

# KVH Best Practice Advice

## Managing resistance to Psa control products



### Background

Since July 2015, resistance to streptomycin and copper has been found on a number of orchards. These finds were detected in an ongoing monitoring programme. Product resistance can occur naturally. Therefore, these finds were not completely unexpected.

As few products are currently known to have efficacy against Psa-V it is essential all growers manage resistance, as the loss of an effective product due to resistance will make Psa-V more difficult to control.

### Best Practice Strategies

It is essential all kiwifruit growers incorporate best-practice strategies to reduce the risk of resistance Psa control products developing; and to minimise the build-up and spread of resistant populations when present.

- 1. Monitor orchards regularly for Psa-V symptoms.** Regular monitoring will identify Psa symptoms early and enable swift action.
- 2. Remove and dispose of diseased material from the orchard.** Removal and disposal of infected material reduces the level of bacteria and limits potential for spread.
- 3. Maintain a year-round comprehensive Psa-V protective spray programme. Use a combination of and /or alternate effective products from the [KVH Recommended Product List](#).** Products with different modes of action should be utilised during the growing season – either alone or in combination, e.g. Kasumin™ then copper. The repeated use of the same crop protection compound or class of compound can result in resistance developing. As the majority of the population becomes resistant, control failure may occur.
- 4. Always use label rates.** Applications of crop protection products at less than optimal rates may not kill 100% of the bacterial population, and can allow for the development of resistance.
- 5. Ensure good spray coverage is achieved** Maintain a flat, open canopy structure to support even distribution of the chemical throughout the canopy. Consider the use of super spreaders to improve spray coverage. Calibrate sprayers correctly and alternate sprayer direction.
- 6. Contact KVH if resistance is suspected.** Growers who believe spraying is not providing Psa-V control and suspect resistance should contact KVH on 0800 665 825. It is important suspected resistance is reported early. KVH may arrange testing to be carried out. If resistance is confirmed, affected growers will be notified and advised of next steps.
- 7. Ensure strict orchard hygiene measures are in place.** Good hygiene measures are essential to reduce the risk of transferring resistant or tolerant Psa-V within and between orchards. This includes sanitising tools between vines, washing down orchard equipment between orchards and ensuring all visitors are aware of orchard hygiene procedures.

### About Copper

The most widely-used Psa-protectant sprays are copper-based. Copper products are proven to be active on plant leaf and cane surfaces and knock back high Psa-V populations associated with the establishment of infection. Copper is persistent as it shows good levels of resistance to being washed off by rain.

Copper kills bacteria on contact. The copper ions travel through the cell walls of the bacteria and disrupts the cellular enzyme activity. (Note: Copper is non-systemic) Copper is a protectant and needs to be applied evenly to the plant surface before the disease develops. Water on plant surfaces (from rain, dew or irrigation) reacts

with leaf excretions to form weak acids (pH<6.0). This low pH increases the solubility of copper products, slowly dissolving them to release a small and constant supply of copper ions.

### **How does resistance to copper develop?**

Copper is an essential trace element that is required by bacteria, hence, will contain a number of functioning copper genes that will be involved in protecting the bacteria from excess, or toxic, levels of copper. Psa has previously been found to contain the genes *CopA* and *CopB*, which by themselves will not lead to copper tolerance in Psa.

Copper resistance arises when Psa *can survive a low level (or sub lethal concentration)* of exposure to copper. If that Psa population is subsequently killed when a higher rate of copper is used, for example at the full label rate, it is said to be showing a *level of resistance* to copper. Development of copper resistance tends to be incremental, with the bacteria surviving gradual increases in copper levels as they gradually become able to process higher levels of copper.

Resistance to copper can occur by one of two mechanisms:

1. As a result of other bacteria exchanging their genetic material via plasmids, resulting in bacteria acquiring additional copper genes.
2. Or through a novel Integrative and Conjugative Element (ICE) which may contain the complete copper resistance locus.

### **When copper resistant Psa is present:**

- **Only use label rates.**
- **Apply five applications of copper** at full label rates over winter (post-harvest to pre bud-break). Include a super spreader.
- **Apply Kasumin™** in Spring (pre-flowering)
- **Dispose of infected material** by burning or burial onsite. Mulching is the least preferred method of disposal.
- **Restrict plant movement** (budwood, pollen and rootstock) from the orchard to prevent spread.
- **Strengthen orchard hygiene** measures.

Refer to [KVH Protocol: Resistance to Psa control products](#) for hygiene and movement controls required.

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