



# Insecticide Resistance Management Strategies

*Developed by the CropLife Australia Insecticide Resistance Management Review Group*

**Valid as at 15 September 2009**

---

This document is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this document is provided in good faith and without any liability for loss or damage suffered as a result of its application and use. Advice given in this strategy is valid as at 15 September 2009. All previous versions of this strategy are now invalid.

CropLife Australia Limited  
Locked Bag 916, Canberra ACT 2601  
Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

## Contents

		<b>Page</b>
<b>Introduction</b>		<b>3-5</b>
<b>Crop(s)</b>	<b>Pest(s)</b>	<b>6 – 18</b>
Brassica	Diamondback Moth	6
Strawberries/Ornamentals	Two-spotted Mite, Western Flower Thrips	7
Pasture/Winter Crops	Redlegged Earth Mite (RLEM)	8-9
Various	Green Peach Aphid	10
Sorghum, Maize, Summer Grain Legumes	Cotton Bollworm / Heliothis	11
Tomato	Heliothis/Tomato Budworm	12
Potato	Potato Moth (Leafminer)	13
Sweet Corn	Heliothis/Cotton Budworm	14-15
Banana	Banana Weevil Borer	16-17
Pome Fruit	Two-spotted Mite	18
<b>CropLife Australia website strategy attachments</b>		
Cotton- TIMS Resistance Management Strategies for 3 districts		
Brassica DBM (Diamondback Moth) resistance management strategies for 3 districts		

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009. All previous versions of this strategy are now invalid.  
 Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

## INTRODUCTION

The CropLife Australia Insecticide Resistance Management Review Group (IRMRG) has drafted insect resistance management strategies in conjunction with growers, researchers and agronomists to minimise the development of insect resistance to insecticides. These strategies provide growers with guidelines for insecticide use (and other methods) for sustainable insect control.

## PRINCIPLES OF RESISTANCE MANAGEMENT

Insecticide or acaricide resistance management strategies seek to minimise the selection for resistance to any one type of insecticide or acaricide. This requires an understanding of insecticides as they are grouped according to similarity of Mode of Action (MoA) in controlling insects and mites.

In practice, sequences or rotations of compounds from different MoA groups provide an effective approach to resistance management. These MoA groups are shown in Table 2

## EFFECTIVE RESISTANCE MANAGEMENT STRATEGIES USE ALTERNATIONS OR SEQUENCES OF DIFFERENT MODES OF ACTION

The objective of Insecticide Resistance Management is to prevent or delay resistance developing to insecticides, or to help regain susceptibility in insect pest populations in which resistance has already arisen. IRM is important in maintaining the efficacy of valuable insecticides. It is usually easier to prevent resistance occurring than it is to reactively regain susceptibility.

Insecticide applications are often arranged into MoA spray windows or blocks that are defined by the stage of crop development and the biology of the pest(s) of concern. Local expert advice should always be followed with regard to spray windows and timings. Several sprays of a compound may be possible within each spray window but it is generally essential to ensure that successive generations of the pest are not treated with compounds from the same MoA group.

## WHAT IS RESISTANCE?

Resistance to insecticides and acaricides may be defined 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*'.

Resistance arises through the over use or misuse of an insecticide or acaricide against a pest species and results in the selection of resistant forms of the pest and the consequent evolution of populations that are resistant to that insecticide or acaricide.

---

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

## **MODE OF ACTION, TARGET-SITE RESISTANCE AND CROSS-RESISTANCE**

In the majority of cases, not only does resistance render the selecting insecticide ineffective but it often confers cross-resistance to other chemically related compounds. Compounds within a specific chemical group usually share a common target site within the pest, and thus share a common Mode of Action (MoA). It is common for resistance to develop that is based on a genetic modification of this target site. When this happens the compound loses its pesticidal efficacy. Because all compounds within the chemical sub-group share a common MoA, there is a high risk that the resistance will automatically confer cross-resistance to all the compounds in the same sub-group. It is this concept of cross-resistance within chemically related insecticides or acaricides that is the basis of the Mode of Action classification.

