



# **Psa-V Seasonal Management Guide**

***Helping Growers manage Psa-V  
all year round***

**August 2015-16**

**Version 1**

## BACKGROUND

This KVH Seasonal Management Guide is designed to support growers in the year-round management of PsA-V. Successful management involves an integrated approach which matches individual site risk and responds to seasonal risk factors.

This guide provides a basis for growers to build their individual PsA-V Orchard Management Plans for the coming season and is relevant to growers in all regions. To find out more about your region go to [www.kvh.org.nz/maps\\_regional](http://www.kvh.org.nz/maps_regional). Always refer to the latest version of the PsA-V Seasonal Management Guide on the KVH website or contact KVH.

A visual [PsA-V Seasonal Management Wall Chart](#) is also available to growers. This outlines:

- PsA-V risk associated with different times of the growing season.
- Guidance for planning monitoring.
- Recommendations for canopy management to minimise PsA-V risk.
- Recommended product list.
- Best practice spray advice.
- Ongoing biosecurity recommendations, including movement protocols

The Wall Chart can be placed in offices and smoko rooms as reference to support education of orchard staff.

### Keep up to date with latest PsA-V information

The industry has learnt a lot about the PsA-V since its discovery in 2010 and for many growers managing it has become 'business as usual'. PsA-V information is available on the KVH website, including research reports. The KVH Bulletin provides fortnightly information on PsA-V and wider biosecurity. [Click here](#) to subscribe to the KVH Bulletin.

### PsA-V Orchard Management Plans

Each orchard must have a PsA-V Orchard Management Plan in place. To assist growers with their Plans, KVH has developed templates for growers. More information, including the templates can be found on the KVH website at [www.kvh.org.nz/Orchard\\_Management\\_Plans](http://www.kvh.org.nz/Orchard_Management_Plans)

### Mandatory Monitoring

All kiwifruit growers are required to have a monitoring plan and should monitor their orchards for PsA-V symptoms regularly. Under the National PsA-V Pest Management Plan (NPMP) the annual mandatory monitoring requirements are as follows.

- **Exclusion regions—one round for all orchards**
  - mid-September to mid-October (reporting to KVH due 31 October)
- **Containment regions—one round for all orchards**
  - mid-September to mid-October (reporting to KVH due 31 October)
- **Recovery regions—one round for not-detected orchards only**
  - mid-September to mid-October (reporting to KVH due 31 October)

**Note**—online templates and other information to assist growers can be found at [www.kvh.org.nz/monitoring\\_plan](http://www.kvh.org.nz/monitoring_plan).

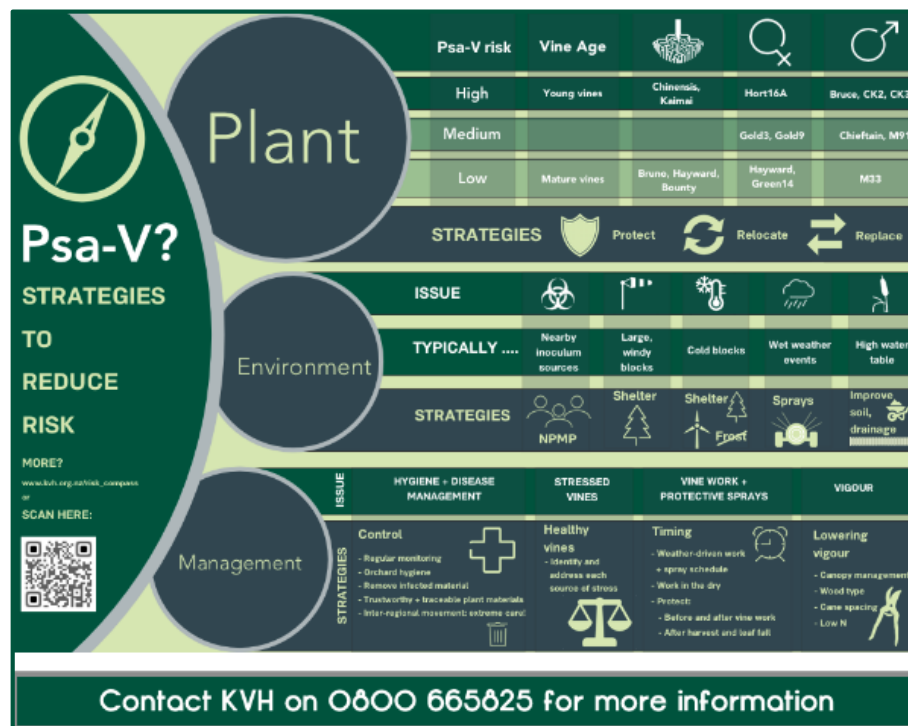
# Contents

BACKGROUND .....	2
PSA-V RISK COMPASS .....	4
MONITORING .....	5
MANAGING INFECTED MATERIAL .....	8
CANOPY MANAGEMENT .....	10
SHELTER MANAGEMENT .....	14
GIRDLING .....	14
GRAFTING .....	15
IRRIGATION.....	16
HAIL PROTECTION.....	16
FROST PROTECTION.....	17
FERTILISERS AND NUTRITION .....	17
PEST AND DISEASE CONTROL .....	18
MOWING, MULCHING AND SHELTER TRIMMING .....	18
SOURCING NEW PLANTS .....	19
SPRAYING.....	20
KVH Recommended Product List (budbreak to harvest).....	26
KVH Recommended Product List (harvest to budbreak).....	27
BIOSECURITY.....	32
POLLINATION .....	33
KVH BEST PRACTICE—ORCHARD HYGIENE (one pager) .....	35
CONVENTIONAL SANITISERS AND DISINFECTANTS .....	36
KVH BEST PRACTICE—ORCHARD MONITORING (one pager) .....	37
KVH BEST PRACTICE—MANAGING INFECTED MATERIAL (one pager) .....	38
KVH BEST PRACTICE—POLLINATION (one pager).....	39
KVH BEST PRACTICE—CANOPY MANAGEMENT (Budbreak to harvest).....	40
KVH BEST PRACTICE—GRAFTING (one pager).....	41
KVH PSA-V RISK MODEL.....	42

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# PSA-V RISK COMPASS



Identify your orchard's Psa-V risk profile to determine suitable strategies.

## Rationale

Individual orchards have different Psa-V risk profiles. Variety, region, orchard environment and management practices all contribute to the orchard risk profile. Psa-V severity will be worse in seasons/regions when winter is colder and early spring is wetter. This risk should be considered when formulating your seasonal *Psa-V Orchard Management Plan*. Strategies to reduce risk can be found in the Psa-V Risk Compass.

## Resources

- [Psa-V Risk Compass](#)
- [Psa-V Seasonal Management Wall Chart](#)

# MONITORING



## Identification, Recording and Reporting

Ensure all orchard staff can identify Psa-V symptoms and understand the orchard's tagging, recording and reporting process. Detection date, number and location of affected vines and severity of symptoms should be recorded. If symptoms are found for the first time inform your Packhouse Psa-V Manager or KVH (0800 665 825) immediately.

### Rationale

Orchard staff are best placed to find symptoms quickly. Identification of the symptoms allows accurate recording of severity and spread within the orchard, and prompt removal of infected material. Lab testing will confirm the presence of Psa-V in the sample. It's a requirement to report symptoms identified for the first time on previously undetected orchards within 48 hours.

## Planning

Develop a monitoring plan which considers your orchard's Psa-V risk profile and the time of year. Focus on high-risk orchard areas, e.g. high traffic areas, blocks exposed to prevailing winds, blocks which are poor-performing due to stress factors (water-logged, cold and frost-prone), heavily contoured blocks and areas where vines have previously expressed symptoms. Gold-fleshed varieties, males and young vines are more susceptible to Psa-V. Adjust monitoring frequency to match seasonal risk.

### Rationale

Regular monitoring allows the best chance of detecting Psa-V early. Early detection and intervention is the most effective method for controlling or minimising the impact of Psa-V.

## Spring Planning

Monitor weekly and after high-risk weather. Growers seeing symptoms for the first time should confirm with lab testing as some symptoms are not specific to Psa-V only.

### Rationale

In spring sap starts to flow in the vines and new growth increases xylem and phloem movement through the vines. Previously dormant infection may start expressing symptoms as exudate. As leaves and shoots develop, leaf-spotting is a key indicator of PsA-V presence. Shoot die-back, cane die-back and bud and flower infection may also occur.

### Summer Planning

**Continue to monitor high-risk areas weekly and reduce to fortnightly if weather remains warm and dry and minimal or no symptoms are found. Always monitor after high-risk weather.**

### Rationale

Warmer, drier conditions can slow the pace of disease spread. However, leaf spot, shoot die-back and cane die-back can continue to develop. As diseased material builds in the orchard inoculum pressure rises and can result in increased risk to all varieties and neighbouring orchards. Monitoring allows early identification and prompt removal of infected material.

### Autumn Planning

**Continue to monitor fortnightly and after high-risk weather. Pay particular attention to young and recently grafted vines.**

### Rationale

Cooler, wetter autumn conditions favour disease development and spread. Fruit stalks and leaf scars, immature late growth, and wounds due to frosts and storms, provide possible infection entry points to vines at this time of year. Note – autumn infection may not express visually until the following spring.

### Winter Planning

**Use winter pruning and other winter activities such as grafting, as an opportunity to continue monitoring throughout dormancy. Increase monitoring in late winter as sap starts to flow.**

### Rationale

The risk of PsA-V infection continues throughout winter. PsA-V may be spread during wet periods and during orchard activities such as winter pruning, lowering strung canopies and grafting. Cane dieback and exudate typically start to express in late winter. These symptoms may be due to winter infection or infection during the previous growing season.

### Mandatory Monitoring and Reporting

**Complete mandatory monitoring during the last two weeks of September and the first two weeks of October. Report monitoring results to KVH by 31 October.**

### Rationale

Mandatory monitoring is a requirement under the National PsA-V Pest Management Plan (NPMP). Information from this monitoring confirms if Exclusion regions are still clear of PsA-V symptoms, identifies the extent of the spread throughout Containment regions and tracks progression of PsA-V in Recovery regions. Information collected from mandatory monitoring gives the industry a more accurate picture on the extent and progression of infection and enables comparisons to be made between years to give a long-term perspective of disease control.

## Resources

- [KVH Psu-V Symptoms Guide](#)
- [KVH Psu Symptoms Guide for Zespri Varieties](#)
- [KVH Website—Monitoring](#)
- [KVH Website—Sampling and Testing](#)
- [KVH Website—Mandatory Monitoring](#) (includes reporting templates and forms)
- [KVH Website—National Psu-V Pest Management Plan](#) (refer to Rules 3 and 4)
- [Psu-V Risk Compass](#)
- Psu-V Yearly Monitoring Guide—Page 43 of this Guide below.

# MANAGING INFECTED MATERIAL



## Removal

**Take practicable steps to remove infected material found during monitoring or routine orchard activities. Continue to monitor.**

### Rationale

Infected material poses ongoing risk of further spread as bacterial populations can rise quickly if left unmanaged. This can result in disease spread within and between orchards. Ongoing monitoring helps growers understand the extent of infection.

Your removal strategy should consider the following:

#### a) New incursion

Aggressively remove infection where isolated cases are detected, i.e. new region or orchard incursions, particularly if infection is seen in susceptible varieties (Hort16A, CK2, CK3 and Bruce males).

##### Rationale

If infection has not yet become widespread, early cut-out has the potential to eliminate the disease. Disease moves more quickly in susceptible varieties.

#### b) Variety

For highly-susceptible varieties (e.g. Hort16A, CK2, CK3 and Bruce males) and rootstock (e.g. Chinensis and Kaimai) remove infection as soon as possible, preferably whole vines. Where possible consider notch-grafting across to more tolerant varieties and rootstocks (e.g. Bruno, Bounty). Before removing males, consider future pollination requirements as part of your decision-making.

##### Rationale

Retention of susceptible varieties creates ongoing Psa-V risk for you and your neighbours. Widespread infection of males may mean you will need supplemental pollination at flowering.

#### c) Vine age

Proactively remove infected material, particularly from young vines. Ideally cut back 40cm beyond the last infection point.

##### Rationale

Young vines are more susceptible to Psa-V. It's less likely to lose whole vines or grafts if a proactive approach is taken. Research shows pruning to 40cm below Psa lesions is the most effective treatment for reducing symptoms in both Hayward and Gold3.



d) **Type of symptoms**

Cane die-back and cankers should be removed as soon as possible to minimise inoculum levels and reduce the risk of infection to rootstock. Cut back to at least 40cm from the last infection point. Remove infected flower buds prior to pollination.

