POTATO PRODUCTION STEWARDSHIP PROGRAMME

A COLLABORATIVE INITIATIVE OF POTATOES SOUTH AFRICA, CROPLIFE SOUTH AFRICA AND THE INSECTICIDE RESISTANCE ACTION COMMITTEE

potatoes aartappels SA

IRAC Insecticide Resistance Action Committee South Africa

CropLife SOUTH AFRICA SUID-AFRIKA

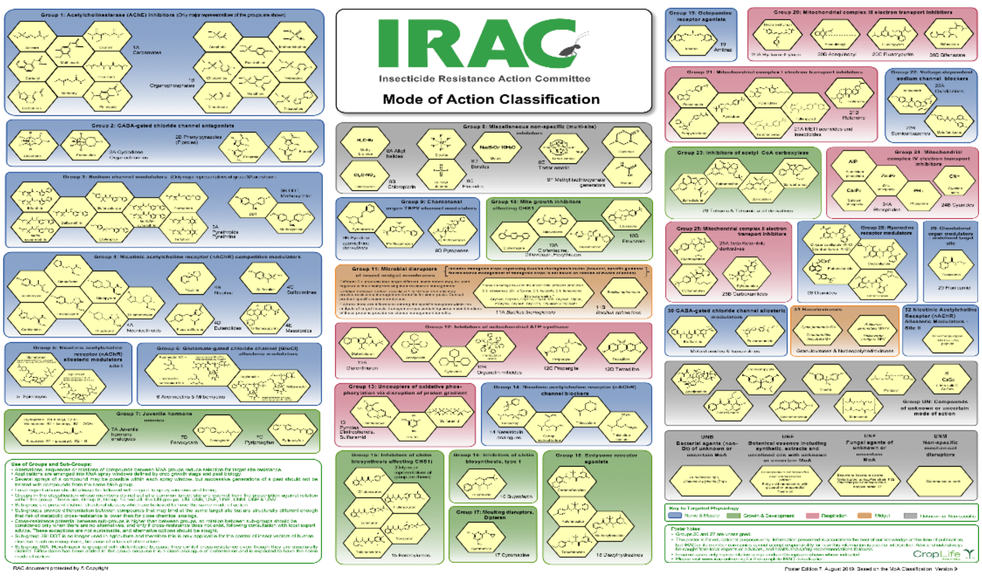
MONOGRAPH 4

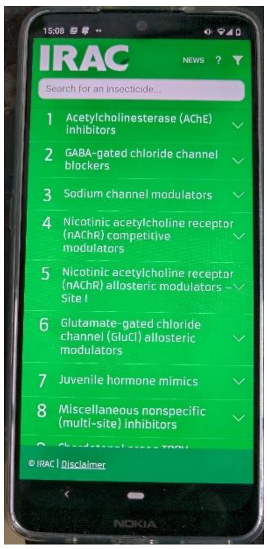
RESISTANCE MANAGEMENT IN THE CONTROL OF POTATO TUBER MOTHS IN POTATO PRODUCTION

Principal author: Roleen la Grange
Contributors: Desireé van Heerden, Dr Fienie Niederwieser, Dr Gerhard H Verdoorn
Version 1: March 2021

Resistance development

Resistance is the phenomenon where populations of insects evolve to become less responsive to insecticides (also called sensitivity shift) and populations can no longer be controlled by the dosage of insecticide which is normally used to provide effective control. A sensitivity shift that leads to resistance develops through mutations in the genetic coding of the insect. Mutations usually occur randomly with most mutations having no impact on the insect's physiology or biochemistry. However, on occasion, a mutation confers resistance of an insect to an insecticide, resulting in a competitive advantage for the insect and its offspring if the same insecticide is used repeatedly. If insecticides with different modes of action are not rotated or used interchangeably, insects that carry the resistance mutation will survive and become more representative in the population, increase the pace of sensitivity shifts and ultimately result in the whole population developing resistance within a few generations. To prevent insects with resistance mutations from becoming dominant in the population, insecticides with different modes of action should be altered in sequence or rotation to ensure that consecutive pest generations are not exposed to insecticides with the same mode of action. This practice will decrease selection pressure on these insecticides and slow the pace of sensitivity shifts significantly. However, cross-resistance may also occur when resistance to one insecticide confers resistance to another insecticide, even where the insect has not been exposed to the latter product.