## **ALTERNATION OF CHEMISTRY**

Constant use of insecticides from one chemical grouping (MoA) will increase the risk of rapid build up of resistance to that chemical group. Alternate use of chemical groups with different MoAs will slow down the process of selection for resistance.

## **USE OF CULTURAL PRACTICES**

Incorporation of cultural techniques for controlling an insect pest will reduce selection pressure from the insecticides. Any resistance management strategies should incorporate all available methods of control for the insect pest concerned.

## **UNDERSTANDING OF THE INSECT/MITE LIFE CYCLE**

A good understanding of the life cycle of the pest is essential so that control methods can be effectively targeted. An insecticide or acaricide should always be targeted at the pest growth stage that is most susceptible for that insecticide or acaricide.

## **APPLICATION**

### **Label Recommendations**

Insecticide labels have been carefully developed to ensure the most effective control of the pest. The label should be carefully read and adhered to at all times.

### **Rates**

Full recommended rates of registered insecticides should always be used to ensure the most effective control of the pest.

### **Coverage**

The majority of insecticides require good coverage of the target area to ensure the best possible chance of contact and subsequent control of the pest.

---

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

## RESISTANCE MANAGEMENT STRATEGY DESIGN

### Crop/Pest or Regional Strategies

The strategies below are provided on a CROP by PEST basis (eg. Tomato - heliothis). However, in horticultural and agricultural areas often a range of crops are grown that are attacked by a range of pests.

In many cases, a specific MoA insecticide can be used across this range of crops to control multiple pests that have the ability to move from crop to crop. There is interaction between intensive horticulture and broadacre farming, as with Diamondback Moth (DBM) in Brassica vegetables and resistance strategies that could be compromised by widespread use of insecticides for DBM control in canola.

Also, the pest complex for a specific crop will vary within production regions, especially between Northern and Southern Australia.

For this reason, CROP by PEST strategies can be flawed and further Insecticide Resistance Management (IRM) advice for specific pests should always be sought on a local basis.

An alternative to the CROP by PEST strategy is that of "Regional strategies" such as those for Cotton, Brassicas and the Southern NSW & Northern Victorian IRM strategy for grain & annual horticultural crops".

These regional or specific crop strategies are located on the CropLife Australia website.

The overall Resistance Management Strategy of avoiding overuse of individual Modes of Action insecticides should be followed, not just on a specific crop and pest but on a broad perspective of crops and pest complex.

### ADDITIONAL INFORMATION

Further information on Insecticide Resistance, Management Strategies and Insecticide Mode of Action can be found on the International IRAC (Insecticide Resistance Action Committee) website [www.irc-online.org](http://www.irc-online.org).

---

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

**Crop(s) : Brassica**  
**Insect(s) : Diamondback Moth**

**Refer to the separate Diamondback Moth (DBM) strategies for -**

- 1. Queensland**
- 2. New South Wales, Victoria, South Australia**
- 3. Western Australia**

**Further DBM resistance management information is available on website:**

[http://www.sardi.sa.gov.au/pestsdiseases/horticulture/horticultural\\_pests/diamondback\\_moth/insecticide\\_resistance\\_management](http://www.sardi.sa.gov.au/pestsdiseases/horticulture/horticultural_pests/diamondback_moth/insecticide_resistance_management)

**Guidelines:**

Strategies are based on:

1. Distinct windows split at times of peak DBM population and which divide the brassica growing periods in each of the regions.
2. Alternating insecticide groups (changing groups) at the nominated date (ie. new use window).
3. Consultation with local industry advisers to set the regional window dates.
4. Using *Bacillus thuringiensis* (Bts) in earlier crop stages to encourage beneficials.
5. Monitoring pest levels and not spraying unless pest thresholds are reached.
6. NOT using mixtures of insecticides for controlling DBM.
7. Good crop hygiene such as the use of clean seedlings.