**Rationale**

These symptoms indicate disease has been present for some time and may be widespread. This approach reduces inoculum sources from the block without seriously impacting productivity and provides the best opportunity for vine recovery.

## **Treating Wounds**

**Protect cut wounds on canes, cankers and stumps with a recommended wound sealant that provides a persistent barrier. Where cutting is not practical on cankers, use a blow torch to ensure all exudate has dried from the canker and/or apply protective copper sprays.**

**Rationale**

Wound protection reduces risk of re-infection. Recommended products have shown proven efficacy against PsA-V. Refer to VLS research reports listed below.

## **Leaf Spot**

**Apply an ongoing protective spray programme to manage leaf spot to minimise inoculum build-up.**

**Rationale**

Leaf spot can provide an ongoing source of inoculum for many weeks and may lead to flower infection if not controlled. Under humid conditions, even 'old' leaf spots are capable of producing exudate at the edge of the lesion. This contains large numbers of viable bacteria.

## **Disposal**

**Dispose of infected plant material onsite immediately following removal, preferably by burial or burning. Fine mulching with digesters is acceptable though the least preferred method of disposal.**

**Rationale**

Infected plant material left on the orchard increases inoculum pressure. PsA-V is capable of living and multiplying in kiwifruit plant material for long periods of time. Mulching with a digester speeds the break-down of plant material that may harbour PsA-V. However, onsite burial or burning is more likely to eliminate the inoculum source from the orchard. Under the National PsA-V Pest Management Plan (NPMP) infected material may not be moved from the orchard.

**Resources**

- [KVH Protocol—Disposal](#)
- [KVH Website—Vine Removal and Disposal](#)
- [VLS Research Report—Invitro study of PsA survival in wound protectants](#)
- [VLS Research Report—Invitro study of PsA survival in Prunetec \(wound protectant\)](#)
- KVH Best Practice One Pager—Managing Infected Material (Refer Page 38 of this Guide below)

# CANOPY MANAGEMENT



Above: flat, open canopies

**Maintain a flat open canopy structure throughout the year with no more than four leaf layers. Carry out pruning, girdling and flower-thinning during low-risk weather. Use the Psa-V Risk Model to plan orchard activities. Maintain good tool hygiene and protect wounds. Consider a hand-held sprayer to apply wound protectants. Use well-supervised teams capable of moving through areas and completing tasks quickly. Remove disease material as it is found throughout the season.**

## Rationale

All products on the [KVH Recommended Product List](#) require good spray coverage of all vine parts to be effective. A flat open canopy helps optimise spray coverage. All wounds, including man-made wounds, provide an entry point for Psa-V; and combined with wet conditions will increase infection risk. Psa-V can be transferred between vines on non-sanitised tools and equipment. Wound protectants minimise Psa-V entry into plants. Good supervision ensures orchard and tool hygiene is carried out and completing activities quickly allows sprays to be applied sooner to protect wounds. Removal of infection reduces inoculum build up and infection spread.

## Spring Canopy Management

**Tip squeeze often and early to control canopy vigour. As the canopy closes, remove regrowth, blank shoots and excess cane. Retain medium to low-vigour wood. Keep leader zones open and maintain separation of male and female plants. Minimise zero leaf pruning. Apply a trunk girdle 30-40 days before flowering to green varieties (G14 and Hayward) in areas that are prone to bud-rot.**

## Rationale

Early tip-squeezing results in smaller wounds. This avoids the need to make large cuts with secateurs later in the season—infection risk increases by using unclean secateurs. Removal of regrowth, blank shoots and excess canes de-clutters canopy structure allowing for better spray coverage. Cluttered canopies can increase the incidence of bud-rot by providing environmental conditions more suited to Psa-V multiplication. Medium and low-vigour wood requires less summer intervention. Males are more susceptible to Psa-V and infection transfer is reduced if separation between males and females is maintained. Zero leaf pruning creates risk. Research has shown girdles applied to green varieties approximately one month prior to flowering can reduce leaf spot and improve fruit-set in areas prone to bud-rot.

## Summer Canopy Management

**Reassess canopy density as the season progresses and reduce dense areas of the canopy. Carry out fruit thinning during dry periods. Complete girdling during dry weather periods. In conversion blocks girdle large diameter stumps rather than smaller-diameter scions. Avoid the use of girdling chains on smaller diameter scions. Choose trunk girdling over cane girdling.**

### Rationale

Maintaining an open canopy throughout the season supports effective spray coverage. Fruit thinning and girdling creates wounds and entry points for PsA-V. Incorrectly applied girdles can stress the vines, resulting in unhealed wounds and increases infection risk. Young scions are more susceptible to PsA-V. Trunk girdling creates fewer infection points than cane girdling.

## Autumn Canopy Management

**Remove late vegetative growth. Complete girdling during dry weather periods. Avoid the use of girdling chains on smaller diameter scions. Avoid girdling stressed vines.**

### Rationale

Dense canopies reduce spray coverage and slows drying time. Soft tissue associated with late growth is vulnerable to infection. Girdling stressed vines increases risk of PsA-V infection. Autumn is a particularly high-risk time of the year.

## Winter Pruning

**Prune and tie down wood to create a low, flat structure. Select medium vigour wood. Maintain even cane spacing. Maintain gaps between male and female vines. Apply recommended wound protectants to all pruning cuts.**

### Rationale

Low, flat structures support good spray coverage throughout the growing season and low vigour wood minimises canopy density. Separation of male and female vines reduces risk of infection transfer and improves spray coverage. Wound protectants reduce risk of infection. PsA-V risk continues through winter. Recommended products have shown proven efficacy against PsA-V.



## Strung Canopies – Spring/Summer Management

Consider strung canopies only if complete spray coverage can be achieved throughout the season. Lower canes as soon as they are long enough to fill the intended canopy space. Avoid stringing canes over mature canopies if possible. If unavoidable, provide open zones along the leaders and/or the centre of the canopy and adjust sprayer nozzles to place more spray above the canopy. When stringing, always protect canes from wire rub.

### Rationale

Strung canes are more vulnerable to wind damage and wounding. Stringing over mature canopies compromises spray coverage. Wire rub creates wounding and entry points for PsA-V.

## Strung Canopies – Autumn/Winter Management

### *Developing blocks:*

Consider lowering strung canes before high-risk autumn weather. Apply Actigard™ and copper four to seven days prior to lowering canes. Do not use Actigard™ if there is any risk of spray drift onto producing blocks. Squeeze tip lowered canes to maintain apical dominance and prevent late lateral growth. Where long canes are turned to fill bays, take care to minimise micro-cracking.

### *Lowering canes in winter:*

Complete work during low-risk weather periods. Maintain tool hygiene and protect wounds.

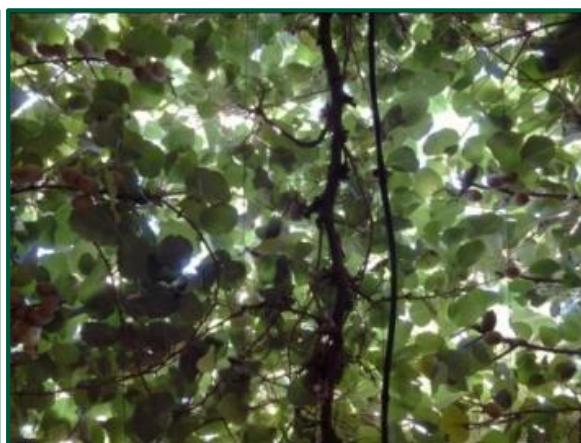
### Rationale

High-winds and autumn weather events can cause cane damage. Wounding appears to correlate with an increased incidence of PsA-V where inoculum is present. Elicitors and copper will minimise infection risk. Spray drift to producing blocks may result in fruit residues. Late growth is vulnerable to PsA-V infection. Working in dry weather, applying protective sprays and maintaining good tool hygiene is best practice and will minimise chances of infection.

## Male Management – Spring/Summer



Light, open male canopy



Dense male canopy

Manage male vigour to minimise the amount of pruning required throughout the season. Tip squeeze new spring shoots and button cut strong canes. Maintain medium to low vigour wood. Manage spring cankers and where possible remove diseased material immediately, or after flowering. Consider applying an elicitor approximately



**seven days prior to male pruning. Continue pruning rounds through summer. Assess the health of your male vines. Replace susceptible male varieties with more tolerant varieties where practical. Ensure you have a plan for future pollination requirements if males need to be cut out.**

#### **Rationale**

Male canopies with medium to low vigour wood appear to have less infection as they are better protected by sprays and require fewer cuts. Reduction in the number of pruning wounds reduces infection risk. Managing cankers reduces the risk of bud infection which leads to bud-loss and can compromise pollination. Elicitors provide an additional protection through the high-risk flowering and pruning periods. Diseased males can impact future pollination requirements. More tolerant varieties are more likely to provide an ongoing source of pollen within the orchard. New Zealand must become self-sufficient for future pollination as imported pollen is banned.

#### **Male Management – Autumn/Winter**

**Continue trimming rounds through autumn and winter. Remove, button stub or tie down high growth to maintain a low, flat, open canopy. Ensure late growth is removed prior to periods of high-risk autumn and winter weather including frosts. Graft across to more tolerant male varieties in winter. Apply notch-graft to Psa-affected males.**

#### **Rationale**

Button stubbing preserves growing points. A flat canopy maximises spray coverage. Late growth (soft tissue) does not have time to harden before winter and is more susceptible to frost damage and Psa-V infection. Healthier male varieties maximises future pollination.

#### **Resources**

- [KVH Best Practice Advice—Protecting Males in a Psa-V Environment](#)
- [KVH Information Sheet—Male Susceptibility to Psa-V](#)
- KVH Best Practice Hygiene—(Refer to Page 35 of this Guide below)

## SHELTER MANAGEMENT



**Provide good on-orchard shelter. Consider artificial wind breaks, under vine shelter or complete overhead shelters made of hail cloth or plastic cover. Maintain permeable natural shelter. Keep shelter trimmed in spring and consider spraying shelters in high inoculum areas.**

### Rationale

Shelter reduces the impact of wind and wounding of vines and protects young plants which are more susceptible to Psa-V infection. Well-sheltered blocks show lower levels of infection than less-sheltered blocks. Well-sheltered blocks are warmer, reducing vine stress. Plastic covers eliminate high-risk weather elements, i.e. wind, rain and hail. Permeable natural shelter reduces wind speed and turbulence and subsequent damage to vines. It also allows foliage to dry faster – reducing infection risk and reduces drying times for applied sprays. Psa-V can potentially harbour within shelters.

### Resources

- [KiwiTech Bulletin No. 57—Shelter Spraying](#) (available on Zespri's Canopy)

## GIRDLING

**Complete girdling during dry weather periods. Ensure orchard hygiene protocols are in place. Sterilise girdling tools between every vine. Apply girdles to stumps in preference to young scions.**

**Girdle to the correct depth (cut through the bark and phloem layers but do not penetrate beyond the xylem hardwood tissue). Avoid the use of chains on smaller diameter stumps and scions.**

**Cover wounds immediately with a protectant copper spray.**

**Consider applying elicitors approximately one week prior to wounding activities such as girdling.**

**Consider applying a trunk girdle 30-40 days prior to flowering, or when sepal staining is first seen, to varieties prone to bud-rot (Hayward and Green14) and blocks where flower bud loss is prevalent. Girdle both male and female vines.**

## Rationale

If present, Psa-V multiplies rapidly in high-risk weather. Psa-V can move into vines through wounds such as girdling. Psa-V can spread between vines on unclean tools and equipment. Mature trunks are less susceptible to damage through over-girdling. Young plants/scions are more susceptible to Psa-V. Over-girdling stresses vines and slows wound healing, making vines more susceptible to Psa-V. Wound protectants reduce the risk of Psa-V entry into the vine.

Research trials showed girdling (trunk and cane) applied prior to flowering can reduce the level of leaf spot and bud-rot. Research is ongoing to understand optimal timing and girdle methods.

## Resources

- [KVH Best Practice—Orchard Hygiene](#)
- KVH Best Practice Hygiene (refer to Page 35 of this Guide below)

# GRAFTING



**Consider grafting across to more tolerant varieties, including males. Notch-grafting is an option.**

**Complete grafting during dry weather periods. Ensure orchard hygiene protocols are in place. Sanitise all tools used in the preparation of scions and stumps. Cover exposed surfaces of scions and stumps with a protective sealant.**

**Source budwood in compliance with [KVH Protocols](#).**

**Consider grafting four scions onto mature stumps in situations where Psa-V symptoms have been high and where established trunks are available for re-grafting.**

**Grow suckers to provide additional grafting options, particularly if blocks have been previously infected with Psa-V.**

## Rationale

In areas where Psa-V is not present (i.e. Exclusion regions) early notch-grating to more tolerant varieties

may reduce production loss if growers are forced to cut out as a result of PsA-V infection arriving in the orchard. More tolerant male varieties are likely to provide ongoing pollen supplies.

