



Impact of covered structures on the progression of Psa-V

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Executive Summary

Impact of covered structures on the progression of Psa-V

Casonato S, Manning M, Reynolds S, Horner I, February 2013, SPTS No. 7940

Initial results from infected mature vines placed under plastic, breathable covering structures, indicated there is little to no reduction in the expression of disease relative to that observed in vines in uncovered areas. The trend observed in Canon Rd and Tuapiro Rd suggests that, at this stage, the symptoms that are being exhibited in the vines undercover are still from the infections that occurred before the covers being erected. It will be critical to continue monitoring these plants to determine whether the symptoms of Psa infection will decline with potentially reduced inoculum levels likely to occur in the presence of the covers.

The preliminary results do suggest that when clean plants are placed under covers they remain relatively disease free and have fewer visible symptoms of Psa-V infection even though they were placed in close proximity to already infected mature vines. These trials need to continue to monitor the progression of the disease in the uncovered and covered areas throughout the entire growing season.

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1 Introduction

Psa-V proliferates in moist environments with rain events shown to exacerbate symptoms of the disease. In drier, warmer conditions the progression and expression of Psa-V is lessened. Based on this knowledge a number of growers are considering the construction of large plastic shelters over existing kiwifruit blocks. The proposition is that if vines are kept under cover where leaf and vine wetness is minimised, this could potentially lessen the impact of the disease. The main questions that this trial will address are:

1. Does covering plants reduce the infection of kiwifruit vines, or reduce the progression of symptoms in vines already infected with Psa-V?
2. Does the covering reduce the inwards movement of inoculum (e.g. from the rain aerosol, or rain splash of inoculum from soil or debris)?
3. Does growing undercover affect kiwifruit yield and dry matter?

The effect of covering vines that are already infected with Psa is unknown and is a critical question as this is the most probable scenario given the disease status of the majority of kiwifruit orchards. The outcomes of this project will be used to guide growers on the potential with using covered structures for preventing or slowing infection with Psa.

2 Methodology

Trials were established at three sites: Canon Road and Tuapiro Road in Katikati, and Maungarangi Road in Paengaroa. Each trial area is planted with a different Zespri cultivar: 'Hort16A' at Canon Road, 'Zesy003' (Gold9) vines notch grafted with 'Zesy002' (Gold3) at Tuapiro Road and a row of 'Zesh004' (Green14) and Gold9 at Maungarangi Road. The vines at Maungarangi Road were badly affected by the spring frosts in 2012 and were cut back to the leaders. At this site, uninfected potted 'Hort16A' and Gold3 vines were planted out within the existing rows. All three sites were infected with Psa-V at the onset of the trials. The Canon Road orchard appeared to have the least visible secondary symptoms associated with the virulent strain of *Pseudomonas syringae* pv. *actinidiae* (Psa-V) at the start of the trials and before adding the covering structures. At each site, the growers have installed a structure to cover a length of the block, spanning four rows by three bays. For replication for research purposes, the growers installed the covers so that there are three covered areas and three uncovered areas alternating along the length of the structure. In addition, at the two Katikati sites, rows outside the covered block were also assessed as controls.

At the Katikati sites, trap plants (*Actinidia chinensis* seedlings) were planted in covered and uncovered areas. At the Maungarangi Road site, grafted 'Hort16A' and 'Gold3' vines were planted within each bay down two central rows of the trial block

Mature and newly planted vines were assessed at regular intervals. Assessments within the covered area were only on the central two rows and away from the edge of the cover. Mature vines were assessed for the number of canes and the presence of secondary symptoms on canes or leaders. After each monitoring round, canes with dieback were marked and removed by the orchard manager; therefore the count of canes reflects the amount of material that has been removed as a result of Psa infection. Recently planted vines have also been assessed for the incidence and severity of Psa leaf spot symptoms. The severity of the leaf spot symptoms

was scored using a rating that described the area of the leaf infected. The incidence of the disease recorded as the amount of necrosis on the plant caused by Psa.

Additional measurements being included as part of these trials include collection of temperature data and use of trap plates to monitor inoculum load. Dry matter and yield evaluations are planned for harvest 2013.

3 Results

The results presented here summarise the findings of the three trials in relation to the progression of Psa symptoms over the first two months of the trials.