---

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009. All previous versions of this strategy are now invalid.  
Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

**Crop(s) : Strawberries/ornamentals**

**Mite : Two Spotted Mite**

**Guidelines:**

1. Monitor mite activity and treat infestations before thresholds are reached, ie. spray earlier rather than later. Seek advice on local threshold levels.
2. Do not apply sequential applications of products from any one chemical group.
3. Preferably products with the same Mode of Action should not be used more than twice in a growing season
4. Incorporate the use of predatory mites for the control of this pest wherever possible.

**Insect : Western Flower Thrips**

For information refer NSW Department of Primary Industry website

<http://www.dpi.nsw.gov.au/agriculture/horticulture/pests-diseases-hort/multiple/thrips>

---

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009 All previous versions of this strategy are now invalid.  
Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

**Crop(s):** Pasture/Winter Crops  
**Mite:** Redlegged Earth Mite (RLEM)

**Guidelines:**

Rotate insecticide groups.

Do not apply consecutive sprays of products from any one insecticide group

Crop Stage	Group*	Chemical Sub-group	Example chemical
Seed Treatment  (or in-furrow)	4A	Neo-nicotinoids	imidacloprid
	1B	organophosphates	dimethoate
	2B	phenylpyrazoles	fipronil
Bare Earth (Pre-emergent)	1B	organophosphates	omethoate
	3A	synthetic pyrethroids	bifenthrin
	2A	cyclodiene organochlorines	endosulfan
Early Season (Autumn when limited green growth)	3A	synthetic pyrethroids	alpha-cypermethrin
	1B	organophosphates	chlorpyrifos
Spring	1B	organophosphates	omethoate
	3A	synthetic pyrethroids	gamma-cyhalothrin

**\*Groups are the International Resistance Action Committee Insecticide Groups based on mode of action of the insecticides - refer MoA tables.**

If both autumn and spring applications are needed, alternate between synthetic pyrethroids and organophosphates

**Timing of Sprays**

1. Monitor redlegged earth mite (RLEM) activity carefully and only treat if damage has reached threshold levels.
2. One well timed spray in Autumn or Spring will maximise effectiveness of treatment.

**Placement of Sprays**

1. Apply perimeter sprays where infestations are concentrated on the edge of fields.
2. Use blanket sprays where appropriate.

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009. All previous versions of this strategy are now invalid.  
 Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

**Crop(s): Pasture/Winter Crops (cont.)**

**Mite: Redlegged Earth Mite (RLEM) (cont.)**

**Guidelines: (cont.)**

**Cultural Practices**

1. Heavy grazing or cutting for hay or cultivation will reduce mite numbers.
2. Develop damage thresholds.
3. Rotate crops and pastures that are more tolerant to the pest.
4. Encourage predator survival by judicious use of insecticides.
5. Control alternative hosts such as capeweed and Paterson's curse.

---

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009. All previous versions of this strategy are now invalid.  
Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

**Crop(s) : Various**  
**Insect(s) : Green Peach Aphid**

**Guidelines:**

1. Rotate between registered insecticides that have different modes of action (eg. Group 1, Group 4 and Group 9).
2. Do not apply consecutive applications of insecticides that have the same mode of action within and between seasons.
3. The Modes of Action (groups) and registered insecticides for control of green peach aphid are listed below.

<b>Group*</b>	<b>Chemical sub-group</b>	<b>Example chemical</b>
1A	Carbamates	pirimicarb
1B	Organophosphates	methamidophos
4A	Neo-nicotinoid	imidacloprid
9B	Pymetrozine	pymetrozine

\*Refer: *CropLife Australia Insecticide Resistance Management Review Group Mode of Action Classification for Insecticides*

**Notes:**

1. There is known cross-resistance between Groups 1A and 1B. Rotate between Group 1 and Group 4A and 9B.
2. Seek advice from the manufacturers and/or government advisory services to determine local resistance levels for particular Group 1, Group 4 and Group 9 insecticides.
3. Do not exceed the maximum number of applications permitted on the insecticide label.
4. When using insecticides/miticides to control other pests, consider the chemical group in relation to contributing to resistance development of Green Peach Aphid.

