

KPCS Best Practice Advice

CROP PROTECTION ADVICE FOR NURSERY PRODUCTION

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1. Introduction – crop protection as a tool in an overarching system

Producers of kiwifruit plants have a number of tools in their arsenal to minimise the risk of introducing or spreading pests and diseases. Their greatest tool is control of the growing environment. Through effective environmental control, good planning and sound biosecurity practices, a nursery can produce good-quality pest and disease-free plants.

In the same way that the old nursery adage “the way to have no weeds is to have no weeds” is applied to weed control, “the way to have no disease is to have no disease” can be applied to kiwifruit plant production. For this to work, it is paramount to start with clean disease-free material, prevent any chance of contamination and to provide an environment that favours the plant and not the disease.

The application of crop protection products is a valuable tool to provide an additional level of confidence to a system. It should not be solely relied on to compensate for short-comings in other areas.

All nurseries should have a crop protection plan that covers key areas such as incoming and outgoing plant material and have plans and resources in place to implement a comprehensive spray programme for events or activities deemed to present an elevated risk of infection (i.e. if the threat of infection by a target organism was to suddenly increase).

This document provides guidance on some key areas for nurseries to consider with regard to crop protection programmes.

Starting Material

Any material brought into a nursery must be free of target pests and diseases. The nursery must take necessary measures to ensure starting material is clean. This includes, but is not limited to, surface sterilising seed, selecting disease-free scion or cutting wood and as a further precaution, spraying or treating any material that comes into the nursery environment to provide a higher level of confidence.

Propagating Environment

Raising kiwifruit seedlings, storing cuttings and grafting kiwifruit plants require a high-humidity moist environment, which is also favourable for certain pathogens. Any wounds on plants can be a potential source of disease entry. The use of protectant chemicals during this phase of production is very important, particularly to control fungal and bacterial diseases. Wounds caused by grafting should be sealed with a protectant wax. Plant hygiene and the regular removal of dead and damaged leaves, reduces possible sources of infection.

Growing Environment

The ideal growing environment would include protection from outside contamination, good air flow and plants that are not stressed through excessive temperatures or low moisture levels. Watering that does not wet the foliage is ideal (capillary watering, or drippers) but not always practical. If overhead sprinklers are used, care must be taken to ensure watering is done early in the day and plants are not wet during cold nights and/or during slow-drying conditions. Plant spacing is important to reduce overcrowding, plant entanglement and to reduce high humidity. Humidity and slow-drying conditions can cause phytotoxicity damage. Refer to the section on phytotoxicity later in this module for more information.

Pre-dispatch treatment

Application of a crop protection product prior to dispatch provides customers with an added level of confidence that plants are free of target pests and diseases. This treatment must be applied within seven days of dispatch and the date and type of treatment given should be provided on the dispatch form for the grower’s reference.

2. Considerations for Psa-V Protection

Currently Psa-V is the target organism on the KPCS Standard.

Psa-V is a bacterial disease which spreads via direct contact with infected soil or plant material, via wind and water. It can enter plants through natural openings such as stomata, lenticels, leaf scars, and flowers as well as through wounds caused by wind, hail, frost and man-made wounds such as pruning cuts or abrasions occurring during plant handling.

All plants need to be protected from Psa-V as there is no known way of eliminating Psa-V from plants once infection becomes systemic. Juvenile plants such as young seedlings are particularly vulnerable.

Complete spray coverage of all plant parts is recommended, with spray frequency sufficient to protect plants during high-risk weather periods or through periods when high-risk activities (e.g. wounding, pruning and grafting) are undertaken. Nurseries should assess their relative risk of exposure to Psa when planning spray programmes, e.g. field grown plants are more likely to be exposed than those grown in fully covered environments.

Autumn through to spring is a high-risk period as Psa-V thrives in cool, wet environments. Risk of disease spread is reduced in hot dry conditions.

The use of a combination of products with different modes of action is recommended where practicable.

Timing of application

Any plant material brought into a nursery should be treated on arrival to ensure a clean start. It is also a requirement that plants are given a further spray treatment prior to dispatch. Other crop protection applications should be used as a precautionary tool surrounding high-risk events. For example, when plants are trimmed, staked or have fresh wounds. If part of the crop becomes infected, infected material should be destroyed and the remaining crop treated with a protectant spray.

Psa-V protection sprays must be applied to meet specific requirements of the KPCS. A sample spray diary which could be used to record all sprays applied to plants is included in Appendix 1.

An annual spray plan should be timed to ensure protection is in place when high-risk activities are occurring (i.e. pruning, vine training) and outside plantings are also protected prior to high-risk weather as identified by the KVH Psa-V Risk Model.

For an example of a spray plan which could be used, refer to [KPCS template – Nursery Spray Plan](#).