If present, PsA-V multiplies rapidly in high-risk weather. PsA-V can move into vines through wounds such as grafting and spread through unclean tools. Grafting wax and wound protectants provides a physical barrier which reduce the risk of PsA-V entry.

Movement of budwood presents one of the greatest risks for disease transfer.

Establishing four leaders allows rapid canopy establishment and provides better options of maintaining canopy fill should trunks and leaders need removal due to infection.

Suckers may be grafted during the summer period or maintained for re-grafting into the future, providing an insurance policy against poor graft take or infection occurring.

### Resources

- [Psa-V Risk Compass](#)
- [KVH Website—Male susceptibility to PsA-V](#)
- [Psa-V Risk Model](#)
- [KVH Protocol—Budwood](#)

## IRRIGATION

**Avoid overhead irrigation where possible. Pay careful attention to coverage and dose rates if applying PsA-V protectant sprays through irrigation systems. Lower frost protection emitters once risk of frosts has passed.**

**Irrigate through dry periods to avoid vine stress, particularly young vines.**

### Rationale

Overhead irrigation results in leaf wetness which increases infection risk if PsA-V inoculum is present. Dose rates can be difficult to manage through irrigation systems resulting in incorrect doses. This can lead to phytotoxicity or ineffective cover. Frost protection using water does reduce wounding which creates potential entry points for PsA-V.

### Resources

- [Psa-V Risk Compass](#)

## HAIL PROTECTION

**Assess hail risk to your orchard. Consider hail netting. Apply a PsA-V copper protectant as soon as possible following a hail event. Consider combining copper and Actigard™ during approved use periods of Actigard™.**

### Rationale

Hail causes significant damage and wounding, increasing the risk of PsA-V. Growing plants under cover provides a greater degree of protection. Applying protective products minimises chances of PsA-V infection through wounds. Use of copper and Actigard provides an additional mode of action.



## FROST PROTECTION



**Assess orchard frost risk and identify high-risk areas. Plan frost protection and monitor weather conditions. Protect against autumn frosts. Consider frost protection options such as frost fans, overhead irrigation and under-vine shelter.**

### Rationale

Frost stresses vines and damages tissue, increasing likelihood of Psa-V entry. It is unknown what temperatures or temperature variations trigger Psa-V and symptom expression, however observations show a link between frost-damaged areas of orchards and symptom expression in the following spring. Severe frost events, or where temperatures drop below 0°C, can result in significant Psa-V expression, particularly if they occur in autumn before vine dormancy. Repetitive frosts add further risk.

Some protection methods pose further risk such as overhead irrigation which will result in wetting of the canopy. Excessive use of water or use on poor draining soils may result in water logging which increases vine stress. Frost fans may provide the best option. Use of under-vine shelter can assist in warming the orchard environment and may also reduce frost risk.

### Resources

- [Frost and hail section in the Zespri Canopy](#)
- [KVH Psa-V Risk Model](#)

## FERTILISERS AND NUTRITION

**Maximise plant health by providing adequate nutrition and water throughout the season. Manage nitrogen inputs. Do not rely solely on nutritional products for Psa-V control. Apply composts. Refer to your horticulture advisor.**

### Rationale

Stressed plants are more susceptible to disease. Managing nitrogen inputs avoids excess canopy growth. All kiwifruit plants are susceptible to Psa-V infection and require a protectant programme on top of a strong nutritional programme. Composts support soil biology and promote good root health.

### Resources

- [Psa-V Risk Compass](#)
- [Zespri Canopy—Nutrition, Soil and Water Resources](#)
- Consult with your horticultural advisor

## PEST AND DISEASE CONTROL

**Consider an application of Talstar® and Engulf® as soon as practical after leaf fall to control cicadas. Address diseases such as armillaria and phytophthora.**

### Rationale

Cicadas create wounds in early summer which provide entry points for Psa-V.

Stressed or unhealthy vines are more prone to Psa-V.

### Resources

- [KiwiTech Bulletin—Cicadas](#)
- [KiwiTech Bulletin—Armillaria](#)
- [KiwiTech Bulletin—Phytophthora](#)

## MOWING, MULCHING AND SHELTER TRIMMING

**Avoid mowing, mulching and shelter trimming in wet conditions. Avoid machinery wounds to kiwifruit trunks when mowing.**

### Rationale

Wet conditions create risk of Psa-V infection spread. Wounds provide Psa-V entry points.

### Resources

- [KVH Protocol—Disposal](#)

## SOURCING NEW PLANTS



Follow [KVH Protocols](#) when sourcing and moving nursery stock. Source the cleanest plant material you can, preferably nursery plants certified under the Kiwifruit Plant Certification Scheme (KPCS). Otherwise, only source plant material from nurseries registered with KVH. Maintain records of where new plantings have been sourced. Inspect plants on arrival **BEFORE** introducing them to your orchard. Order plants from nurseries one year in advance where possible.

### Rationale

Movement of plant material presents one of the greatest risks for disease transfer. Movement controls minimise the risk of spreading disease into regions where it has not yet been identified or where there is only limited infection. Sourcing plants certified under the KPCS gives growers assurance they are investing in the best possible start when establishing new vines. Other nurseries operating in accordance with KVH Protocols meet KVH's minimum biosecurity requirements. Inspection of plants can help confirm their health status. Early ordering ensures nurseries can meet industry demand and prevent supply shortages.

### Resources

- [KVH Protocol: Nursery Stock](#)
- [KVH Website—Nursery List](#) (includes nurseries selling KPCS plants and registered nurseries)
- [KVH Website—Kiwifruit Plant Certification Scheme](#)
- [KVH Website—KPCS Information for Growers](#)

## SPRAYING



**Caution:** misuse or over-use of any product, particularly on young or stressed vines, can be detrimental to vine health and/or orchard productivity. If unsure of product suitability or use conditions, contact your technical advisor.

- Consider your individual orchard Psa-V risk profile when planning your spray programme [www.kvh.org.nz/psa\\_risk\\_compass](http://www.kvh.org.nz/psa_risk_compass)
- Develop and implement a year round spray plan using [KVH recommended products](#) with different modes of action. KVH recommended products have ACVM registration and have shown efficacy in the control of Psa-V in field trials.
- Organic growers should confirm BioGro status of products prior to application.
- Always check marketer requirements when selecting any spray products. Different rules may apply for producing and non-producing vines and through different growth stages. Refer to KVH Recommended Product List on pages 26 and 27 of this Guide.
- Manage applications of copper to ensure you stay within your annual copper budget. Consider using products such as zinc sulphate, urea and potassium chloride instead of copper sulphate for defoliating vines prior to winter pruning. Copper sulphate contributes significantly to your annual copper budget.
- Ensure protective sprays are in place before high-risk weather. If this is not achievable, spray as soon as possible after infection events.

### Spray Frequency

#### Areas without Psa-V (Exclusion Regions)

Spray a proven product prior to any significant wet weather event as this is the most likely time for new incursions to occur. Apply protectants following extreme events such as hail and frost. Refer to the [KVH Psa-V Risk Model](#).

**Rationale:** Psa-V may remain undetected in a region for a period of time before symptoms are reported. A proactive spray plan will minimise the impact of Psa-V spread by weather events. Hail and frost increase vulnerability to Psa-V.



### **Areas with Psa-V (Recovery and Containment Regions)**

Ensure protectant and elicitor sprays are in place before significant wet weather events—particularly if the forecast includes strong wind or other causes of damage. Refer to the [KVH Psa-V Risk Model](#).

**Rationale:** Psa-V is present in orchards in these regions and can survive in vines, weeds and shelter species. Following infection events, bacterial populations can rise quickly and cause disease symptoms. The risk of Psa-V infection increases if wet weather is associated with frost, hail or severe winds.

### **Product Resistance and Tolerance**

**Use bactericides and copper-based products correctly to avoid the risk of product resistance or tolerance developing, which could result in the loss of effective products from the [KVH Recommended Product List](#).**

- Monitor orchards regularly
- Remove and dispose of infected material from orchard
- Use a combination and/or alternate effective products from the KVH Recommended Product List
- Always use label rates
- Ensure good spray coverage is achieved.
- Contact KVH on 0800 665 825 if you believe spraying is not providing Psa-V control and suspect resistance.
- Maintain best practice orchard hygiene

#### **Rationale**

Loss of the ability to use bactericides and copper-based products for the control of Psa-V would be a significant issue for the kiwifruit industry. To date, a small number of orchards have been identified with bactericide-resistant Psa-V and others have been identified with copper tolerant Psa-V. Resistance can develop as a result of products not being used properly, using products at lower rates or products being over-used. Removing infected material is an important part of the resistance strategy as it keeps Psa-V populations as low as possible. The KVH and Zespri R&D programme continues to monitor orchards for resistance.

### **Spray Coverage**

**Calibrate sprayers and check nozzle set up before spraying. Use wetter papers to check coverage of leaf undersides and high-risk areas of the vine, such as treated cankers on leaders, canes and trunks. Use AI nozzles until canopy closure. Review and change sprayer set up and water rates through spring as the canopy target changes. When dilute spraying, use 600-1000l/ha over the bud-break to flowering period; and 1000-2000l/ha from flowering to harvest. Use suitable spreaders to improve spray coverage. When concentrate spraying, change sprayer settings, adjust chemical rates and use super-spreaders. Follow label recommendations. Change direction of sprayer travel for consecutive spray rounds. Manage canopy density if spray coverage is compromised.**

#### **Rationale**

Thorough coverage of all vine parts is essential for effective Psa-V control. Well-calibrated and well-setup kiwifruit sprayers can deliver effective coverage and chemical dose.

AI nozzles must be used early season to reduce spray drift. Use AI nozzles with bactericides.

Two times concentrate spraying with the addition of super-spreaders provides good, if not better coverage than dilute spraying. It also reduces drying times and therefore may reduce phytotoxicity risk. Changing the direction of sprayer travel improves coverage of surfaces missed in previous spray rounds.

### **Mitigating Phytotoxicity Risk**

**Use copper products correctly to avoid phytotoxicity.**

- **Follow copper product label rates**
- **Ensure adequate agitation during product mixing and application**
- **Avoid low water pH (less than 6.0)**
- **Check compatibility with other products before tank mixing, particularly with acidic products**
- **Observe recommended spray intervals**
- **Apply during good drying conditions**
- **Alternate copper with other products to reduce leaf impacts, particularly if vines are stressed**
- **Take particular care with young vines and varieties more susceptible to phytotoxicity, e.g. Hort16A and Green14.**
- **Use copper in combination with other products with different modes of action (bactericides and Actigard™)**
- **Consider using products to offset the effects of copper phytotoxicity**
- **Apply seaweeds at least 24 hours after rather than immediately prior to copper sprays.**

#### **Rationale**

Copper sprays may be phytotoxic to kiwifruit leaves, flowers or fruit if used incorrectly. Leaf damage is seen as vein darkening on the leaf undersides and also leaf margin burn. Fruit damage appears as skin burn or stain – similar to typical water stain or stain seen with oil marking. Using a combination of products avoids leaf damage through over-use of copper. Growers have reported some benefit from using seaweed sprays to reduce leaf damage through copper use. Research indicates seaweeds applied 24 hours before copper can bind up copper ions. No effect was seen when applied 24 hours after copper.

### **Young Vines and New Grafts**

**Develop a strong year-round protective spray plan for young vines and new grafts in all growing regions using the [KVH Recommended Product List](#). Apply elicitors approximately one week prior to wounding activities, such as lowering strung canes. Avoid excessive use of elicitors. Take extreme care to avoid spray drift onto producing vines when using Actigard™, bactericides and CPPU products. Use low rates of super-spreaders if using knapsack sprayers and avoid spraying to run-off.**

#### **Rationale**

Young vines and new grafts are more susceptible to PsA-V than older vines so they require greater attention. The application of elicitors may provide additional protection. However, excessive use of elicitors on young vines and new grafts may stunt vine growth. Spray drift or spray contamination resulting in Actigard™, bactericides or CPPU products reaching flowers or fruit risks residues. Using lower super-spreader rates helps avoid phytotoxicity issues.