3.1 Orchard 1: Canon Road – ‘Hort16A’

The ‘Hort16A’ vines at Canon Road are looking extremely healthy with a vigorous and heavy crop of fruit per bay. There are some issues with *Sclerotinia* sp. and *Phomopsis* sp. with whole canes of fruit falling and sclerotes causing blemishes on the fruit; however, these are minor in comparison to those caused by Psa.

Baseline cane counts and disease scores were obtained for all vines within the trial on 12 November 2012, with a total of six assessments being undertaken to date. Results indicate that regardless of whether the vines were under cover, had no cover, or were outside control vines, the number of canes per bay has decreased as a result of the removal of Psa-infected canes throughout the trial. There are as yet no obvious difference between those vines covered and those not, despite wet and windy conditions (considered conducive to Psa infection) over the December/January period (Figure 1).

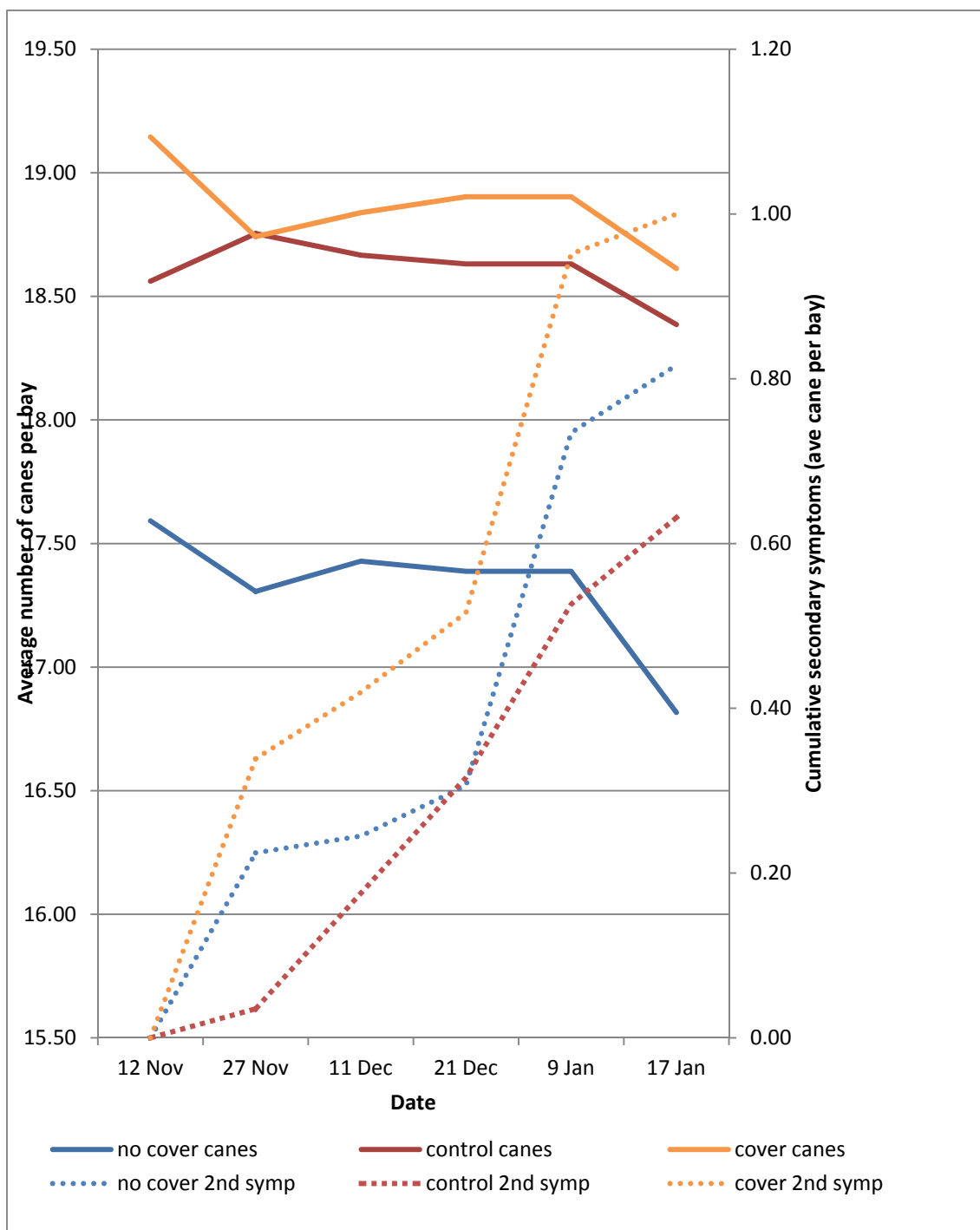


Figure 1. The comparison of cane numbers for pre-*Pseudomonas syringae* pv. *actinidiae* (Psa)-exposed 'Hort16A' plants that are under cover, not covered or in outside control areas (solid line) and the cumulative number of secondary symptoms observed (dotted line) at the Canon Road, Katikati, orchard from the months of November 2012 until January 2013 after the covering structures were erected.