---

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009. All previous versions of this strategy are now invalid.  
Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

**Crop(s) :** Sorghum, Maize, Summer Grain Legumes  
**Insect(s) :** Heliothis/Cotton Budworm (*Helicoverpa* spp.)

Stage I	Stage II	Stage III	Post Harvest
GEMSTAR/VIVUS			Cultivate to destroy over-wintering pupae as soon as possible after harvest
ENDOSULFAN			The use of late winter sown chickpeas to act as trap crops for the first generation of emerging moths in spring is recommended
	STEWARD – Max of 1		
	TRACER – Max of 3		
		SYNTHETIC PYRETHROIDS – Max of 2	
		CARBAMATES/ OPS – Max of 3	
Dec 10	Jan 10	April	

For additional information refer: *Cotton and the Regional Southern NSW-Northern Victoria IRM strategies on the CropLife Australia website.*

**Note :** to conserve “beneficials” delay the use of carbamate and synthetic pyrethroid insecticides for as long as possible.

**Guidelines:**

1. In maize the critical stage of infestation is during silking. Infestation could extend through to when the grain in cobs begins to harden although spraying for Heliothis is generally not required after silking is complete.
2. In sorghum the critical stage of infestation is during flowering and milky dough stage. Infestation could extend through to when the grain begins to harden.
3. Monitor pest levels and do not spray unless pest thresholds are reached.
4. Do not use consecutive applications of products from the same chemical group in Stages II and III.
5. Sorghum, maize and grain legumes are often grown in areas where cotton is grown and product selection should be mutually compatible.
6. Sorghum, maize and summer grain legume grain or forage is often fed to livestock. Recognition of possible insecticide residue in forage and possible animal residues resulting from consumption is critical (eg. endosulfan) especially for produce destined for export markets.
7. Post-harvest cultivation to destroy pupae, as practised in cotton crops, should also be practised in sorghum, maize and grain legume crops.

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator’s (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009 All previous versions of this strategy are now invalid.  
 Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

**Crop(s) : Tomato**  
**Insect(s) : Heliothis/Tomato Budworm (*Helicoverpa* spp.)**

**Guidelines:**

1. Monitor pest levels and do not spray unless pest thresholds are reached.
2. Do not apply products outside their window of application for that chemical group.
3. Integrate both chemical and non-chemical means of control as part of the overall control strategy. Examples are the use of predators/parasites and relevant cultural practices (crop hygiene, rotation of planted areas, and strategic time of planting).
4. Seek local advice on pest incidence and the risk of resistance development from insecticide programs used to control heliothis in other crops or to control other pests
5. When using insecticides/miticides to control other pests on tomato, consider the chemical group in relation to contributing to resistance development of heliothis.

---

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009. All previous versions of this strategy are now invalid.  
Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

**Crop(s) : Potato**  
**Insect(s) : Potato Moth (Leafminer)**

<b>Group*</b>	<b>Chemical sub-group</b>	<b>Example chemical</b>
1B	<b>organophosphates</b>	acephate, azinphos-methyl, methamidophos, , diazinon, dichlorvos
1A	<b>Carbamates</b>	carbaryl, methomyl
3A	<b>Pyrethroids</b>	permethrin
2A	<b>Cyclodienes</b>	endosulfan
5	<b>Spinosyns</b>	spinosad
28	<b>Diamides</b>	chlorantraniliprole

\* Refer: *CropLife Australia Insecticide Resistance Management Review Group Mode of Action Classification for Insecticides*

#### **Guidelines:**

1. Monitor pest levels and do not spray unless pest thresholds are exceeded.
2. Rotate insecticide groups and do not use two consecutive applications of products with the same Mode of Action.
3. Integrate both chemical and non-chemical means of control as part of the overall control strategy. Examples are the use of predators/parasites and relevant cultural practices (crop hygiene, rotation of planted areas, and strategic time of planting).

