



# Pest Management Transition Project

## Tree Fruit Research & Extension Center

### INSECTICIDE RESISTANCE

.....

The Insecticide Resistance Action Committee (IRAC – <http://www.irc-online.org/>) defines **insecticide resistance** as:

*“a heritable change in the sensitivity of a pest population that is reflected in the repeated failure of a product to achieve the expected level of control when used according to the label recommendation for that pest species”*

Within any insect population there can be a few individuals that are genetically more resistant to a specific insecticide. When an insecticide is used as a control, the normal, susceptible individuals are removed from the population, leaving those that carry the genes for resistance. If the same insecticide is used against successive insect generations, the number of genetically resistant individuals will continue to increase, as

those carrying the genes for resistance continue to multiply and eventually become predominant. This **selection** process ultimately results in insecticide applications that become increasingly less effective and pest control that weakens until control failures occur. The cycle that leads to insecticide resistance can be avoided by following a few, simple principals of resistance management.

### INSECTICIDE GROUP NUMBER

.....

An effective strategy to minimize the selection for resistance from a particular insecticide group is to **rotate products from groups with different modes of action**. The **mode-of-action** of an insecticide refers to the manner in which it intoxicates the insect. While

many new insecticides have been registered over the past few years, many share the same mode-of-action. To help growers determine the mode-of-action group that a product belongs to, IRAC has developed a classification scheme. The **group number**, which

appears on the label of most of the new products, classifies insecticides by mode-of-action and active ingredient. The group number can help to determine which products could be used in a rotation strategy to create a sound resistance management program.

### RESISTANCE MANAGEMENT

.....

Avoiding overuse is another important principle in managing insecticide resistance. Employing pheromone mating disruption as part of an Integrated Pest Management (IPM) program will help to reduce insecticide inputs. In most instances, however, supplemental insecticide applications will still be necessary to achieve acceptable control. When choosing among the insecticides available for use, resistance management should be considered. To help maintain insecticide efficacy and reduce the selection for resistance, *it is recommended that growers avoid using the same mode-of-ac-*

*tion (identified by the same group number) against successive generations of a pest*. It can become a challenge to keep track of which modes of action have already been used in the growing season. One method that can help is to adopt a **resistance management checklist**, such as the one shown on the following page. Planning is an important part of a resistance management program. Advanced planning will lead to better management decisions, better pest control, and help to ensure that growers retain the use of new pest control products in their pest management programs.

#### **Resistance Management**

- Avoid using the same mode-of-action against successive pest generations.
- Use the group number developed by the Insecticide Resistance Action Committee (IRAC) to identify insecticides that have a common mode-of-action, that is, have the same IRAC group number.
- Using the same mode-of-action multiple times against the same generation is acceptable. Choose a different mode-of-action to target the next generation to avoid developing resistant populations.

## RESISTANCE MANAGEMENT PLANNING CHECK LIST

In the sample below, the growing season is divided into two parts – based on the development cycles for codling moth and leafrollers. If a product is used in the first part of the season, it is marked with an “X.” It is possible to use a product with the same group number, 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 that mode-of-action. However, 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. If an insecticide is used in the first part of the season, all insecticides in the group are crossed off the table as options for use in the second half of the season.

### Sample

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								
Agrimck	abamectin	6																	
Proclaim	emamectin benzoate	6																	
Esteem	pyriproxyfen	7C								X									
Rimon	novaluron	15																	
Intrepid	methoxyfenozide	18A																	
Avaunt	indoxacarb	22									X	X							
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.

Growers can create their own simple checklist, like the one illustrated above, to help track the insecticide products that they are using. More information about resistance management can be found in the PMTP handbook (<http://pmtп.wsu.edu/handbook2.html>) and the IRAC website (<http://www.iraс-online.org/>).

Visit PMTP online at:  
<http://pmtп.wsu.edu>

Pest Management Transition Project  
Washington State University  
1100 North Western Avenue  
Wenatchee, WA 98801