3.2 Orchard 2: Tuapiro Road – Gold9

The same assessment methodology was used as described for Canon Road. There is as yet no significant difference in the average number of canes per bay between those undercover, no cover and the outside control vines (Figure 2). The number of canes has declined in all treatments as a result of cane removal in response to Psa secondary symptom development. The degree of secondary symptoms has increased over time, with all treatments showing an increase. There appears to be no difference between the covered and non-covered plants that are located within the same rows. There has been substantially more infection of the leaders in those vines under cover than of those non-covered and the outside control (Figure 3). This increase in disease under the covered structure may be a result of the damage that was caused to the plants during the construction process, as canes had to be cut and bent to enable access above the canopy.

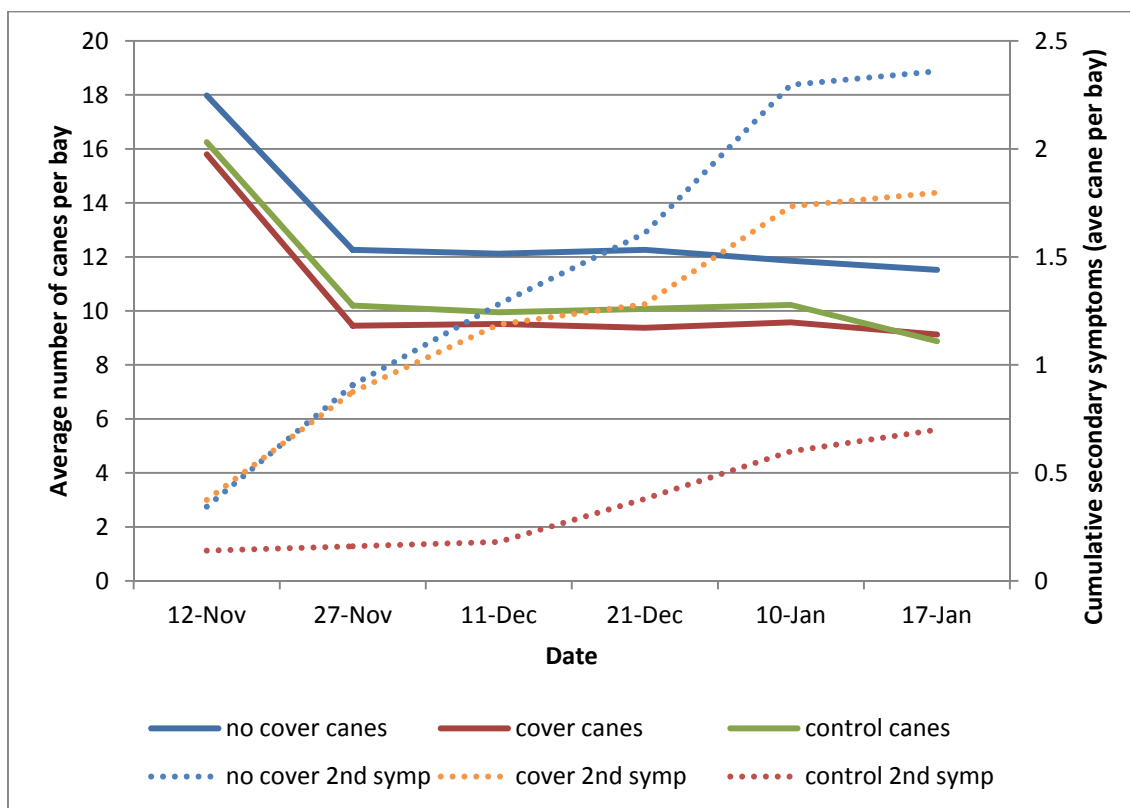


Figure 2. The comparison of cane numbers for pre-*Pseudomonas syringae* pv. *actinidiae* (Psa)-exposed 'Zesy003' (Gold9) plants that are under cover, not covered or in outside control areas (solid line) and the cumulative number of secondary symptoms observed (dotted line) at the Tuapiro Road, Katikati, orchard from the months of November 2012 until January 2013 after the covering structures were erected.