---

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009 All previous versions of this strategy are now invalid.  
Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

**Crop(s) : Sweet Corn**  
**Insect(s) : Heliothis/Cotton Budworm (*Helicoverpa* spp.)**

Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>North QLD</b>	No crop		NPV <sup>1</sup> B.t. carbamates SP's endosulfan			spinosad NPV, B.t. carbamates SP's, endosulfan		NPV B.t. carbamates SP's			No crop	
<b>South QLD</b>	spinosad NPV B.t. carbamates SP's, endosulf.	NPV B.t. carbamates SP's				No crop			spinosad NPV B.t. endosulfan	NPV B.t. carbamates SP's endosulfan		
<b>NSW/VI C</b>	spinosad NPV B.t. carbamates SP's endosulfan	NPV B.t. carbamates SP's		No crop					NPV B.t. carbamates SP's, endosulfan			
<b>TAS</b>	NPV B.t. carbamates SP's, endosulfan		No crop							spinosad NPV B.t. carbamates SP's		
Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

For further information : Refer to both the Cotton and the Regional Southern NSW-Northern Victoria IRM strategies on the CropLife Australia website.

**Guidelines:**

1. The critical stage of infestation is during silking. Even low levels of heliothis infestation are unacceptable at the silking stage. Because sweet corn is not attractive to heliothis before flowering and it is picked soon after silking is completed, there is a relatively short period of protection required.
2. Monitor crops regularly and do not spray unless pest thresholds are exceeded.
3. Use of biological insecticides, Bt and Gemstar(NPV), in the early stages of crop development is encouraged
4. Labels of new products place a limit on the number of applications. If further control is required on one planting, different groups within the same window should be used.

<sup>1</sup> NPV = Nuclear polyhedrosis virus – used for biocontrol of insects.

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

**Crop : Sweet Corn (cont.)**

**Insect : Heliothis/Cotton Budworm (*Helicoverpa* spp.) (cont.)**

**Guidelines (cont.)**

5. Do not retreat a spray failure with a product from the same chemical group.
6. Do not use mixtures of insecticides for controlling heliothis.
7. Cultivation after harvest to destroy pupae will greatly assist in managing heliothis.
8. Seek local advice on pest incidence and on the risk of resistance developing from insecticide programs used to control heliothis in crops other than Sweet Corn.

---

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009. All previous versions of this strategy are now invalid.  
Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

**Crop(s) : Banana**  
**Insect(s) : Banana Weevil Borer**

**Components of the strategy:**

1. Use only clean planting material.
2. If replanting into an old banana block allow at least 6 months fallow after old banana material has rotted down.
3. Remove weeds and trash around banana stools to allow maximum effectiveness of insecticides and reduce sheltering sites for weevils. Application of insecticide to trash may lead to reduced control of banana weevil borer
4. Cut up fallen and harvested pseudostems to reduce weevil-breeding sites.
5. Monitor regularly for banana weevil borer activity by trapping (when adult weevils are active) or corm damage ratings.
6. Only use insecticides when populations reach or exceed accepted threshold levels. Refer local DPI guidelines
7. Only use insecticides at the registered rate of application and apply at times when the particular product will have the maximum impact, i.e. use contact insecticides only when adult weevil borers are active.
8. Do not use insecticides from the same insecticide group continuously for more than one year.
9. Consider the impact of the use of other pesticides such as nematicides on banana weevil borers.

