



Understanding chemical 'modes of action'

Viti-note Summary:

- Chemical groups:
Translaminar, systemic and contact
- Fungicides
- Insecticides and miticides
- Herbicides

Other topics in this Viti-Notes series include:

- Targeting sprays for vineyard pests and diseases
- Maintaining product performance in spray mixes
- Selecting and using spray adjuvants
- *Understanding chemical 'modes of action'*
- Managing chemical resistance in the vineyard
- Equipment adjustment and evaluation to maximise spray coverage
- A single rate per hectare – why it shouldn't be used
- Determining chemical rates for dilute and concentrate spraying
- Determining dilute water volumes for spraying
- Calculating chemical rates for vines

Groups or families of related chemical compounds have been categorised based on a similar chemical structure and 'mode of action'. This is the way in which the active ingredients work to inhibit or eliminate the target pest organism.

The active ingredients in a product may act in only one way on a target organism (single-site activity) or have a range of impacts (multi-site activity). Chemical groups with multi-site activity have a number of effects which reduce the risk of an organism developing resistance to them. Those with single-site activity impact on a specific protein or enzyme produced by the organism, or one structure or metabolic process and are thus at a greater risk of developing resistance in a population as individuals which are unaffected survive and pass on their resistance to their offspring.

Informed decision-making about the best products for a particular situation means understanding the behaviour and mode of action of the products available, as well as the life cycle of the target organism, the characteristics of the application target at each vine growth stage, and the influence of weather and other environmental conditions. Understanding the mode of action is also important in managing chemical resistance in pest populations.

Chemical groups: Translaminar, systemic and contact

The terms translaminar, systemic and contact relate to the way in which the active ingredient in a chemical is presented to, or is transported into or within the vine. Different chemical groups behave in different ways:

- Translaminar control agents penetrate into the plant tissue and are moved within a plant organ such as a leaf,

but do not travel to other parts of the plant. For example, the chemical may move from the upper to lower surface of a leaf.

- Systemic control agents can be effective at sites other than where they are sprayed. They may enter the plant via the roots or shoots, and move through the vessels to operate at distant sites which were not directly sprayed (translocated). Very few agrochemicals registered for use in viticulture are truly systemic. This means that effective spray coverage is a key component of successful chemical use.
- Contact (surface-active) control agents are not absorbed by plant tissue. This type is very common and works by direct contact with the target organism. It is usually sprayed directly onto foliage or bunches where the insect pest or fungus is living or feeding.

Fungicides

A fungicide generally inhibits spore production, germination or growth of selected fungal organisms. The active ingredients in these compounds make direct contact with the fungus (either within the vine's cells or on the plant surface) or vapours emitted by the chemical are absorbed by the fungus. Fungicides may be applied preventatively to control a fungus (pre-infection), or be applied post-infection with the aim of eradicating the growing organism.

Insecticides and miticides

These are biological or chemical compounds designed to kill, injure, reduce the fertility of, or modify the behaviour of insects and mites. For example, they can cause the target organism to experience nervous system malfunctions and paralysis, weaken the cuticle so that the insect cannot move properly, or prevent normal development from juvenile growth stages.

Insecticides and miticides make contact with the inside or outside of the target pest, by being eaten, absorbed through the insect cuticle, or by the vapours produced by the chemical being inhaled. Some insects are able to accumulate certain chemicals in fatty tissue or bind it to protein molecules which has the effect of disabling the active ingredient. Other insects can actively detoxify certain chemicals and many excrete them before they can prove harmful.

Herbicides

Depending on their mode of action, herbicides either prevent germination of weed seeds in the soil, or kill newly germinated seedlings or older plants. They generally enter the plant through the foliage or roots. Some are absorbed into the wax layer of leaves, some penetrate the cuticle, and some herbicides enter the plant tissue via the stomata (the breathing pores found on green plant tissue, principally the leaves).

A herbicide may be designed to selectively control certain plant species only or be effective on all plants. Unlike fungicides, insecticides and miticides which are designed to make contact with or move about within the vine without damaging the vine itself, post emergent herbicides are designed to contact or move about in plants expressly to kill or impair plant tissue. Herbicides applied close to vines need to be administered carefully as, depending on the selectivity and mode of action, some products can damage or even kill vines via spray drift or root uptake.

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Further information

Innovator network factsheets

Spray application by Alison MacGregor

http://www.gwrdc.com.au/webdata/resources/files/GWR_070_Spray_Application_Fact_Sheet_FINAL_WEB.pdf

Training

For regional specific training in pest and disease control, the AWRI is running Research to Practice: Integrated Pest Management for changing viticultural environments.

Contact

Marcel Essling: rtp@awri.com.au for more information.

Agrochemical information

Agrochemicals registered for use in Australian Viticulture - updated annually.

Visit www.awri.com.au for the latest version.

Useful references

Nicholas, P., Magarey, P.A. and Wachtel, M. (Eds.) 1994 Diseases and pests, Grape Production Series 1, Hyde Park Press, Adelaide (a glove box edition of this book is also available).

For images of grapevine symptoms visit www.winetitles.com/diagnosis/index.asp.

Product or service information is provided to inform the viticulture sector about available resources and should not be interpreted as an endorsement.



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