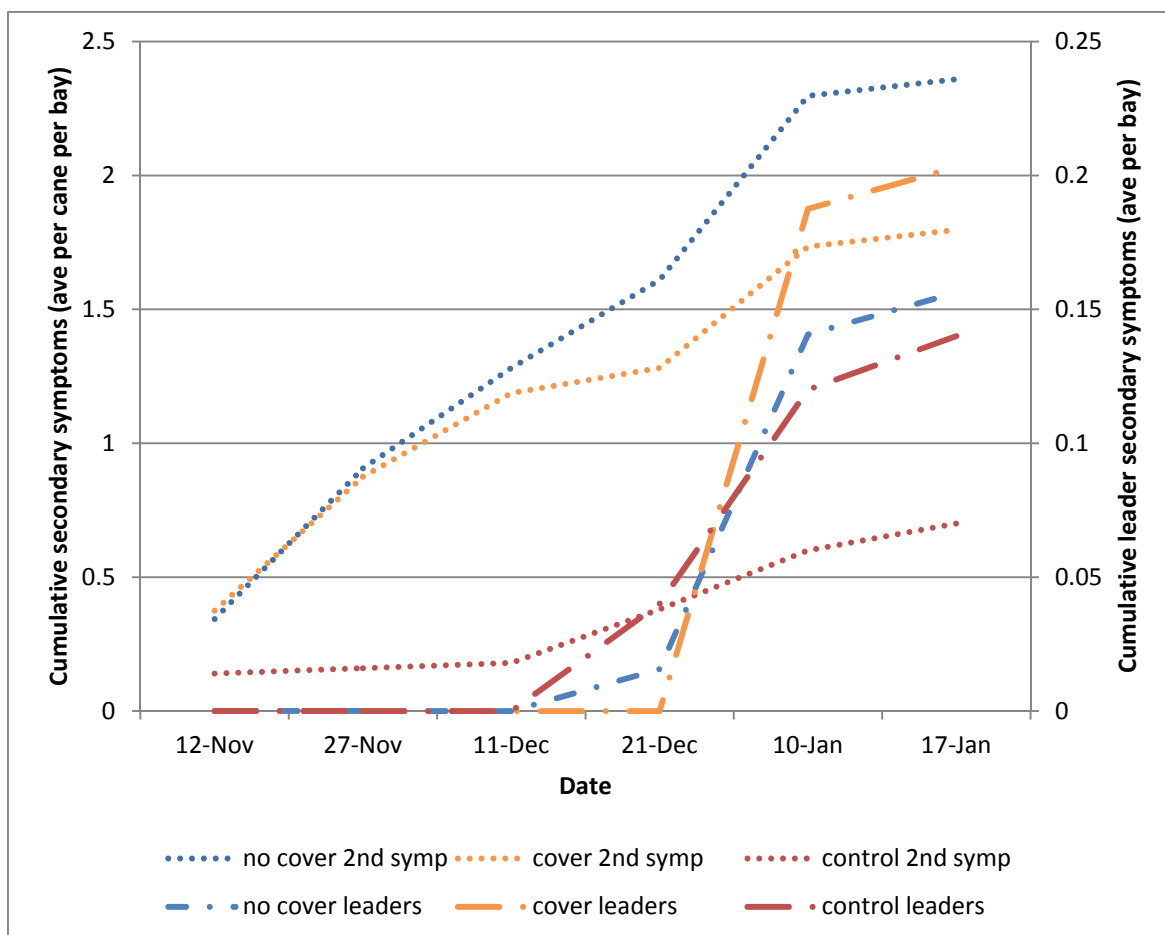


Figure 3. The comparison of the cumulative secondary symptoms exhibited in canes (dotted line) for pre-*Pseudomonas syringae* pv. *actinidiae* (Psa)-exposed 'Hort16A' plants that are under cover, not covered or in outside control areas and the cumulative number of leaders infected with Psa and showing visible symptoms dot and dash line) at the Tuapiro Road, Katikati, orchard from the months of November 2012 until January 2013 after the covering structures were erected.