## Spring Spray Planning

**Focus on spraying copper at regular intervals from budbreak onwards to provide ongoing protection of expanding leaves, shoots and flower buds. Ensure all growth is protected prior to high-risk weather. Use elicitors to provide additional protection. Apply these before Psa symptoms occur. For stressed sites/vines delay application until 21-28 days prior to flowering.**

**Consider bactericides in high-risk situations, e.g. high-risk weather through the budbreak period and if signs of leaf and/or flower bud infection are present prior to flowering. Consider use of CPPU products midway between budbreak and flowering.**

**Spray copper and elicitors close to flowering. If flowering is prolonged and/or high-risk conditions exist, also consider applying copper and soil-applied Actigard™ through the flowering period. Avoid spraying open flowers as much as possible. Applying coppers early in the flowering period when most flowers have not opened should minimise potential yield impacts.**

**Consider biological sprays over flowering to assist with control.**

**Be vigilant in areas where bud-rot has historically occurred and particularly if spring conditions are cold and wet. Hayward and G14 need particular focus.**

**DO NOT apply bactericides, elicitors or CPPU products to any open female flowers.**

## Rationale

The aim during spring is to avoid leafspot and flower bud infection.

Leafspot creates ongoing infection risk as lesions can continue to exude Psa inoculum in high risk weather. Ongoing inoculum presence can lead to more leaf spotting and may also increase the risk of flower bud infection. Infected flowers lead to flower loss, affecting productivity.

Very young leaves (one to five weeks of age) are particularly susceptible to Psa. They are also growing rapidly therefore young canopies require repeat spray applications to ensure protective cover of new growth is maintained.

Spraying copper at regular intervals ensures expanding leaf surfaces and flower buds remain protected prior to high risk weather.

Elicitors assist by prompting a plant defence response which helps protect against leafspot and flower-bud loss.

As this response may divert resources away from canopy growth, delayed application timings are prudent for sites/vines under high stress e.g. through water-logging, frost, hail or wind, or where plants have poor roots or are in poor health. This allows early canopy to establish, lessening risk of growth impacts.

Bactericides are effective in knocking down inoculum and are suited for use in high risk situations.

CPPU products should be applied prior to leafspot occurring. Ambitious applied mid-way between budbreak and flowering when there is sufficient canopy present for absorption (shoots at around 100mm) can reduce leaf spot. Effects on flower bud loss has not been demonstrated.

To date no sterilant or biological product has shown efficacy in high inoculum testing.

Programs using a range of products with different modes of action have shown best results in controlling Psa through spring.

## Summer Spray Planning

Spray frequency can be reduced during summer. Focus on spraying copper prior to high-risk weather, particularly if the forecast includes strong winds or hail, and protect wounds following pruning rounds. Ensure new growth on males is protected prior to high-risk weather. Soil-applied Actigard™ can be used on fruiting vines. For non-fruiting vines foliar-applied Actigard™ and Ambitious may also be considered. Avoid spray drift onto fruiting vines and avoid risk of tank contamination. Maintain recommended spray windows between coppers and other applied products. Refer to [KVH Recommended Product List](#).

### Rationale

Once leaves mature (from around five to six weeks of age) they become less susceptible to Psa-V and rate of growth also slows. Warm, dry summer conditions lower the Psa-V infection risk. Under the right conditions however, infection can still occur. Therefore best practice spraying through these seasons still applies. A limited selection of products is available during the fruit-set to harvest period as some KVH recommended products present residue risks.

## Autumn Spray Planning

Maintain spray programmes through autumn. Consider likely harvest date when planning copper applications. Adhere to copper budgets according to marketers rules. Protect fruit stalk and leaf scars by applying a combination of copper and Actigard™ immediately after harvest. Ensure good spray coverage. Ensure leaves are actively photosynthesising if applying Actigard™. Reapply three weeks later if canopy condition allows to extend protection into the leaf fall period. Avoid spray drift onto un-harvested blocks and clean spray tanks thoroughly after use.

Ensure copper is applied to protect fresh leaf scars as autumn progresses and particularly following the use of leaf drop sprays.

### Rationale

Autumn is a high-risk period as cooler, wetter weather favours Psa-V infection. A pre-harvest interval (PHI) of seven days applies for copper products. Chemical companies also advise a seven day gap between application of copper products and fruit clean up sprays. This avoids the potential for acidic ingredients in clean up sprays to react with copper and cause phytotoxicity. Fruit stalk and leaf scars are provide possible Psa-V entry points. Spray applications immediately following harvest maximises protection. A combination of copper and Actigard™ provide a dual mode of action. Spray drift onto un-harvested fruit can cause residue.

Leaf drop sprays promote rapid leaf fall resulting in multiple Psa-V entry points through leaf scars.

## Winter Spray Planning

Maintain protective spray programme ensuring cover is in place following wounding activities and high-risk weather such as rain and frost. Maintain a one-week window between application of coppers and bud enhancing sprays and/or insecticides (Passion Vine Hopper and cicada control). Ensure copper is in place immediately before and after pruning.

### Rationale

While vines are dormant during winter, Psa-V can still be active and enter through pruning wounds, new grafts and frost-damaged tissue. Interaction between copper products and budbreak sprays and/or insecticides, can increase phytotoxicity risk. Applying copper knocks down inoculum levels before



pruning and protects wounds after pruning. Winter is a low-risk time to apply copper as risk of phytotoxicity is minimal.

### Resources

- [KVH Website—KVH Recommended Product List](#)
- [KVH Best Practice Advice: Management to limit resistance to Psa control products](#)
- [KVH Website—Spray Products](#)
- [KVH Website—Seasonal Management Guide Wall Chart](#)
- [KVH Website—Sprayer Nozzling Guide](#)
- [KVH Website—Spring Spraying Kit](#)
- [KVH Website—Guidelines for Protection of Developing Grafts](#)
- [KVH Information Sheet—Phytotoxicity vs Leaf Spot](#)
- [KVH Information Sheet—Kiwifruit Leaf Phytotoxicity Effects](#)

# KVH Recommended Product List (budbreak to harvest)

Only products with ACVM label claim are included. Organic growers should confirm BioGro status of all products prior to application.

Coppers	Relative Efficacy	Rate/100L	PHI	%Cu	Cu/ha /app 2000l/ha	Product Rules
Nordox™ 75WG (BioGro certified)	High	37.5g	7 days	75%	562.5g	<ul style="list-style-type: none"><li>▪ <b>Full label claim:</b> Nordox 75WG and Kocide® Opti™</li><li>▪ <b>Limited label claim:</b> Hortcare® Copper Hydroxide 300, Coptyzin®, Champ™ DP and Tri-Base Blue®, AgCopp 75</li><li>▪ Nordox™ 75WG and Hortcare® Copper Hydroxide 300 are BioGro certified</li><li>▪ During budbreak to fruit-set period, use Coptyzin® at 1.5l/ha if infection risk is high</li><li>▪ Ideally use coppers with other proven Psa-V products to improve control.</li><li>▪ Applications below label rate are not recommended as they are likely to result in sub-optimal control and an increased risk of resistance.</li><li>▪ Avoid spraying open flowers.</li><li>▪ Higher levels of phytotoxicity can occur when applications are made to weak vines.</li><li>▪ Copper budgets of 8kg/ha/annum apply for conventional growers.</li><li>▪ Copper budgets of 6kg/ha/annum apply for organic growers. However, this is flexible provided the average quantity used over a five-year period (consisting of this year and the four preceding years) does not exceed 6kg/ha/annum. Restrictions remain around maximum allowable levels of copper residues in the soil of 60mg/kg. Monitoring of soil residues is recommended.</li></ul>
Kocide® Opti™	High	70-90g	7 days	30%	420-540g	
Hortcare® Copper Hydroxide 300 (BioGro certified)	High	50-90g	7 days	30%	300-540g	
Coptyzin (‘TEPA’ chelated copper product)	High	Apply at 1 – 1.5 L/ha	7 days	9.5%	100g	
AgCopp 75	High	37.5g	7 days	75%	562.5g	
Champ™ DP *	High	50-75g	7 days	37.5%	375-562.5g	
Tri-Base Blue® *	High	150ml	7 days	19%	570g	
* The use of Champ™ DP and Tri-Base Blue® during post-flowering to harvest is not recommended by manufacturers.						
Bactericides						Product Rules
Kasumin®	High	500ml	Allowed from budbreak until 21 days before first kiwifruit flower opens or until 15 Dec 2015 (whichever comes first). Refer to <a href="#">Kasumin User Guide</a> .		Limited label claim. <b>STRICT USE CONDITIONS APPLY.</b> Zespri growers applying bactericides must complete an Orchard Psa-V IPM Strategy (OPIS) document for each variety and submit to Zespri before application and before 1 October 2015. Bactericides must <b>NOT</b> be applied to any vines when flowers or fruitlets are present. A maximum of two applications of Kasumin and/or KeyStrepto is permitted in the bud phase period. Ideally these should be alternated (this applies to both producing and non-producing vines). Further use requires a Justified Approval (JA). After two consecutive applications of bactericides apply a different Psa-V control product. Only ground-based application methods are allowed. AI nozzles and drift-reducing adjuvants must be used until canopy develops. A site inspection record must be completed before each application. <b>Bactericides are not currently authorised for use in the South Island.</b> Refer to <a href="#">User Guides</a> .	
KeyStrepto™		60g	Allowed from budbreak until 1 week before first kiwifruit flower opens. Refer to <a href="#">KeyStrepto User Guide</a> .			
Elicitors						Product Rules
Actigard™	Moderate	20g (200g/ha in minimum 300L/ha when soil applied)	Soil applied: Use allowed budbreak to harvest. 14 day PHI. Foliar applied (producing): Use allowed budbreak to first female flower opening. Foliar applied (non-producing): Use allowed budbreak to 28 Feb 2016. Refer to <a href="#">Actigard™ User Guide</a>		Full label claim for foliar applications (Limited label claim for soil applications). Use in conjunction with other protectant sprays. A maximum of four Actigard™ applications in total are allowed per season (harvest to harvest). This is regardless of application method or vine producing status. The maximum allowable product rate is 200g/ha. Only ground-based application methods are allowed. Avoid over use on young and/or stressed vines. Refer to the Actigard™ label or <a href="#">Actigard™ User Guide</a> .	
Other						Product Rules
Ambitious® 10SL	Low - Medium	50ml	Producing vines: Use allowed until one week before first kiwifruit flower opens.		Limited label claim. Not recommended for use on Gold varieties. Only two applications are allowed in the pre-flowering period on producing vines. Do not use as a fruit sizer. Refer to the <a href="#">CPPU User Guide</a> .	
Caplit™		50-75g	Non-producing vines: Use up until 28 Feb 2016 only. Refer to <a href="#">CPPU User Guide</a> .			
Biological						Product Rules
BOTRY-Zen® (BioGro certified)	Low	800g	Use allowed from budbreak to fruit set.		Limited label claim. BioGro certified. Apply immediately once mixed. Do not apply after fruit set and avoid drift onto fruit-bearing vines as fruit-staining can occur.	

# KVH Recommended Product List (harvest to budbreak)

Only products with ACVM label claim are included. Organic growers should confirm BioGro status of all products prior to application.