Group*	Chemical sub-group	Example chemical	Year 1 use	Year 2 use
1A or 1B	Carbamates* or Organophosphates	oxamyl or cadusafos, chlorpyrifos, prothiofos, terbufos	Yes	No
2B	Phenylpyrazoles (Fiproles)	fipronil	Yes	No
3A	Synthetic pyrethroids	bifenthrin	No	Yes
4A	Neo-nicotinoids	imidacloprid, clothianidin	No	Yes

\*Refer: CropLife Australia Insecticide Resistance Management Review Group Mode of Action Classification for Insecticides

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009 All previous versions of this strategy are now invalid.  
 Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

**Crop(s) : Banana (cont.)**  
**Insect(s) : Banana Weevil Borer (cont.)**

**Guidelines:**

1. The resistance management strategy may start at any point in the product group rotation. (Years 1 or 2)
2. The product(s) used in any one year should not be followed by product(s) from the same insecticide group in the next year.
3. Products from different insecticide groups should not be applied during the same period for banana weevil borer control.
4. If product(s) from Group 1A or Group 1B are being used for nematode control in a block of bananas, then product(s) from Groups 1A or 1B should not be used for control of banana weevil borer control the following year. Thus, if cadusafos, terbufos, oxamyl or other Group 1A or Group 1B product is used for nematode control in one year, these or other Group 1A or Group 1B products should not be used for banana weevil borer control the following year.
5. Where there is evidence of banana weevil borer resistance to a product, or group of products, these should not be used again for banana weevil borer control until there has been use of products from the other Mode of Action groups for a period of 2 years.
6. Soil applications of fipronil or bifenthrin for rust thrips control should be considered as applications for banana weevil borer in terms of the resistance management strategy. Do not use either chemical by soil application separately for rust thrips and banana weevil borer in the same year.

---

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009. All previous versions of this strategy are now invalid.  
Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

**Crop(s) : Pome Fruit**  
**Mite(s) : Two-spotted Mite, European Red Mite**

**Guidelines:**

1. Make no more than one application from each registered miticide group per season. Rotate registered miticides that have different mode of action (i.e. Group 6A, Group 13A, Group 14A, Group 21A and Group 2D).
2. For miticides that have the same mode of action (eg. Group 21A) do not use consecutive applications within and between seasons.

Group*	Chemical sub-group	Example chemical
6	Avermectins	abamectin
13	Chlorfenapyr	chlorfenapyr
12C	Propargite	propargite
21A	METI acaricides	fenpyroximate, tebufenpyrad
UN	Bifenazate	bifenazate
10B	Etoxazole	etoxazole

\* Refer CropLife Australia Insecticide Resistance Management Review Group Mode of Action Classification for Insecticides

**Notes:**

1. Miticides should be used as part of an Integrated Mite Control (IMC) program.
2. Mite levels should be monitored and thresholds utilised before deciding to make miticide applications.
3. Where practicable, predatory mites should be incorporated into an IMC program.
4. When using insecticides/miticides to control other pests of pome fruit such as codling moth, lightbrown apple moth and woolly aphid, consider the chemical group and the potential impact it may have on resistance development of mite pests.

---

This strategy is a guide only and does not endorse particular products, groups of products or cultural methods in terms of their performance. Always follow the product label for specific use instructions. While all effort has been taken with the information supplied in this document no responsibility, actual or implied, is taken for the day to day accuracy of product or active constituent specific information. Readers should check with the Australian regulator's (APVMA) product database for contemporary information on products and actives. The database can be sourced through [www.apvma.gov.au](http://www.apvma.gov.au). The information given in this strategy is provided in good faith and without any liability for loss or damage suffered as a result of its application and use.

Advice given in this strategy is valid as at 15 September 2009 All previous versions of this strategy are now invalid.  
Phone: 02 6230 6399 Email: [info@croplifeaustralia.org.au](mailto:info@croplifeaustralia.org.au) Fax: 02 6230 6355 Website: [www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)