	LR	CAM	RAA	WAA	SB	SJS	LAC	
Danitol	fenpropathrin	3																	
Warrior	lambda-cyhalothrin	3																	
Assail	acetamiprid	4																	
Calypso	thiacloprid	4																	
Provado	imidacloprid	4																	
Success	spinosad	5																	
Delegate	spinetoram	5																	
Agrimek	abamectin	6																	
Proclaim	emamectin benzoate	6																	
Esteem	pyriproxyfen	7C																	
Rimon	novaluron	15																	
Intrepid	methoxyfenozide	18A																	
Avaunt	indoxacarb	22																	
Movento	spirotetramat	23																	
Altacor	rynaxypyr	28																	
Belt	flubendiamide	28																	

CM = Codling moth; LR = leafroller; CAM = campyloomma; RAA = Rosy apple aphid; WAA = Woolly apple aphid; SB = Stink bug; SJS = San Jose scale; LAC = Lacanobia fruitworm

*This is only a partial list of insecticides that are available for apple IPM programs. This type of check list could be developed for each situation to help plan a resistance management strategy.