Coppers	Relative Efficacy	Rate/100L	%Cu	2000L/ ha before leaf fall	600L/ ha after leaf fall	Product rules
Nordox™ 75WG (BioGro certified)	High	55 – 70g*	75%	562-715g	247-315g	<ul style="list-style-type: none"><li>▪ <b>Full label claim:</b> Nordox75WG and Kocide® Opti™</li><li>▪ <b>Limited label claim:</b> Hortcare® Copper Hydroxide 300, Coptyzin, Champ™ DP, TriBase Blue® and AgCopp 75.</li><li>▪ <b>Nordox™ 75WG and Hortcare® Copper Hydroxide 300 is BioGro certified</b></li><li>▪ Ideally use with other proven Psa-V products to improve control.</li><li>▪ Do not apply coppers within 7 days of budbreak sprays.</li><li>▪ Do not use below-label rates as this increases the risk of resistance developing.</li><li>▪ Copper budgets of 8kg/ha/annum apply for conventional growers.</li><li>▪ For organic growers copper budgets of 6kg/ha/annum apply. However, this is flexible provided the average quantity used over a five-year period (consisting of this year and the four preceding years) does not exceed 6kg/ha/annum. Maximum allowable levels of copper residues in the soil of 60mg/kg. Monitoring of soil residues is recommended.</li></ul>
Kocide® Opti™	High	70-90g	30%	420-540g	126-162g	
Hortcare® Copper Hydroxide 300 (BioGro certified)	High	70-90g*	30%	420-540g	126-162g	
Coptyzin (TEPA chelated copper)	High	Apply at 1.5l/ha*	9.5%	142g	43g	
Champ™ DP	High	107-140g*	37.5%	803-1050g	241-315g	
Tri-Base Blue®	High	280ml*	19%	1064g	319g	
AgCopp 75	High	55-70g*	75%	562-715g	247-315g	
* In early harvested blocks summer rates of copper may be preferred to minimise leaf damage. (Check summer rates table in page above). However winter rates should be applied through dormancy.						
Elicitors						Product rules
Actigard™	Moderate	20g (200g/ha in minimum 300L/ha when soil applied)	Use allowed harvest to leaf fall period as foliar or soil application. Extreme care should be taken to avoid spray drift or contamination from spray tanks onto fruiting vines. Refer to <a href="#">Actigard User Guide</a> .		Full label claim for foliar applications (Limited label claim for soil applications). Use in conjunction with other protectant sprays. A maximum of four Actigard™ applications in total are allowed per season (harvest to harvest). This is regardless of application method or vine producing status. The maximum allowable product rate is 200g/ha. Only ground-based application methods are allowed. Avoid over use on young and/or stressed vines. Refer to the Actigard™ label or <a href="#">Actigard™ User Guide</a> .	
Biological						
BOTRY-Zen® (BioGro certified)	Low	800g	Use allowed post-harvest to budbreak.		Limited label claim. BioGro certified. Can be applied post-harvest and through dormancy. Avoid spray drift onto non-harvested vines.	
Bactericides						
Kasumin® KeyStrepto™	High	60g	Use of Kasumin® and KeyStrepto™ is strictly prohibited during this period.		Use of Kasumin® and KeyStrepto™ is STRICTLY PROHIBITED during this period.	
CPPU products						
Ambitious® Caplit™	Moderate	50ml 50-75g	CANNOT be used from 28 Feb 2016 to 15 Jun 2016 unless a JA has been issued.		Limited label claim. Not permitted for use between 28 February 2016 and 15 June 2016 unless a Zespri JA is granted (in extenuating circumstances only). For non-Zespri varieties refer to your marketer. Refer to the <a href="#">CPPU User Guide</a> .	





## PRODUCT DESCRIPTION TABLE

Note—only products with an ACVM label claim and have shown efficacy in the control of Psa in field trials are listed in the KVH recommended product list. Products have not been tested on all kiwifruit varieties at this time. For product testing results, see the [KVH website](#).

### Bee safety

All products listed below, when applied in their correct use periods, are known to be ‘bee safe’. However, they should not be applied when bees are actively foraging.

Product	Attributes	Considerations
<b>Coppers</b>		
<b>Nordox 75 WG™ (Cuprous oxide)</b>	Contain copper as cuprous oxide, which through a range of actions causes death of bacterial cells.	<ul style="list-style-type: none"> <li>Nordox 75 WG™ and Hortcare® Copper Hydroxide 300 are BioGro certified.</li> <li>Coppers should be applied with other proven Psa-V products to maximise disease control and to avoid the risk of copper tolerance developing.</li> <li>Do not use below-label rates as this increases the risk of copper tolerance developing.</li> <li>Time applications to ensure protection is in place around high-risk orchard activities and prior to high-risk weather identified by the KVH <a href="#">Psa-V Risk Model</a>.</li> <li>Apply under good drying conditions to avoid phytotoxicity.</li> <li>Multiple applications to the same leaves may cause damage over time (phytotoxicity).</li> <li>Do not tank mix with other products unless proven safe. Seaweed products are particularly high-risk.</li> <li>Coppers can be tank mixed with Actigard™ and Bactericides.</li> </ul> <p><b>Budbreak to harvest (spring/summer)</b></p> <ul style="list-style-type: none"> <li>In spring, cool, wet weather favours Psa-V and young tissue is particularly prone to infection. From bud-break, spray copper regularly ensuring expanding leaves, shoots and flower-buds have protection in place prior to high-risk weather.</li> <li>Applications should be approximately fortnightly or more frequently (10-14 days) if unfavourable weather conditions occur.</li> <li>Apply a combination of copper and Actigard™ close to flowering to provide protection through the flowering period.</li> <li>Once leaves have matured (summer) reduce copper sprays to 3-4 weekly intervals. However, ensure any new growth is protected before high-risk weather.</li> <li>Manufacturers of AG Copp 75 recommend applying alone post-flowering to reduce risk of fruit marking or leaf damage.</li> </ul> <p><b>Harvest to budbreak (autumn/winter)</b></p> <ul style="list-style-type: none"> <li>Autumn is high-risk for Psa-V. Spray protection should continue and young vines especially should be protected prior to high-risk weather.</li> <li>Apply copper and elicitors immediately after harvest and into the leaf-fall period to protect fruit stalks and leaf scars. Protection in autumn is believed to reduce infection in the following spring.</li> <li>Through winter apply copper after leaf-fall, before and after pruning and pre bud-break as a minimum. Maintain a seven-day window between copper and bud enhancing sprays.</li> </ul> <p><b>IMPORTANT NOTE:</b></p> <ul style="list-style-type: none"> <li>Follow manufacturer's spray interval recommendations, e.g. between copper and other products as below: <ul style="list-style-type: none"> <li>Movento: 5 days either side of application</li> </ul> </li> </ul>
<b>Kocide® Opti™ (copper hydroxide)</b>	Are relatively persistent on plant surfaces.	
<b>Hortcare® Copper Hydroxide 300</b>	Persistence varies with application rate, leaf expansion, product formulation and weather.	
<b>Coptyzin® (‘TEPA’ copper chelated by tetraethylene pentamine)</b>	Reapplication to expanding leaves is required.	
<b>Champ DP™ (copper hydroxide)</b>	Coppers are likely to provide protection for up to a month on mature leaves at label rates.	
<b>Tri-Base Blue® (tribasic copper sulphate)</b>		
<b>AG Copp 75 (cuprous oxide)</b>		

		<ul style="list-style-type: none"> <li>– Benefit: 7 days before or 3 days after</li> <li>– Oils: For Hayward, allow 5 day interval if spraying oil after copper; and allow a 3-day interval if spraying copper after oil. For Gold varieties, allow a 7-day interval on either side of application.</li> <li>– Foliars: refer to manufacturer</li> <li>– Harvest clean up sprays: refer to manufacturer</li> <li>– Budbreak sprays: 7 days either side of application</li> </ul>
<b>Bactericides</b>		
<b>Kasumin®</b>  <b>KeyStrepto™</b>	<p>Active ingredient in Kasumin® is Kasugamycin.</p> <p>Active ingredient in KeyStrepto™ is streptomycin.</p> <p>Bactericides are highly effective and are used against a range of bacterial diseases in horticulture.</p> <p>Bactericides are moderately rainfast but have a very limited residual life – approx. 3-7 days.</p>	<ul style="list-style-type: none"> <li>• <b>Bactericides have very strict use conditions.</b> Misuse of bactericides can result in fruit residue and/or resistance developing. Always refer to the <a href="#">User Guides</a>.</li> <li>• Bactericides should always be used in a spray programme with other recommended products with different modes of action. Alternate between bactericides to minimise risk of resistance.</li> <li>• Bactericides should only be used in high-risk situations and where PsA-V is present.</li> <li>• Two applications of bactericides are allowed during bud phase.</li> <li>• <b>Kasumin</b> may be used up to 21 days before the first flower (male or female) opens. Not permitted after 15 December 2015.</li> <li>• <b>KeyStrepto</b> may be used up to 7 days before the first flower (male or female) opens.</li> <li>• Bactericides can be tank mixed with copper.</li> <li>• Good coverage is required.</li> </ul> <p><b>Budbreak to harvest (spring/summer)</b></p> <ul style="list-style-type: none"> <li>• Apply bactericides only if sufficient leaf surface is present, i.e. leaf size of 3-4 cms.</li> <li>• Aim to apply immediately prior to high-risk weather. Application within 48 hours following high-risk weather will assist with disease control.</li> <li>• Bactericides must never be applied to open flowers.</li> </ul> <p><b>Harvest to budbreak (autumn/winter)</b></p> <ul style="list-style-type: none"> <li>• Use of bactericides is <b>strictly prohibited</b> during this period.</li> </ul>
<b>Elicitors</b>		
<b>Actigard™</b>	<p>Contains acibenzolar-s-methyl which activates the vine's natural defence system.</p> <p>Requires an activation period of approximately 4-7 days before fully effective. Likely to provide some control for 2-3 weeks.</p> <p>Refer to the <a href="#">Actigard™ User Guide</a>.</p>	<ul style="list-style-type: none"> <li>• Actigard™ should be used in a programme with other recommended products with different modes of action. Do not rely solely on Actigard™ for control.</li> <li>• Can be foliar or soil applied. Research is underway to understand optimal use conditions for soil applications.</li> <li>• Soil-applied Actigard™ is thought to trigger a whole vine response.</li> <li>• Foliar applications create a more localised effect. Therefore good coverage is required.</li> <li>• A maximum of four applications per season is allowed (harvest to harvest) regardless of application method or vine production status.</li> <li>• Actigard™ is compatible with copper products and bactericides.</li> <li>• Extreme care should be taken to avoid residues through spray drift or contamination from spray tanks onto flowers or fruit.</li> </ul> <p><b>Budbreak to harvest (spring/summer)</b></p> <ul style="list-style-type: none"> <li>• First application can be made when there is sufficient leaf to absorb Actigard™ (shoots ~100mm long). However, do not apply Actigard™ in the early spring growth period if vines are under</li> </ul>

		<p>stress due to water logging, wind, frost, hail or poor root or vine health. Delay application until 21-28 days prior to flowering.</p> <ul style="list-style-type: none"><li>• Two foliar applications are recommended pre-flowering on producing vines. 21 day intervals apply.</li><li>• Foliar applied Actigard™ to producing vines may be used up to the start of female flowering.</li><li>• Foliar applied Actigard to non-producing vines can be used up until 28 February 2016.</li><li>• Soil applied Actigard™ may be used up to harvest – a 14 day PHI applies.</li><li>• Extreme care should be taken to avoid residues through spray drift or contamination from spray tanks onto flowers or fruit.</li></ul> <p><b>Harvest to budbreak (autumn/winter)</b></p> <ul style="list-style-type: none"><li>• Apply with copper immediately after harvest to protect fruit stalks and leaf scars.</li><li>• Reapply three weeks later if canopy conditions allow to extend protection into winter.</li><li>• Elicitors are only effective if leaves are actively photosynthesising.</li></ul>
Other		
<b>Ambitious 10SL</b>	Contains forchlorfenuron, (CPPU) a synthetic plant growth regulator.	<p><b>IMPORTANT NOTE</b> <b>CANNOT BE USED between 28 February 2016 and 15 June 2016 unless a Zespri JA is granted (in extenuating circumstances only).</b></p> <ul style="list-style-type: none"><li>• CPPU products should be used in a programme with other recommended products.</li><li>• Compatible with copper products.</li><li>• Not recommended for use on Gold varieties as may cause shape issues.</li><li>• Do not use as a fruit sizer.</li><li>• Good coverage is required.</li><li>• Do not allow drift onto flowers or fruit as this will result in fruit residues.</li></ul> <p><b>Budbreak to harvest (spring/summer)</b></p> <ul style="list-style-type: none"><li>• Two applications are allowed between budbreak and 1 week before first flower opens.</li><li>• Applications midway between budbreak and flowering are the most effective for reducing leaf spot.</li><li>• First application can be made 2-3 weeks post budbreak if sufficient canopy present to absorb product (shoots ~100mm long). Apply 2 weeks later if making a second application.</li></ul> <p><b>Harvest to budbreak (autumn/winter)</b></p> <ul style="list-style-type: none"><li>• May only be used under extenuating circumstances and requires a Zespri-issued JA.</li></ul>
<b>Caplit™</b>	Mode of action is not clearly understood.  Refer to the <a href="#">CPPU User Guide</a> .	
Biological		
<b>BOTRY-Zen®</b>	Contains Ulocladium oudemansii, a naturally occurring saprophytic fungus.  BioGro certified.	<ul style="list-style-type: none"><li>• BOTRY-Zen is BioGro certified.</li><li>• Do not apply between fruit-set and harvest.</li><li>• BOTRY-Zen should be used in a programme with other recommended products.</li><li>• Can be tank mixed with copper. Apply immediately once mixed.</li><li>• Good coverage is required.</li></ul>

Resources:

- [Zespri Crop Protection Standard](#)—available on Zespri Canopy

# BIOSECURITY



**Protect your property from the entry and spread of pests and diseases. Report any suspected new pests or unusual symptoms to the MPI hotline on 0800 99 66.**

## Rationale

Early detection of new pests and diseases gives the best chance of control.