Product choice

Over 200 products have been assessed for efficacy against Psa-V as part of the KVH/Zespri R&D programme. Glasshouse and potted plant field trials on kiwifruit plants were undertaken and recommendations on product rates for orchard applications were made in conjunction with advice from supplying merchants. These should only be seen as a guide for nurseries. To date, only a handful of products have proven to be effective in reducing the impacts of Psa-V. The four product types with proven efficacy are:

- Coppers
- Elicitors
- Biologicals
- Bio-Bactericides
- CPPU

Coppers

- Currently, the most effective Psa-protectant sprays are copper based. Coppers are proactive on plant surfaces and reduce Psa-V populations associated with the establishment of infection. It is

probable that Cu²⁺ ions redistribute during rainfall /watering and accumulate where bacteria also redistributed. Their optimal use remains unknown.

- All coppers are relatively persistent. The length of efficacy is thought to be 3 – 4 weeks when applied on non-expanding surfaces at label rates.
- Applications below label rates should be avoided as they are likely to result in sub-optimal control and increase the risk of resistance occurring.
- Coppers can be applied in a programme containing other proven Psa-V products to improve control.
- Applications should be timed to ensure protection is in place when high-risk activities are occurring (i.e. pruning, vine training) and prior to high-risk weather as identified by the KVH Psa-V Risk Model.
- For field grown plants and/or plants exposed to the environment (e.g. adjacent ventilation vents) repeated applications of copper may be needed through both the budbreak and leaf fall periods to ensure young expanding tissues and leaf scars are protected.
- For fully covered plants, applications should be timed to match high risk activities.
- Care should be taken with nursery plants to ensure phytotoxicity is not developing. If phytotoxicity is detected, it may be necessary to reduce application frequency (*refer to Phytotoxicity section below for further information*).
- When multiple rate options are provided, use lower rates through periods where phytotoxicity risk is higher, (e.g. spring growth). Higher rates are recommended if disease pressure is high.
- Nordox™ 75WG and HORTCARE Copper Hydroxide 300 , Agcopp75, ChampION++ are currently BioGro certified.

Product	Label Claim	% Cu	Rate/100L			
			Use Period			
			Spring	Summer	Autumn	Winter (dormancy)
Nordox™ 75WG	Full	75%	37.5g	37.5g	37.5g	55–70g
AgCopp 75	Full	75%	37.5g	37.5g	37.5g	55–70g
Kocide® Opti™	Full	30%	70– 90g	70–90g	70–90g	70–90g
Coptyzin	Limited	7.6%* (by volume)	15-22.5mls/10L Min 10 days between applications	15-22.5mls/10L Min 10 days between applications	12.5mls/10L Min 10 days between applications	15-30mls/10L Min 10 days between applications
Champ™DP	Limited	37.5%	50–75g	50–75g	50–75g	107 – 140g
Tri-Base Blue®	Limited	19%	150ml	150ml	150ml	150ml
HORTCARE Copper Hydroxide 300	Limited	30%	50–90g	50–90g	50–90g	70–90g
ChampION++	Full	30%	70-90g	70-90g	70-90g	70-90g

* Coptyzin is an aqueous solution supplying 7.6% a.i. by volume. This equates to 95g cu/L

Elicitors - Actigard™

- Contains Acibenzolar-S-Methyl, which stimulates the plant’s natural defence system.
- Apply 5-7 days prior to an infection period.
- Apply only as a foliar – good coverage is essential.
- Do not exceed four applications per season.
- Do not apply as a soil directed spray to potted kiwifruit seedlings.

- More suitable for use on established nursery plants. Avoid use on very small, young or weak plants.
- Elicitors are only effective if leaves are actively photosynthesising.
- Refer product manufacturer.

		Rate/100L			
		Use Period			
Product	Label Claim	Spring	Summer	Autumn	Winter
Actigard™ (Foliar applied)	Full	20g	20g	20g	-

Biologicals - BOTRY-Zen®

- BOTRY-Zen® contains *Ulocladium oudemansii*, a naturally occurring saprophytic fungus.
- BOTRY-Zen® has shown activity against Psa-V leaf spot in potted plant trials.
- BOTRY-Zen® should be applied immediately once mixed.
- BOTRY-Zen® is compatible with Nordox and can be tank mixed. Add BOTRY-Zen® to the spray tank first, wait 5 minutes before adding Nordox, then spray immediately. Refer to manufacturer re compatibility with other copper products.
- BOTRY-Zen® is BioGro certified.