Categorisation of insecticides according to mode of action

The Insecticide Resistance Action Committee (IRAC) categorises insecticides according to their mode of action into groups. These groups are easy to find on the IRAC website www.irac.com or the IRAC app for smart devices (see above). This is a very valuable tool for farmers and crop advisors to understand the different groups and their respective modes of action. A high-resolution version of the IRAC Mode of Action poster as displayed above is also available on the IRAC website.

Pest management practices required to delay the pace of sensitivity shifts and resistance development

- Identify and know the mode of action of the insecticide that is used and alternate with insecticides of a different mode of action. In South Africa, the mode of action of the insecticide is displayed on the front panel of the label:

GROUP	1A	INSECTICIDE

- In the example above, the compound falls within mode of action Group 1 (acetylcholinesterase inhibitors), and in sub-group A (carbamates). Sub-groups represent distinct classes of insecticides that have the same mode of action but are different in structure or mode of interaction with the target protein; this sub-categorisation differentiates between closely related insecticides and reduces selection for either metabolic or target site cross resistance. The cross-resistance potential between sub-groups is much higher than between groups, thus rotation between sub-groups should be avoided.

- Apply insecticides during the correct application "windows" to avoid consecutive pest generations being exposed to the same mode of action. An application "window" is a period of residual activity provided by a single application, or several applications of the same mode of action applied in sequence, generally coinciding with the timeframe of one pest generation (approximately 30 days, depending on local conditions).

- Multiple successive applications of the same mode of action are acceptable practice if used to treat a single insect generation.

- Following a treatment "window", rotate to a different "window" of applications with a different mode of action.

- Never apply insecticides at reduced or higher dosage rates, or reduced water volumes. Apply insecticides only at the label instructed timings and number of applications.

- When making use of insecticide mixtures according to the label instructions, and always apply active ingredients at their individually registered dosage rates.

Integrated pest management

To reduce the number of insecticidal treatments required and optimize application timing, pest populations should be monitored throughout the season by means of regular scouting which includes using pheromone traps. If weather conditions are conducive of high pest populations, the shortest spray interval and the highest recommended rates on the label should be used. Systemic and translaminar pesticides (such as cyantraniliprole or acetamiprid) should only be used at the beginning of the season when plants are actively growing to allow the chemicals to sufficiently translocate within the potato plants. When developing a spray programme for the control of potato tuber moth specifically, ensure that chemicals with the same modes of action are not repeated in the programme for the control of a different pest on potato crop, especially if the presence of these pest species overlap (e.g. potato leaf miner). Where two pests are present simultaneously, the higher recommended rate for the more difficult to control pest should be used. Similarly, if other crops in the vicinity are also hosts of the potato tuber moth (e.g. tomatoes), ensure that the spray programmes are aligned in terms of the modes of action applied against a specific generation of the pest. In South Africa, approximately 26 different active ingredients representing 12 different modes of actions are registered for the control of the potato tuber moth on potatoes, providing adequate variety for insecticidal rotation during and between seasons.

When making use of agrochemicals, good agricultural practices should always be followed. This includes using spray equipment that is properly calibrated and in good working order, only using spray equipment and application methods as stipulated on the product label, ensuring good penetration into the crop canopy and sufficient wetting of the leaf surface by using a registered surfactant for optimal coverage (if recommended as such on the label) and not spraying during unfavourable conditions (e.g. during the hottest time of the day or in windy conditions).

Minimizing selection pressures and delaying the onset of resistance for insecticides can also be achieved by making use of integrated pest management (IPM), which considers all available techniques to reduce pest populations. These methods include crop rotation, cultivar selection, planting of genetically modified crops (which are not currently available in potatoes), monitoring pest populations, biological control, releasing sterile insects and mating disruption. When chemicals are used, chemicals should always be used selectively and as part of an integrated resistance management (IRM) programme.