## Orchard Hygiene

**Develop and maintain strict orchard hygiene practices throughout the year. Ensure all visitors and staff are aware of, and follow these practices. These should include:**

- **Prominently displayed Psa-V signage at orchard entrances to raise awareness and restrict entrance onto the orchard. Ensure contact phone numbers are displayed on your sign.**
- **Designated parking to restrict vehicle on-orchard movement.**
- **Designated wash-down area for people, vehicles, tools and equipment on entry and exit to the orchard.**
- **Provide appropriate hygiene equipment, including disposal facilities.**
- **Sanitise all tools frequently based on risk. Between vines is recommended.**
- **Use KVH-approved sanitisers.**

## Rationale

Psa-V can spread within and between orchards via plant material, sap and soil. People, vehicles, equipment, tools, boots and clothing can transfer disease. Wash-down and sanitisation reduces the risk of disease spread.

Tools used for wounding activities such as pruning, grafting and girdling have the ability to transfer Psa-V from vine-to-vine. Sanitising these tools successfully decontaminates them.

KVH-approved sanitisers have been tested and have proven efficacy against Psa-V.

## Movement Controls

**Follow [KVH Protocols](#) for pollen, budwood, nursery stock, orchard equipment & infrastructure, beehives and other plant material.**

## Rationale

Movement of plant material poses the greatest risk of disease transfer. Movement controls minimise the risk of spreading Psa-V into regions where it has not yet been identified or where there is only limited infection. [KVH Protocols](#) and are a requirement of the National Psa-V Pest Management Plan (NPMP).

## Resources

- [KVH Protocol: Artificial Pollination](#)
- [KVH Protocol: Budwood](#)
- [KVH Protocol: Nursery Stock](#)



- [KVH Protocol: Orchard Equipment & Infrastructure](#)
- [KVH Protocol: Other Plant Material](#)
- [KVH Protocol: Pollination with Bees](#)
- [KVH Best Practice Advice—Orchard Hygiene](#) (includes KVH-approved sanitisers)
- KVH Best Practice Hygiene (Refer to page 35 of this Guide below)

## POLLINATION



**Minimise the risk of Ps-a-V introduction and spread through the pollination period by following [KVH Protocols](#) around the movement of bees and pollen.**

**Assess your orchard to determine future pollination requirements. Consider both artificial and bee pollination.**

**Aim to become self-sufficient through optimising pollination systems including selecting more Ps-a-V tolerant males, increasing numbers and distribution of males and managing male canopies to minimise Ps-a-V impacts. Ideally avoid the need for artificial pollination.**

### Rationale

Pollen and bees have the potential to act as a Ps-a-V vector. [KVH Protocols](#) minimise the risk of contamination of orchards through the placement and feeding of pollination hives during pollination and the movement of hives following pollination.

Ps-a-V has the ability to affect natural pollination. Well-managed males reduce the risk of Ps-a-V infection and flower loss, and the potential requirement for artificial pollination.

### Pollination with Bees

**Work with your beekeeper to ensure hygiene and KVH Protocols are being observed. Provide mats or pallets for consolidated beehive placement; and adequate wash-down facilities for the beekeeper vehicles.**

**Do not introduce hives until at least 10 percent of female flowers have opened and manage swards to reduce the presence of open flowers around the pollination period.**

### Rationale

Beekeeping equipment including vehicles and beehives has the potential to introduce and/or spread Ps-a-V through hitch-hiking soil or plant material.

Timely introduction of hives reduces foraging in nearby orchards and sward management avoids attracting bees from neighbouring properties. Reduction of the bees foraging range reduces potential cross contamination from outside orchards.

Hive consolidation reduces vehicle movement within the orchard.

## Artificial Pollination

**Apply pollen milled from flowers sourced from within the same orchards where possible. Ensure purchased pollen is collected, milled, packaged and supplied in compliance with KVH Protocols. Order pollen early from KVH-registered pollen providers for future pollination requirements and store pollen for next season wherever possible.**

### Rationale

New Zealand must become self-sufficient for future pollination as imported pollen is banned. While New Zealand does not currently have a pollen shortage, a bad Psa year could possibly impact future pollen supply. Therefore its essential growers plan ahead for future pollination requirements.






### Resources

- [KVH Protocol—Pollination with Bees](#)
- [KVH Protocol—Artificial Pollination](#)
- KVH Best Practice—Pollination (Refer Page 39 of this Guide below)

## KVH BEST PRACTICE—ORCHARD HYGIENE (one pager)

Key principles: Psa is easily spread through infected plant material and soil. Good hygiene will limit, or prevent, Psa-V spread by people, machinery and vehicles moving between orchards.



	1. Orchard visitors, staff and contractors	2. Tool hygiene	3. Machinery and Vehicle hygiene	4. Harvest hygiene	5. Plant material, orchard equipment & infrastructure
What To Do	Comply with Orchard Hygiene procedures at all times.	Sterilise tools at a frequency that reflects orchard risk i.e. infection level, variety, region.	Minimise equipment movement between orchards. Deny access to dirty machinery.	Clean and sanitise bags used for flower and fruit harvest. Ensure bins are cleaned and sanitised.	Ensure KVH Protocols are followed. Refer to <a href="http://www.kvh.org.nz/kvh_protocols">www.kvh.org.nz/kvh_protocols</a> .
Purpose	Avoid disease entry through plant material and soil transfer. Avoid inoculum transfer between orchards.	Avoid inoculum introduction through sap or plant material. Avoid inoculum transfer between vines.	Avoid disease entry and transfer via plant material, sap or soil.	Avoid disease entry and transfer via plant material and soil.	Avoid disease entry and transfer through movement of risk items.
How To Do	<p><u>Prior to entry</u> Contact the orchard manager to understand requirements.</p> <p><u>On Entry and Exit</u></p> <ul style="list-style-type: none"> <li>• Ensure headwear, hair, clothing and footwear are clean of plant material and soil.</li> <li>• Sanitise hands and footwear (Change footbath solution at least daily).</li> <li>• Wear protective clothing (hairnets, overalls, bootees, gloves) as requested by the orchard manager</li> <li>• Place all used clothing in special purpose rubbish bins</li> <li>• Work from least infected to most infected blocks.</li> </ul>	<ul style="list-style-type: none"> <li>• Use tools provided at the orchard <u>OR</u> thoroughly clean and sanitise tools on orchard entry. Remove all plant residues including sap.</li> <li>• Use sanitisers with proven effectiveness against Psa-V.</li> <li>• Sterilise tools between vines. Consider the use of two sets of tools (this allows one set to be soaked in sanitiser while the second set is in use).</li> <li>• Consider the possible implications of selected sanitisers – corrosiveness and impact on scions ( grafting tools).</li> </ul>	<ul style="list-style-type: none"> <li>• Minimise movement on and off the property. Consider use of dedicated vehicles and orchard equipment.</li> <li>• Use designated tracks and parking and wash-down areas.</li> <li>• <u>On Entry and Exit</u></li> <li>• Ensure vehicles and equipment are clear of plant material and soil.</li> <li>• Sanitise with particular attention to tyres, wheel arches, undersides of vehicles and vehicle decks.</li> <li>• Choose sanitisers with proven efficacy on rubber (tyres)</li> <li>• Minimise vehicle movement from infected to clean blocks.</li> </ul>	<ul style="list-style-type: none"> <li>• Use bags provided at the orchard <u>OR</u> thoroughly clean and sanitise bags prior to orchard entry.</li> <li>• Avoid placing bags on the ground</li> <li>• Work from least-infected to most-infected blocks.</li> <li>• Require complete cleaning and sanitising of bins prior to delivery to the orchard - Use surface suitable sanitisers Ensure bins remain clear of plant material</li> <li>• Minimise bin exposure to soil, mud and plant material. Use hard stand, load out areas</li> <li>• Avoid bin storage in production areas.</li> <li>• Cover full bins in compliance with KVH regional bin transport requirements</li> </ul>	<p>Ensure compliance with <a href="#">KVH Protocols</a> for:</p> <ul style="list-style-type: none"> <li>• <a href="#">Nursery Stock</a></li> <li>• <a href="#">Budwood</a></li> <li>• <a href="#">Other Plant Material</a></li> <li>• <a href="#">Orchard equipment &amp; infrastructure</a></li> <li>• <a href="#">Pollination with Bees</a></li> <li>• <a href="#">Artificial Pollination</a></li> </ul>
Notes					

# CONVENTIONAL SANITISERS AND DISINFECTANTS

When choosing sanitisers:

- Choose products which are proven to be effective against bacteria (Psa-V).
- Confirm the contact time required to kill the bacteria if sanitiser is applied as a spray or dip.
- Consider user safety.
- Consider corrosiveness of the product on machinery and equipment (the lower the pH, the more corrosive the product).
- Ensure product concentrations are accurate and solutions are replenished regularly (particularly when using footbaths, which can become heavily contaminated).
- Avoid DDAC and other quaternary ammonium based compounds for use as fruit bin or picking bag sanitisers. These products create fruit residue risk (eg, EnviroSan, SteriGene, Varicide and Virkon). Refer to export marketer requirements, eg, ZESPRI 'List of Cleaning and Sanitising Products', to check the acceptability of products used on fruit contact surfaces.

## Research

Efficacy associated with spraying and dipping (shallow immersion) for times from 10 seconds through to two minutes on wood, mild steel, plastic and rubber have been reported to provide 'practical' solutions. Refer to [Disinfectant Efficacy Testing](#) (VLS, 2012) and [Disinfectant Efficacy Testing](#) (VLS, 2013) on the KVH website [www.kvh.org.nz/vdb/document/91123](http://www.kvh.org.nz/vdb/document/91123) and [www.kvh.org.nz/vdb/document/91553](http://www.kvh.org.nz/vdb/document/91553).

				Minimum time required for kill efficacy									
Summary				Sensitive to		Spray Applied				Dip Applied			
Product tested	Conc <sup>n</sup>	pH	Likely residue	pH	OM	Wood	Plastic	Tyre	Metal	Wood	Plastic	Tyre	Metal
EnviroSan *	1%	6.9	Yes	B	NS	10s	1 min	NE	10s	10s	10s	NE	10s
SteriGene *	1%	7.3	Yes	NS	NS	30s	NE	NE	10s	10s	NE	NE	10s
Citrox	1%	6.4	No	NS	NS	10s	10s	NE	2 min	10s	1min	NE	2min
Janola	1%	8.4	No	NS	S	10s	10s	10s	10s	10s	10s	10s	10s
Virkon *	1%	4	Yes	NS	S	10s	10s	10s	10s	10s	30s	10s	10s
H <sub>2</sub> O <sub>2</sub>	3%	6.8	No	NS	NS	10s	NE	2min	10s	10s	2min	NE	10s
Teracep	1%	4.8	No	NS	S	10s	10s	10s	10s	10s	30s	3s	10s
Kiwilustre	1%	4.1	No	S	NS	10s	NE	NE	30s	10s	10s	10s	2min
Extinct pure	1%	4	No	NS	NS	10s	2min	NE	10s	10s	2min	NE	10s
Citric acid	3%	2.5	No	S	NS	10s	10s	30s	10s	10s	10s	10s	10s
Aussan L44	0.3%	3.4	No	-	NS	10s	10s	10s	30s	30s	30s	30s	1 min
Harvestcide Gel	0.1%	5.5	No	NS	NS	10s	10s	10s	10s	10s	10s	10s	10s
Citrox 14T	1%	3.9	No	NS	NS	1 min	1 min	1 min	30s	10s	1 min	1	30 sec
BioWash	1%	8.8	No	NS	S	1 min	2 min	NE	NE	2 min	2 min	NE	1 min
Nuron BioSafe	0.1%	7.2	No	NS	NS	10s	10s	10s	10s	10s	30s	10s	10s
Active Clean B	5%	4.5	No	NS	NS	10s	10s	10s	10s	10s	10s	10s	30s
Byotrol *	0.5%	6.9	Yes	NS	NS	10s	10s	10s	10s	10s	10s	10s	10s

**Table 1—Summary of results – VLS Disinfectant Efficacy Testing**

\* Not for use on surfaces that come into contact with fruit due to potential residue issues. Refer to Zespri's list of cleaning and sanitising product or a list from your marketer.