		Rate/100L			
		Use Period			
Product	Label Claim	Spring	Summer	Autumn	Winter
BOTRY-Zen	Full	800g	No label claim	800g	800g

Bactericides

- While bactericides KeyStrepto™ and Kasumin® are currently available to the kiwifruit industry for use against Psa-V, strict use conditions apply.
- Should only be considered in very high-risk situations where Psa is present.
- Extreme care must be taken to avoid off-target drift and/or contamination.
- Should be used in a programme with other recommended products with different modes of action.
- Before using a bactericide KVH written permission must be sought. Contact KVH on info@kvh.org.nz

Bio - Bactericides - Aureo Gold

- Contains the yeast like fungus *Aerobasidium pullalans* (YBCA5)
- Research indicates Aureo Gold can cause physical disruption of Psa on leaf surfaces, which limits the ability of Psa to colonise stomatal entry points. Aureo Gold also primes plant defence genes.
- Aureo Gold produces no anti-microbial compounds, so resistance development is unlikely.
- Apply Aureo Gold once sufficient foliage has developed. Re-apply at 7-14 days intervals for ongoing protection, using shorter intervals in faster growing conditions and under high disease pressure.
- Thorough coverage is essential for optimal disease control. Addition of an adjuvant – DuWett or Driftstop is highly recommended.
- Aureo Gold is best used in a programme with other Psa management products.
- When used in a program with copper, do not apply closer than 10 days after Kocide, or 14 days after Nordox.
- DO NOT tank mix with coppers.
- Maximum number of 10 applications/year.
- Aureo Gold has a full label claim and is Biogro certified

		Rate/100L			
		Use Period			
Product	Label Claim	Spring	Summer	Autumn	Winter
Aureo Gold	Limited	50g	50g	50g	-

CPPU - Ambitious 10SL™

- Contains forchlorfenuron (CPPU), a synthetic plant growth regulator.
- Use CPPU products prior to leaf-spot occurring. Requires 5-7 days to activate the plant resistance reaction.
- Ambitious is compatible with copper-based products and can be tank mixed with copper.
- Good coverage is essential.
- Is unlikely to have efficacy during dormancy.
- Use may be appropriate for outdoor plants at more risk to effects of environmental Psa.
- More suitable for use on established nursery plants. Avoid use on very small, young or weak plants.
- Refer to product manufacturer.

		Rate/100L			
		Use Period			
Product	Label Claim	Spring	Summer	Autumn	Winter
Ambitious 10SL	Limited	50ml	50ml	50ml	-

3. Product application considerations

Mixing

Spray mixtures should be determined by the number of plants to be sprayed and the equipment to be used. For sprayers with small reservoirs (i.e. a knapsack sprayer), it can be difficult to accurately measure the amount of chemical required. Therefore, the recommendation is to mix a larger volume of product and decant from this volume for spray application.

To avoid product settling prior to decanting and during spraying, ensure products remain sufficiently agitated. Poor mixing can lead to both under-dosing and over-dosing of sprayed plants. This increases risk of reduced disease control (under-dosing) and/or phytotoxicity effects (overdosing) and can also contribute to product resistance developing.

Be cautious when combining products within the same spray tank. Check product compatibility with product manufacturers.

Coverage

Thorough coverage of all vine parts, including the underside of leaves, leaf scars, canes and trunks is essential for Psa-V control.

The use of the super spreader Du-Wett® has shown to improve surface coverage of all vine parts. Two times concentrate spraying with the addition of super spreaders can provide the same level of coverage as dilute spraying. Refer to the manufacturer use rates for nursery production.

Improved spray coverage can be achieved by ensuring adjacent rows are sprayed in opposite directions and by alternating the direction of sprayer travel each spray round.

Phytotoxicity

Phytotoxicity is leaf damage usually caused by excessive application of a chemical onto a leaf (to the point of run off) or excessive adsorption of a chemical into a leaf. Young tissues and stressed plants are more vulnerable to damage, so care should be taken with chemical rates.

Symptoms of phytotoxicity can include the following:

- Leaf speckling
- Burn at leaf margins
- Large dead areas between the veins of leaves due to chemical run off (with or without leaf rolling)
- Premature leaf drop
- Bronzing of the upper leaf surface
- Brown staining of lower leaf veins
- A combination of the above

Many phytotoxicity symptoms are similar to those seen in Psa-V infection. Therefore, testing and/or assessment by an individual familiar with both Psa-V and phytotoxicity symptoms may be required. If in doubt, contact KVH or refer to the [KVH Information Sheet: Leaf Phytotoxicity](#)

Some key factors that play a role in phytotoxicity problems are listed below:

- pH - water pH below 6.0 may increase chances of phytotoxicity when using copper products.
- Use of products that are not designed as agrichemicals
- Excessive chemical rates
- Tank mixing multiple agrichemicals
- Poor tank agitation
- Slow drying conditions – high humidity, overcast
- High temperatures during application
- An excessive use of spreaders/super spreaders at high water rates
- An excessive build-up of chemicals on leaves

Products should be applied at recommended rates during good drying conditions to avoid damage.

Spray Drift

Spray drift can pose significant risk to people, the environment, other plants and animals in the vicinity of the nursery. Extreme care should be taken when applying agrichemicals to nursery production areas.

Nurseries in close proximity to kiwifruit orchards should take particular care, as a number of Psa-V sprays have limited use periods on producing kiwifruit vines. Spray drift can result in fruit residues. Other neighbouring crops may also be sensitive to products being applied.