

Insecticide Resistance Management Strategies

Developed by the CropLife Australia Insecticide Resistance Management Review Group

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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. In practice, sequences or rotations of compounds from different MoA groups provide an effective approach to resistance management. These MoA groups are shown in the **Mode of Action Classification for Insecticides Table**.

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.

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 at all times be carefully read and adhered to.

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.

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 and Northern Victorian IRM strategy for grain and 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.