Abbrev: NE = Not Effective, NS = Not Sensitive, S = Sensitive, B = Sensitive to basic conditions, OM = Organic matter

Other products shown to be effective against Psa include the following.

- Varicide and methylated spirits (70% alcohol solution). Refer to [Testing for Psa contamination of surfaces](#) (Plant and Food Research) on the KVH website [www.kvh.org.nz/vdb/document/91202](http://www.kvh.org.nz/vdb/document/91202).
- Sodium hypochlorite (0.5, 1%, 3%) and Path-Away™. Refer to [Efficacy of Sanitisers against Psa](#) (Plant Food and Research) on the KVH website [www.kvh.org.nz/vdb/document/246](http://www.kvh.org.nz/vdb/document/246).

## Hand sanitisers

Suitable products include disinfectant sprays, gel foam or liquid antiseptic solutions.



## KVH BEST PRACTICE—ORCHARD MONITORING (one pager)



- Early detection and early intervention is the most effective method of controlling or minimising the impact of PsA-V. Frequent orchard monitoring will ensure early detection.

Questions	Answers	KVH resources
<b>When and how often should I monitor?</b>	<ul style="list-style-type: none"> <li>• Spring and Autumn are considered higher risk infection periods</li> <li>• Start shortly before budburst, weekly monitoring is advised.</li> <li>• Ideally every plant should be inspected but at least 25% of the orchard area should be covered in each round.</li> <li>• Monitoring is easiest with two people –walking either side of a vine/row.</li> <li>• Walk in a different direction for each round</li> <li>• Vines are driest and light best to see clearly, between 9am and 3pm.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>PsA-V Monitoring</i></li> </ul>
<b>Where should I focus on in my orchard?</b>	<ul style="list-style-type: none"> <li>• Focus on high risk plants that will show infection first: <ul style="list-style-type: none"> <li>• GOLD is more susceptible than GREEN</li> <li>• Young vines are more susceptible than older vines</li> <li>• Male vines are generally more susceptible than female vines.</li> </ul> </li> <li>• Focus on high risk areas of your orchard where infection may appear first: <ul style="list-style-type: none"> <li>• Areas near gaps in shelter exposed to prevailing winds</li> <li>• Edge of blocks with more vehicle movement around the orchard</li> <li>• Areas of stressed vines e.g. frost pockets, water-logged and wind prone areas.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <i>PsA-V Monitoring</i></li> <li>• <i>PsA-V Risk Considerations</i></li> </ul>
<b>What should I look for?</b>	<ul style="list-style-type: none"> <li>• PsA-V symptoms may differ with time of year and the variety.</li> </ul> <p><b>Spring</b> Once there is a canopy, leaf spotting and in advanced cases shoot dieback. Blackened flower buds. Check 10-14 days after high-risk weather events. Leaf spot is not commonly seen in Gold3 – look for shoot or cane dieback. Cane dieback may occur anywhere along the cane, not limited to the end.</p> <p><b>Summer</b> A quieter time for the appearance of symptoms although shoot dieback in all GOLD varieties appears to increase from late summer to early autumn.</p> <p><b>Autumn</b> Most common symptom seen is dieback in replacement and fruiting canes. Wire rub on young vines may result in wounds which provide an entry point for PsA-V.</p> <p><b>Winter</b> The most common symptom is red exudate in canes or leaders. Usually first seen in males. Trunks cut ready for grafting should be inspected as they may show exudate if infected.</p>	<ul style="list-style-type: none"> <li>• KVH fact sheet <a href="#">Identification of PsA-V symptoms</a></li> <li>• YouTube demonstration video on <a href="#">PsA-V monitoring and common symptoms</a></li> <li>• <a href="#">PsA-V Symptoms Guide</a></li> <li>• <a href="#">Orchard PsA-V Biosecurity Guide</a></li> <li>• <a href="#">PsA-V Symptoms Guide for ZESPRI varieties</a></li> <li>• <a href="#">PsA Yearly Monitoring Guide</a></li> </ul>
<b>What do I do if I find symptoms on my orchard?</b>	<ul style="list-style-type: none"> <li>• Photograph and tag the area on the orchard where you have seen symptoms.</li> <li>• Contact your packhouse PsA-V manager or KVH for symptom confirmation and sample collection.</li> <li>• Absence of obvious symptoms does not necessarily mean absence of PsA-V.</li> <li>• Even if no symptoms are found regular monitoring should continue.</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">PsA-V sampling</a></li> </ul>

## KVH BEST PRACTICE—MANAGING INFECTED MATERIAL (one pager)




- Key principles: Monitor frequently. Remove infected material as it is found. Bury or burn onsite; or mulch finely. Follow [KVH Protocol: Disposal Options](#).



	1. Hayward or New Varieties	2. Infected Males	3. Notch-grafted vines	4. Hort16A	
What To Do	Identify the number of infected vines and symptom severity. Remove or manage infection accordingly.	Identify the number of infected vines and symptom severity. Assess impact on pollination and manage risk accordingly.	Identify the number of infected vines and symptom severity. Assess impact on grafted scions.	Aggressively cut out secondary symptoms.	
Purpose	Reduce inoculum levels. Prevent infection spread within vines and within the orchard.	Reduce inoculum levels. Balance infection removal with the need to maintain sufficient flower for pollination. Refer to <a href="#">KVH Information Sheets</a> on males.	Reduce inoculum levels. Manage infection to ensure young scions are not at risk.	Minimise infection spread in this highly-susceptible variety.	
How To Do	<ul style="list-style-type: none"> <li>Monitor blocks and record percentage of vines infected and symptom severity.</li> <li>Where only a few plants are infected consider cutting whole vines.</li> <li>Where infection is wide-spread manage by cutting out or cauterising cankers.</li> <li>Remove infected material. Bury or burn onsite.</li> <li>Maintain an on-going protective spray programme.</li> </ul>	<ul style="list-style-type: none"> <li>Monitor blocks and record percentage of vines infected and symptom severity.</li> <li>Where only a few plants are infected consider cutting whole vines.</li> <li>Where infection is wide-spread manage by cutting out or cauterising cankers.</li> <li>Remove infected material. Bury or burn onsite.</li> <li>Maintain an on-going protective spray programme.</li> <li>Do not harvest flowers from vines expressing secondary symptoms.</li> <li>Consider cut-out of susceptible males following flowering.</li> </ul>	<ul style="list-style-type: none"> <li>Cut canopy where infection is seen.</li> <li>If disease spread is rapid within a block, cut the canopy to preserve grafted scions.</li> <li>Consider applying an elicitor 5–7 days prior to canopy removal.</li> </ul>	<ul style="list-style-type: none"> <li>Cut canopy as soon as infection is seen.</li> <li>If disease spread is rapid within a block, cut vines with a view to re-grafting to a more-tolerant variety.</li> <li>Consider applying an elicitor 5–7 days prior to canopy removal.</li> <li>Cut vines back to tolerant rootstock where possible.</li> <li>Promote sucker growth to provide additional grafting options.</li> </ul>	
Notes	<ul style="list-style-type: none"> <li>Young vines are more susceptible than mature vines. Therefore, management of infection should be more proactive in newly-grafted and young blocks.</li> </ul>	<ul style="list-style-type: none"> <li>Have a pollination plan in place if the decision to cut out males is made.</li> <li>Collect flowers or pollen for next season where possible.</li> <li>In Hayward blocks, spray and manage cankers until pollination is complete.</li> </ul>	<ul style="list-style-type: none"> <li>Work in conjunction with your packhouse Psu-V rep to prepare a management plan ready for decisions around cut out.</li> <li>Establishing young grafts in an infected orchard is extremely challenging.</li> </ul>	<ul style="list-style-type: none"> <li>Work in conjunction with your packhouse Psu-V rep to prepare a management plan ready for decisions around cut out.</li> <li>Consider re-planting if vines are on highly-susceptible Chinensis rootstock.</li> </ul>	
Keep monitoring throughout the season. Monitor, mark and then follow up with cut out. Carry out removal of infected canopy material in dry conditions. Sterilise tools between vines, and apply a wound protectant that provides a persistent physical barrier to all wounds. Maintain an on-going protectant spray programme to reduce inoculum levels. Protect suckers being maintained as future grafting options with protectant sprays.					


## KVH BEST PRACTICE—POLLINATION (one pager)



	1.Pollen – sourcing	2. Pollen – application /hygiene	3. Beehives – movement	4. Beehives – Hygiene	Photos
What	Comply with <a href="#">KVH Protocol: Artificial Pollination</a>		Comply with <a href="#">KVH Protocol: Pollination with Bees</a>		 
Purpose	Mitigate the potential for Psa-V contamination of the orchard by the use of artificial pollination.		Mitigate the potential for Psa-V contamination of the orchard by the use of pollination hives		
How	<ul style="list-style-type: none"><li>● Assess orchard pollination requirements - if possible avoid using artificial pollination.</li><li>● Do not collect flowers from infected vines expressing Psa-V secondary symptoms.</li><li>● Where possible apply pollen milled from flowers sourced from within the same orchard.</li><li>● Ensure purchased pollen is collected, milled, packaged and supplied in compliance with <a href="#">KVH Protocol: Artificial Pollination</a></li><li>● Ensure pollen is clearly identified and full traceability and application records are maintained</li><li>● Any movement of surplus pollen must comply with <a href="#">KVH Protocol: Artificial Pollination</a></li></ul>	<ul style="list-style-type: none"><li>● Comply with KVH orchard cleaning and hygiene procedures for:<ul style="list-style-type: none"><li>- staff and contractors</li><li>- picking bags ( flower picking)</li><li>- applicator equipment</li><li>- machinery movements</li><li>- pollen movement controls</li></ul></li></ul>	<ul style="list-style-type: none"><li>● Know where your beehives have come from.</li><li>● Confirm KVH movement controls are being observed.</li><li>● Minimise the presence of Psa-V infected flowers prior to hive introduction.</li><li>● Ensure ≥10% of female flowers are open when hives are introduced – this avoids off-orchard foraging</li><li>● Mange swards to reduce the presence of open flowers and avoid attracting neighbourhood bees. This includes post orchard pollination.</li></ul>	<ul style="list-style-type: none"><li>● Comply with KVH orchard cleaning and hygiene procedures for<ul style="list-style-type: none"><li>- staff and beekeepers</li><li>- hive auditors</li><li>- hive feeders</li><li>- hive placement and movement</li><li>- machinery movements</li></ul></li><li>● Consolidate hive placement to minimise on orchard vehicle movements</li><li>● Keep access ways clear so hives can be placed without any contact with vines or shelter.</li><li>● Use dedicated orchard vehicles for hive placement and hive feeding.</li></ul>	
Notes	<ul style="list-style-type: none"><li>● Application of Bactericides <b>must stop</b> at least one week before the first flower opens</li><li>● Pollen and bees have the potential to act as a Psa-V vector.</li><li>● Growers should only purchase pollen from suppliers registered with KVH.</li><li>● Safety of historically-produced pollen is based on collection date, flower source and milling site. KVH can confirm historical Psa-V status of KPINS as required.</li></ul>				

## KVH BEST PRACTICE—CANOPY MANAGEMENT (Budbreak to harvest)

**Key principles:** Spring is high risk for PsA-V. Infection can also occur over summer in high-risk weather periods. Natural wounds (*bud-break, wind damage, frost*) and man-made wounds (*crush-tip/ripping/zero-leaf/pruning/stubbing/flower picking and thinning*) all provide possible entry points for disease. Minimise wounding and maintain on-going complete coverage of expanding leaves, new growth and flowers with protectant sprays to reduce PsA-V infection risk.





