

Managing Pesticide Resistance



Pesticide resistance means that a pesticide no longer controls the pest, disease or weed for which it was designed.

Diamondback moth (DBM) was the first insect pest to develop resistance against DDT in the 1950s. DBM has since developed resistance to a number of synthetic pyrethroids and organophosphates. This example shows how the incorrect use of, and sole reliance on, pesticides for pest problems is not a long-term solution. The 'DBM case' was a catalyst for the integrated use of a range of management techniques as a way to avoid pesticide resistance.

This example also highlights how vital resistance management is for maintaining effective crop protection options. Losing control over pests, diseases or weeds due to excessive use of specific pesticides or pesticide groups may result in high crop losses and the need to use expensive alternative control products and methods. Using integrated management strategies will reduce the development of resistance and also contribute towards the quality of the environment.

How can I avoid resistance?

Do not over use products. Generally, a maximum of three applications should be applied in any crop season, and no more than two consecutive sprays before switching to a product from another chemical activity group. This advice may vary on product labels (generally to fewer rather than more applications of the same active ingredient (a.i.)). Do not reduce recommended product application rates as this can easily lead to pest or disease survival and development of resistance in surviving populations.

Note: The same active ingredient may be sold under several different product names. Consult your supplier if you are not sure about active ingredients and their activity groups for different pesticide products.

The basic principles

1. Monitor crops regularly to find the first signs of disease, pest or weed incursion. Learn how to identify early stages of an incursion or employ a trained person to scout your crops for you.
2. Good crop hygiene and management will help to reduce weed, pest and disease pressure.
 - Plant clean, healthy seeds and seedlings
 - Ensure adequate water and nutrients are available for rapid, strong crop establishment, as weak plants get attacked first
 - Control weeds in areas adjacent to your crop, especially if they can be hosts for pests and diseases or are difficult to control in your crop
 - Incorporate post harvest crop residue
 - Rotate crops or use break crops to avoid build up of weeds, pests and diseases
3. Using pesticides in a random manner will cause pests, diseases and weeds to rapidly develop resistance. Help to avoid this by adopting an Integrated Pest Management (IPM) strategy.
 - Avoid broad spectrum insecticide sprays (e.g. Organophosphates – OPs and synthetic pyrethroids – SPs) early in a crop cycle to encourage beneficial insects
4. Delay resistance development by rotating different a.i. groups and restrict their use to certain periods of the year.
 - Labels of some products place a limit on the number of times they can be applied. Adhere to these restrictions
5. Do not use mixtures of insecticides for controlling pests (e.g. bacillus thuringiensis and synthetic pyrethroids).

Key Messages

- Pesticide resistance management requires a whole of industry approach with all producers and their advisers strictly adhering to product label requirements. There are some basic principles which can be readily applied.
- Your supplier will be able to provide information about resistance management on your farm for the specific products and product combinations you are using.
- Strategies for developing and implementing a successful IPM system have to be based on farmer and industry participation. They should include an extensive research and development program with on-farm trial work and demonstration sites, publicity and information development for ongoing farmer and industry training.



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Where can I find further information on resistance management?

Crop Life Australia

Crop Life Australia, the peak body of the plant science industry in Australia, should be your first point of call for information on pesticide resistance management. Their website is www.croplifeaustralia.org.au, which is updated regularly so you can be sure the information is correct.

If you are not able to access this information via the internet, ask your local agronomist or state vegetable association for help. They can also assist you in identifying which information applies to your crops and how to best manage pesticide resistance in your business.

To receive notifications of updated strategies by email, you can send a request using an electronic feedback form on the Crop Life Australia website.

Crop Life Australia's Resistance Management Strategies (which are available on their website) provide a guide for the rotation of crop protection products via different product groups. Information is provided on:

- Fungicide Resistance Management Strategies (including a Fungicide Activity Group Table) available at http://www.croplifeaustralia.org.au/default.asp?V_DOC_ID=1953
- Insecticide Resistance Management Strategies (including details on a range of vegetable insect pests and an Insecticide Mode of Action Table) available at http://www.croplifeaustralia.org.au/default.asp?V_DOC_ID=1955
- Herbicide Resistance Management Strategies (including details on resistant weeds, Herbicide Mode of Action table and an integrated weed management manual) available at http://www.croplifeaustralia.org.au/default.asp?V_DOC_ID=1954

Product Labels

References for resistance management are present on herbicide, insecticide and fungicide labels. These vary from quite detailed information on some fungicide labels through to just a reference to the Crop Life Australia website. Make sure you understand the label conditions prior to using a product.



Important Information

All crop protection products must be handled and applied strictly as specified on the product label or Australian Pesticides and Veterinary Medicines Authority (APVMA) permits. The Resistance Management Strategies do not replace product labels. They are a guide only and do not endorse particular products, groups of products or production methods in terms of their performance. It is important to check with the Australian regulator's (APVMA) product database for up to date information on products and active constituents. The database can be accessed at www.apvma.gov.au.





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Where can I find further information on registered pesticides?