3.3 Orchard 3: Maungarangi Road – ‘Hort16A’ and Gold3 potted plants

Clean, uninfected grafted plants were placed in two rows, one with Gold3 and the other ‘Hort16A’. Plants were planted out across the three covered and three uncovered areas for replication. Disease assessments (Table 1) demonstrated that the covers are keeping the disease incidence for Psa far lower in the covered areas than in the uncovered areas in both ‘Hort16A’ and Gold3. As measured by the presence of leaf spots and dieback of canes or stems, there is 10 times more expression of the disease on average in the plants in the uncovered areas in the ‘Hort16A’ and 30 times more disease in the uncovered areas in Gold3 plants (Table 1). Scoring will continue in this trial.

Table 1. The average percentage of the plant infected by *Pseudomonas syringae* pv. *actinidiae* (Psa) disease symptoms and the severity of leaf symptoms on ‘Hort16A’ and Gold3 plants in the covered and uncovered areas at Maungarangi Road, Paengaroa, when planted under a Psa-V-infected canopy. (Scored on a scale of 0 to 5, with 0 being no Psa symptoms and 5 being dead).

	‘Hort16A’		‘Zesy002’ (Gold3)	
	% disease incidence	Severity	% disease incidence	Severity
Covered	6.19	0.67	0.56	0.06
Uncovered	60.43	2.35	17.30	1.13

4 Discussion

4.1 Orchard 1: Canon Road – ‘Hort16A’

There has been limited cane loss caused by the expression of secondary PsA-V symptoms in this orchard. There has been a decline in cane numbers per bay in all treatments – those undercover, no undercover and control plants. The incidence of PsA symptoms has increased in all treatments. The disease being expressed in vines are from infections that have taken place before the covers were installed. The ‘Hort16A’ vines have a healthy canopy and there is no severe leader infection, as noted in the other trial sites. The trap plants at these sites are beginning to express PsA-V symptoms and these will be quantified in the final report. At this stage there appears to be no difference between the various treatments in the infection of the plants as expressed by dieback of canes and oozing from the site. .

4.2 Orchard 2: Tuapiro Road – Gold9

The Tuapiro Road orchard is heavily infected with PsA-V. The disease in some vines has moved into the leaders and down to the rootstock. As a result, there are numerous bays where no canes are present. Although not quantified in this interim report, there are a proportion of Gold3 grafts that have become infected with PsA and have needed to be removed. The incidence of secondary systems in the Tuapiro Road orchard has steadily increased over the course of the trial. The average number of canes per treatment has been greatly reduced in comparison with numbers at the Canon Road orchard. The trap plants at these sites are beginning to express PsA-V symptoms and these will be quantified in the final report. At this stage there appears to be no difference between the various treatments in the rate of infection of the trap plants.

4.3 Orchard 3: Maungarangi Road – ‘Hort16A’ and Gold3 newly planted vines

The newly planted vines at Maungarangi Road are growing rapidly and the majority have survived. The plants arrived at the sites free of PsA and since the time of planting have expressed leaf spotting in the leaves, secondary symptoms with cane dieback and a few have died from infection due to PsA. . There is as yet far less visible PsA infection with less leaf spotting and cane dieback in the vines that have been planted under the cover than in those that are not under cover. Although inoculum will be present in both the covered and uncovered areas on the heavily infected mature vines overhead, the lower disease incidence on the young plants in the covered area is likely to be the combined result of less inoculum reaching those plants because of protection from rain splash and the drier conditions being less conducive to infection.

4.4 Overall comments

At this early stage of the trial, the results indicate that when vines previously infected with PsA-V are covered by plastic sheeting there is little to no reduction in the expression of disease relative to that in uncovered areas. The trend observed in Canon and Tuapiro Rd suggests that, at this stage, the symptoms that are being exhibited in the undercover vines are from previous infections that occurred before the covers being erected. In addition, when the cover structures were installed, there was a degree of damage that occurred to the vines that potentially exacerbated the expression of PsA in these plants. Thus it will be critical to continue monitoring

these plants to determine whether the symptoms of Psa infection will decline with potentially reduced inoculum in the presence of a cover.

The preliminary results do suggest that when clean plants are placed under covers they remain relatively disease free and have fewer visible symptoms of Psa-V infection even though they are under already infected mature vines. These trials need to continue to monitor the progression of the disease in the uncovered and covered areas throughout the entire growing season.