	1. Canopy structure	2. Canopy management to reduce vigour	3. Avoid wound infection	4. Minimise male risks	5. Minimise girdling risks
What To Do	Maintain a flat open canopy.	Manage canopy vigour early and often.	Protect all wounds.	Manage males to minimise the need for pruning cuts.	Girdle accurately and only in low risk environments.
Purpose	Optimise spray coverage and Promote quick-drying to reduce phytotoxicity risk.	Minimise the number and size of wounds.	Minimise chances of PsA-V entry and subsequent systemic infection.	Minimise vine and orchard risk of PsA-V.	Minimise chances of systemic infection of plants.
How To Do	<ul style="list-style-type: none"> <li>● Keep leader zones open.</li> <li>● Evenly space canes.</li> <li>● Avoid overlapping canes in row centres.</li> <li>● Maintain gaps down the centres of wide rows or in situations where stringing configurations could compromise spray coverage.</li> <li>● Select low and medium vigour wood.</li> </ul>	<ul style="list-style-type: none"> <li>● Tip squeeze early and repetitively to check the canopy.</li> <li>● Remove leader re-growth and blank shoots early and often -this avoids large cuts later.</li> <li>● Use zero-leaf pruning to avoid mid-row clutter.</li> <li>● Moderate fertiliser inputs and avoid excess nitrogen application.</li> </ul>	<ul style="list-style-type: none"> <li>● Ensure a protective spray cover is in place around wounding activities.</li> <li>● Apply elicitors 4–7 days prior to major risk periods, e.g. flowering.</li> <li>● Choose dry weather for wounding activities.</li> <li>● Maintain orchard hygiene on entry and exit of the orchard.</li> <li>● Sterilise tools between vines.</li> <li>● Apply wound protectants to woody cuts (sealants or protective pastes) and follow pruning rounds with protectant sprays.</li> </ul>	<ul style="list-style-type: none"> <li>● Maintain a low, flat, open canopy to optimise spray coverage.</li> <li>● Minimise vegetative growth (e.g. crush tip new shoots, and button-cut strong canes to reduce vigour. Promote spurs.)</li> <li>● Only prune in dry weather and wound protect.</li> <li>● Remove susceptible male varieties to avoid infection risk</li> <li>● Ensure new growth following male pruning is covered with protectant sprays.</li> </ul>	<ul style="list-style-type: none"> <li>● Avoid girdling if inoculum risk is high.</li> <li>● Only girdle in low-risk weather periods.</li> <li>● Avoid girdling stressed weak vines or young scions.</li> <li>● Choose trunk girdling of mature rootstocks over cane girdling or girdling of scions.</li> <li>● Avoid girdling too deep -deeper than cambian layer</li> <li>● Girdling knives may be safer than chains especially on thinner trunks. Maintain strict tool hygiene between vines.</li> <li>● Wound protect all girdles eg with a copper paste.</li> </ul>
Notes	<ul style="list-style-type: none"> <li>● Use medium to low vigour canes as these require less intervention.</li> </ul>	<ul style="list-style-type: none"> <li>● Confirm the need for fertiliser and foliar inputs through leaf and soil samples.-refer to fertiliser consultants.</li> <li>● Manage canopies to ensure there are no more than 4 leaf layers thick.</li> <li>● Root pruning may also be considered to reduce vigour</li> </ul>	<ul style="list-style-type: none"> <li>● Use the <a href="#">KVH PsA-V Risk Model</a> to determine suitable weather conditions and low risk periods for wounding activities.</li> </ul>	<ul style="list-style-type: none"> <li>● Girdling or root ripping of males may be valuable to reduce vigour but there may be an increased infection risk.</li> <li>● Flower picking creates wounds-avoid wet weather and follow-up with protective sprays.</li> <li>● Consider use of elicitors pre flowering.</li> </ul>	<ul style="list-style-type: none"> <li>● Girdling is a high risk activity in PsA-V affected areas. If done correctly it should not create a risk significantly greater than other pruning activities.</li> </ul>



## KVH BEST PRACTICE—GRAFTING (one pager)

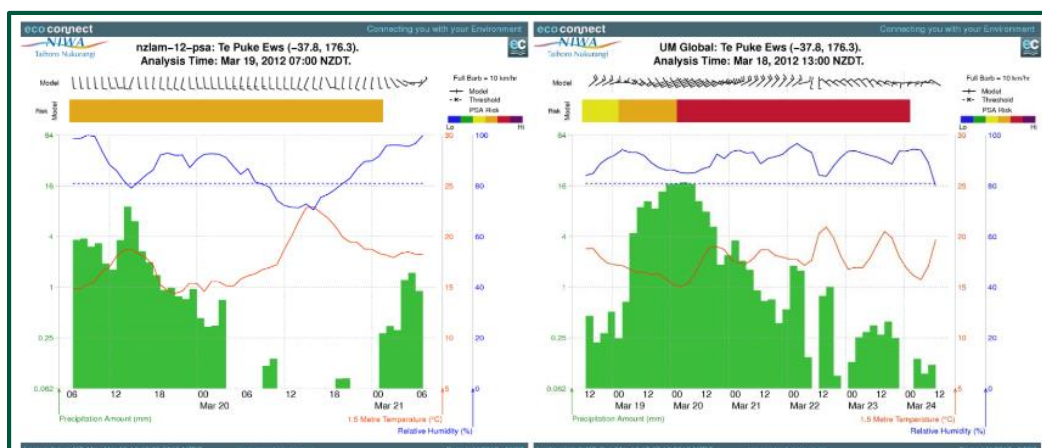
**Key principles:** Ensure tools are sterilised between vines, avoid risk of scion and stump contamination, work from least infected to most infected blocks and protect young growth.



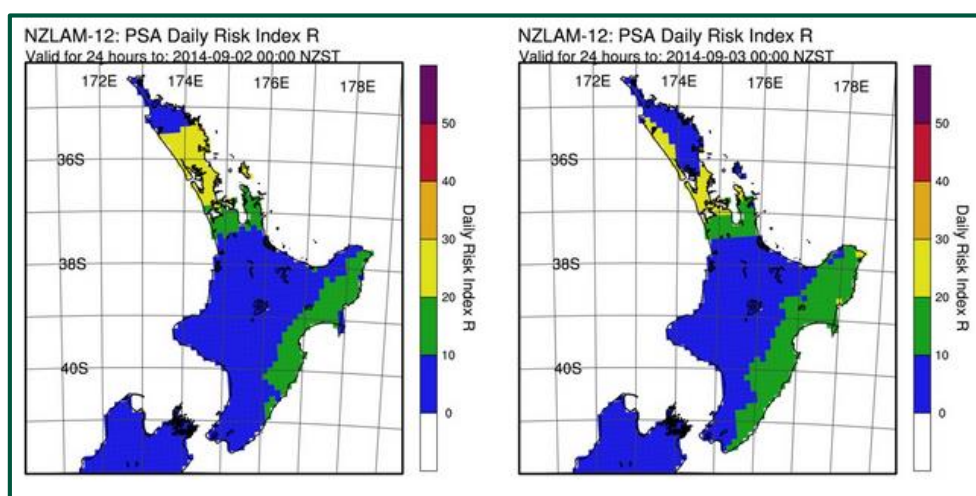
	1. Prior to grafting	2. Preparing graft	3. Post-grafting	4. Protecting new growth	Reminders
What to do	Remove infected material and apply a protectant spray	Sanitise tools used to prepare scions and stump. Protect scions.	Cover placed scions (and stump) with a protectant sealant.	Protect scions and new growth.	<ul style="list-style-type: none"> <li>● Grafting hygiene practices are required in all regions.</li> </ul>
Purpose	Reduce inoculum level in the block. Protect stumps from environmental inoculum.	Avoid the risk of scion and stump contamination and/or disease transfer.	To protect scion/stump from exposure to environmental inoculum.	Minimise the risk of new growth becoming infected.	<ul style="list-style-type: none"> <li>● The <a href="#">KVH Psa-V Risk Model</a> is a tool for growers to identify infection risk periods associated with weather events.</li> </ul>
How	<ul style="list-style-type: none"> <li>● Apply copper sprays. Refer to spraying section on pages 20-27 of this document.</li> <li>● Paint stumps and wounds from removed suckers with a wound sealant.</li> </ul>	<ul style="list-style-type: none"> <li>● Sanitise all grafting tools prior to and following cutting scions or splitting stumps. <a href="#">Envirosan</a>, <a href="#">Citrox</a>, <a href="#">Bleach</a>, <a href="#">Virkon</a>, <a href="#">Meths</a> are examples of suitable sanitisers.</li> <li>● Avoid placing tools on the ground.</li> <li>● Ensure scions remain protected prior to placement i.e. don't leave cut scions in open air environment or on the orchard floor.</li> <li>● Graft in dry weather when infection risk is low.</li> </ul>	<ul style="list-style-type: none"> <li>● Cover all exposed surfaces with a persistent sound sealant.</li> </ul>	<ul style="list-style-type: none"> <li>● Ensure sealant is reapplied if washed off.</li> <li>● Maintain a protective cover on new growth.</li> <li>● For product choices refer to KVH Recommended Product List.</li> </ul>	<ul style="list-style-type: none"> <li>● Ensure a physical barrier is maintained on stump and scion wounds as these are entry points for Psa-V.</li> <li>● Grafts close to the ground may be at higher risk to contamination from the orchard floor i.e. Psa-V has been found in mulched plant material up to 15 weeks later.</li> <li>● Aim to complete grafting in the appropriate grafting windows. Failure to do so may result in sap build up and consequently stumps may need to be bled – creating additional wounds.</li> <li>● Consider keeping suckers as a plan B in case new growth succumbs to infection.</li> <li>● Maintain records on grafting i.e. Where grafters have come from, what tools they have brought with them, and their intended grafting work plan.</li> <li>● <a href="#">Grafting video demonstration</a></li> </ul>
Image					

Refer to [KVH Protocol: Nursery Stock](#) for more information on the movement of budwood and nursery stock to orchards and between regions.

# KVH PSA-V RISK MODEL



Above: Two-day risk model for Te Puke area



Above: Two-day New Zealand risk maps

Use the KVH Psa-V Risk Model to view up to six days of forecasted low-risk and high-risk weather. Identify suitable upcoming weather conditions when planning your orchard activities. For example, plan high-risk activities like pruning and girdling during low-risk weather; and ensure a protective spray cover is applied prior to high-risk weather.

- Low-risk weather will be indicated by blue and green bars on the daily horizontal risk bar
- Moderate risk periods by yellow and orange
- High risk periods associated with wet conditions are indicated by red and purple on the risk index.
- If frost, wind or hail is likely, risk increases as damaged tissue heightens the risk of Psa-V entry into the plant. In these conditions, orange could be considered high-risk.

## Rationale

Weather conditions play a role in the spread of Psa-V and in the expression of disease symptoms. Frosts, hail events and strong winds can damage vines and cause wounds. The KVH Psa-V Risk Model can identify upcoming high-risk periods and low-risk periods to assist growers planning orchard activities. It assigns a daily risk index based on forecasted rain, temperature and humidity which combines to predict the relative risk of Psa-V multiplication.

## Resources



- [KVH Psa-V Risk Model](#)
- [KVH Psa-V Risk Model User Guide](#)
- [New Zealand Risk Maps](#)

# Psa-V

## Yearly Monitoring Guide

Kiwifruit Vine Health | 0800 665 825  
www.kvh.org.nz

### WHAT TO LOOK FOR

						
<b>LEAF SPOT</b>	<b>SHOOT DIEBACK</b>	<b>CANE DIEBACK</b>	<b>BUD INFECTION</b>	<b>FRUIT SHRIVEL</b>	<b>RED/ORANGE EXUDATE</b>	<b>WHITE EXUDATE</b>
<ul style="list-style-type: none"> <li>• with/without halo</li> <li>• less common in new varieties</li> <li>• <u>continue to monitor</u></li> </ul>	<ul style="list-style-type: none"> <li>• young soft green shoot dieback</li> <li>• <u>remove and dispose</u></li> </ul>	<ul style="list-style-type: none"> <li>• dehydrated cane</li> <li>• <u>remove and dispose</u></li> </ul>	<ul style="list-style-type: none"> <li>• darkened buds / stalks</li> <li>• <u>record flower loss</u></li> </ul>	<ul style="list-style-type: none"> <li>• associated with cane die back</li> <li>• <u>remove and dispose (cane)</u></li> </ul>	<ul style="list-style-type: none"> <li>• test to confirm</li> <li>• <u>remove infected tissue</u></li> </ul>	<ul style="list-style-type: none"> <li>• test to confirm</li> <li>• <u>remove infected tissue</u></li> </ul>

### Psa-V

#### What to look for

- Leaf spot
- Shoot dieback
- Cane dieback
- Bud infection
- Fruit shrivel
- Red exudate
- White exudate

#### Risk factors

- Inoculum presence
- Rain
- 12 - 20°C

### GROWER ACTIONS

- Maintain a protectant spray programme
- Monitor regularly
- Remove infected material
- 'Doing nothing is not an option'

Season	Winter			Spring			Summer			Autumn			
	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	
	Dormant		Bud break		Flowering		Fruit set		Fruit growth		Leaf fall		
	Winter prune		Bud break sprays	Bud and flower thinning + pollination		Male prune		Canopy management + thinning + girdling				Harvest	
Symptoms				LEAF SPOT									
	SHOOT DIEBACK												
	CANE DIEBACK												
					BUD INFECTION								
							FRUIT SHRIVEL						
RED / ORANGE or WHITE EXUDATE													

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