APVMA Gazette

The Australian Pesticides and Veterinary Medicines Authority (APVMA) Gazette is published fortnightly and contains:

- Details of the registration of agricultural and veterinary chemical products and other approvals granted by the APVMA
- Notices as required by the Agricultural and Veterinary Chemicals Code (the Agvet Code) and related legislation
- A range of regulatory material issued by the APVMA

For example, a recent issue of the APVMA Gazette contains a list of non-renewed registrations (for 2010-2011) and amendments to maximum residue limits (MRLs) of agricultural and veterinary chemicals, particularly for produce entering the food chain.

The APVMA Gazette, and information about subscribing to the gazette alert service, is available on the APVMA website at www.apvma.gov.au.

Infopest

Infopest is a comprehensive guide on registered agricultural and veterinary chemicals and their permitted uses plus Material Safety Data Sheets (MSDS). It is an easy to use national database for farmers, commercial sprayers, consultants, pesticide companies and educators. You can search Infopest for pesticide products registered to control weeds, pests or diseases in crops and animals. Infopest also includes information on pesticide resistance management information.

The Infopest range consists of three products:

- Infopest MSDS
- Infopest AgVet DVD
- The comprehensive Infopest DVD, which combines Infopest AgVet and MSDS

Infopest is updated in March, July and November of each year ensuring the most accurate and up-to-date information. The range can be ordered as a single version or in an annual subscription that offers updated information three times a year.

More information and details on how to order can be found at www.dpi.qld.gov.au/4790_4885.htm.

Minor use permits

Some products are not registered for use in particular vegetable crops i.e. the crop is not listed on the product label. The reason for this is that the APVMA registration process requires extensive data collection on product efficacy, crop safety (phototoxicity) and required withholding periods (freedom of residues). This is very expensive for producers of crop protection products, so a minimum production area is required to make the process viable (therefore crops grown on a minor scale nationally may not be included on the product label).

If a product is not registered for a crop, it is possible for the industry to obtain a minor use permit. Horticulture Australia Limited has supported many of these permit applications. For minor use permits it is not required to undertake efficacy and crop safety trials; only withholding periods have to be determined in field trials in major production areas.

More information on the minor use permit process can be found on the APVMA website at www.apvma.gov.au/permits/agricultural/minor_use.php.

As permits are expiring and being renewed all the time the only way to access current information is via the APVMA web site at www.apvma.gov.au/permits/permits.shtml.

Generally the permits specify the maximum number of applications per crop or season to manage resistance development.



"The Vegetable Industry Development Program is funded by HAL using the vegetable levy and matched funds from the Australian Government".



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How to manage pesticide resistance of diamondback moth - A story from the Lockyer Valley

Based on a publication by S. Heisswolf Queensland Horticulture Institute, Department of Primary Industries Queensland and L. Bilston R&D Extension Service

Traditionally Brassica vegetable crops were grown year round in the Lockyer Valley and farmers relied heavily on scheduled sprays of broad-spectrum insecticides to manage a range of insect pests. This practice led Brassica vegetable production in southern Queensland to a crisis point in the mid 1980s. Insecticide resistance in diamondback moth (DBM, *Plutella xylostella* L.) caused frequent spray failures and crop losses. To overcome the resistance problem farmers and industry worked closely with research and extension specialists, to develop an Integrated Pest Management (IPM) system to control the local Brassica pest complex. The implementation of the IPM program was divided into three different phases that were implemented over a number of years:

YEAR 1-2	Implementation of an insecticide resistance management strategy with involvement of crop protection advisers
YEAR 2-5	Reducing reliance on broad-spectrum insecticides by introducing: <ul style="list-style-type: none"> • <i>Bacillus thuringiensis</i> or other predators into the cropping system, coupled with • A targeted production break, crop scouting and improved spray application
YEAR 5 AND ONGOING	Improving and building on the existing IPM system through: <ul style="list-style-type: none"> • Research into natural enemies • Pest monitoring protocols • Insecticide spray coverage • Capacity building (such as developing decision-making tools and industry training)

The Lockyer IPM system includes crop scouting, a break in production over summer, use of narrow-spectrum insecticides within a resistance management strategy, protection of natural enemies, release of predators and well-targeted spray application practices.

AN IPM SYSTEM FOR DBM MUST BE AIMED AT MANAGING THE PEST COMPLEX, NOT ONLY DBM, AT THE CROPPING SYSTEMS LEVEL

DBM was the target pest to manage, but as farmers reduced broad-spectrum insecticide use within an IPM framework, other pests became more problematic. For example a number of lepidopterous pests can cause significant crop damage at certain times of the year. Cabbage white butterfly (*Pieris rapae* L.) can be a sporadic problem in unsprayed crops. Thrips species can cause some concern where broad-spectrum insecticides have been significantly reduced.

In the Lockyer Valley, a key component of the successful R&D and implementation strategy was ongoing farmer and industry participation in the development of the IPM system. A Brassica Improvement Group (B.I.G.) was formed in 1997 and this farmer-driven learning group has remained an important vehicle for ongoing IPM development and extension.

Further Information

For further information on managing pesticide resistance please contact your state vegetable association, local advisor or contact Kristen Stirling from the InnoVeg Program on 03 9882 2670. You can also go to the R+D Insights Database (available in the log-in section of the AUSVEG website) to search for resources on managing pesticide resistance.



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