Use of elicitors in viticulture

The AWRI helpdesk is often asked about new products being marketed to grapegrowers. One such type of product is elicitors, which are promoted as having a range of benefits. In this column, Marcel Essling provides answers to some common questions about elicitors.

Elicitors are often marketed as being able to reduce disease risk while improving quality and yield in the vineyard. How could these products have such a large impact?

Plants have mechanisms to defend themselves against insect or pathogen attack and research has shown that when exposed to certain compounds (elicitors), plants can be induced to activate these defence responses. An elicitor might be applied to increase the level of a plant's resistance against a future pathogen attack. Some elicitors when applied to grapes have been found to trigger the production of polyphenolic compounds such as anthocyanins and tannins that can be desirable for red wine quality. Plants also have mechanisms to protect themselves against stresses such as drought or high temperatures and elicitors have been shown to trigger these stress defence responses by altering the expression of genes related to water stress. If a product contains compounds that have been shown to trigger a defence or stress mechanism in a plant, or upregulate phenolic production, it is conceivable that it may also elicit a desirable response in the vineyard that manifests itself as improved quality or yield.

What pathogen defence mechanisms are triggered by elicitors?

The response observed when an elicitor is applied depends on the elicitor used as well as the rate and timing of application. The types of responses observed in scientific studies include:

- the movement of ions such as calcium into the cell
- the strengthening of cell walls
- the production of antimicrobial compounds such as reactive oxygen species (ROS) or free radicals
- the expression of defence genes leading to the production of pathogenesis related (PR) proteins to resist pathogens
- increased production of phenolic compounds that also have antimicrobial properties.

For some elicitors, the substances that are effective in triggering a response are not known and there is limited understanding of the mode of action. For instance, a defence response can be obtained from crude extracts of plant material or where an ingredient has been leached into a solution (tea). In these cases, it is difficult to ensure that different 'batches' will have the required concentration of compounds responsible for the elicitor effect as they may vary greatly.

Where do elicitors come from?

Many compounds have been shown to trigger a defence response in plant cells. Their origins include plants, animals, microorganisms, inorganic materials and synthetic materials. Some common examples and the associated plant response are listed below.

- **Chitosan** is a polysaccharide obtained from the outer shell of crustaceans. As well as having a direct antimicrobial action, it activates enzymes that increases polyphenol content.
- **Harpin** is a protein of bacterial origin that activates reactive oxygen species and systemic acquired resistance pathways that increase production of phenolics and other compounds.
- **Methyl jasmonate** is a plant volatile that activates enzymes responsible for the biosynthesis of polyphenol compounds as a defence response from insect feeding.
- **Phosphorous acid** is a synthetic material registered for control against downy mildew (Plasmopara viticola). In addition to a direct effect against the pathogen, it stimulates plant defence in the form of expression of anthocyanin biosynthesis pathway and production of certain PR proteins.

If these products provide disease control, why aren't they listed in the 'Dog book'?

The 'Dog book' only includes agrochemicals that are registered with the Australian Pesticides and Veterinary Medicines Authority (APVMA). An elicitor may not be considered as an agrochemical product, depending on the claims being made about its purpose. When a claim about pest or disease control is made on the label or inferred from the product name or in advertising or promotional material, registration with the APVMA is required. If the product is promoted in general terms such as 'provides plant health benefits', or 'gives plants better resistance to sucking insects and fungal attack', it may not require APVMA registration.

Does the AWRI recommend the use of elicitors?

Before making any recommendation the AWRI would ask to see evidence specific to the product that supports the claims being made. An Italian study (Dagostin *et al.* 2011) of more than 100 elicitor products for control of grapevine downy mildew found mixed results for products that were listed as containing the same active ingredient. The AWRI would also consider whether the compounds applied could cause any kind of taint in wine or any chemical residue above the MRL in target markets. Fermentation and wine sensory studies are a requirement for the registration of agrochemicals, to give assurance that the compounds are not likely to cause a wine taint or have a negative impact on fermentation.

What is the future for the use of elicitors in viticulture?

Research suggests that plant elicitors have the potential to play a greater role in viticulture. Acceptance of the use of elicitors requires robust data to show that the products deliver on the label claims in a reproduceable and consistent manner, and that any toxicological or ecotoxicological risk associated with their use is understood and mitigated. Trials should be conducted on the impact of elicitors on fermentation or wine quality, and any residue issues need to be assessed and mitigated through appropriate withholding periods. Elicitor products should come with detailed instructions about the manner and timing of their application. Information about their applicability to different grape cultivars or climatic conditions would increase customer confidence.

For further information on elicitors or any other technical grapegrowing or winemaking questions, contact the AWRI helpdesk on helpdesk@awri.com.au or 08 8313 6600.

References

Dagostin, S., Schärer, H.J., Pertot, I., Tamm, L. 2011. Are there alternatives to copper for controlling grapevine downy mildew in organic viticulture? *Crop Prot.* 30(7): 776-788.