The Costs of Psa-V to the New Zealand Kiwifruit Industry and the Wider Community

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Report to Kiwifruit Vine Health

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Executive Summary

- This report describes research commissioned by Kiwifruit Vine Health Inc. into the costs imposed by Psa-V on the industry and on its wider community. In November 2010 the virulent bacterial disease, *Pseudomonas syringae pv. actinidiae* (Psa-V), was first found on a New Zealand kiwifruit orchard. This disease, which has decimated gold kiwifruit orchards in the Latina region of Italy, is expected to result in the removal of almost all of the gold Hort 16A kiwifruit variety in New Zealand. Hort 16A now accounts for 30 percent of export kiwifruit value.
- The kiwifruit industry immediately organised an industry-wide response to the disease, which has now spread through the Bay of Plenty growing areas, and has been found in South Auckland. The aim of the response is to minimise the damage to the industry and identify a pathway for recovery. Kiwifruit Vine Health Inc. has been established as the agency responsible for managing the disease on behalf of the industry; for developing a pathway for the re-establishment and future growth of the industry; and to consider, prepare and, if ratified, implement the *Kiwifruit Industry National Psa Pest Management Strategy* under Section 84 of the Biosecurity Act 1983. ZESPRI, the post-harvest sector, Plant & Food Research Ltd, and other industry participants are actively involved in the industry response.
- On March 21 2012, ZESPRI announced that it will release licenses for the new gold kiwifruit variety G3 and the new green variety G14 to affected Hort 16A growers, and to a lesser extent other growers, in time for the regrafting/replanting of vines during winter 2012. Both G3 and G14 have exhibited tolerance to Psa-V.
- The impacts of the disease under two potential recovery strategies, which differ in the rate at which industry recovery proceeds, were evaluated. Under the first (the Assisted Recovery (AR) scenario) redevelopment is assumed to proceed without constraint from growers' inability to access redevelopment finance. Under the second, the Unassisted Recovery (UR) scenario, a proportion of highly indebted, seriously affected by Psa-V, growers are unable to proceed with redevelopment in the short term because they do not meet bank lending criteria with respect to debt:equity ratios. The scenarios were identified by KVH, in consultation with industry, after receiving the results of the early stages of the research.
- The potential economic impacts of the failure of the recovery strategy if the gold G3 variety proves to be less Psa-V tolerant than the current evidence suggests were not evaluated in this analysis. In that case, industry redevelopment would almost certainly be suspended until a highly tolerant variety can be bred and tested, which may be expected to take between six to eight years (Stuart Kay, Plant & Food Research Ltd). The production of gold kiwifruit in New Zealand would cease almost entirely as the spread of Psa-V through regions outside the Bay of Plenty and the expected result would be the exit from the industry of large numbers of growers, postharvest operators and others
- The research was conducted in several stages including:
    i. Interviews with a wide range of growers, the post-harvest sector, other industry participants, and representatives of the wider communities affected by Psa-V;
    ii. A survey of trading banks, collated on behalf of the industry by accountancy firm Ingham Mora, to establish the regional and varietal distribution of kiwifruit industry debt;
    iii. Definition of scenarios by KVH in consultation with industry;

iv. Comparison of the outcomes of the recovery scenarios with a Status Quo scenario based on ZESPRI projections for future expansion of the industry;

v. Estimation of the relative Net Present Values of the outcomes of both scenarios to outcomes expected under the Status Quo;

vi. Application of regional output and employment multipliers to estimate the indirect and induced effects of the impacts of Psa-V.

- Psa-V will have a negative impact on export kiwifruit yields both through the immediate impacts of the disease and because of delays in the expected rate of industry expansion. Not only will total export yields be adversely affected, but the planned shift from Hayward production to the production of higher priced gold and other new varieties will be slowed. Under the AR scenario, it is estimated that the planned increase in total production of 29 percent by 2021 will be reduced to an 15 percent expansion, while under the UR scenario that change will be further reduced to seven percent. The total proportion of export production comprising Hayward kiwifruit, expected to decline from 73 to 37 percent by 2021 under the Status Quo scenario, is expected to decline only to 41 percent under the AR scenario and 57 percent under the UR scenario.

- Cost per tray of fruit exported will increase throughout the kiwifruit sector as a result of Psa-V. Changes will occur both in short term response to the impacts of the disease on production but also in the longer term, since continuing plant protection and Psa-V hygiene regimes will be required for the foreseeable future. The relativity of the costs incurred by different sectors within the industry is little changed by Psa-V.

- Analysis showed that Psa-V is expected to cost the kiwifruit industry between $310 and $410 million in net present value terms over the next five years. Over a ten year time horizon the estimated costs will increase to approximately $500 to $600 million and over a 15 year period to between $740 and $885 million. These costs included the immediate impact on net industry returns of the disease outbreak (in the shorter term) and of delays in expected industry development in the longer term. The differences in the net present values under the AR and UR scenarios are expected to be $94 million over five years, $111 million over ten years and $146 million over 15 years.

- When regional and national employment indicators were applied, it was estimated that the losses of employment in the Bay of Plenty between 2012 and 2016 under would be equivalent to between 2,400 and 2,900 full-time person years, or an average of 360 to 470 full-time-equivalent jobs per year from 2012 to 2016 when job losses would be experienced. The expected difference between the AR and UR scenarios is estimated to be 428 FTE years in total or 106 per year in the Bay of Plenty region. Nationally the difference in employment losses between the two scenarios is expected to be approximately 460 or 115 per year over the five year period.

- In the wider Bay of Plenty community the impacts of Psa-V are expected, but with some significant exceptions, have yet to be felt. Outside the industry itself, the two groups which have been most affected include some of the most economically disadvantaged families in the community, and the businesses whose turnover is largely determined by the kiwifruit sector. The former group is already suffering from the impacts of loss of at least one earner's contribution to family income, or a significant decline in income, and this is obvious in the increased demand for food parcels and the social services provided by voluntary agencies in the region. The social impacts of Psa-V on the Bay of Plenty region are expected to increase markedly during the next two years.

Chapter 1
Introduction

1.1 The purpose of the study

This report describes research commissioned by Kiwifruit Vine Health Inc. into the costs imposed by Psa-V, a bacterial disease of kiwifruit, on the New Zealand kiwifruit industry since the disease was first identified in a Te Puke Orchard in November 2010. The research evaluates the impacts of the disease under two potential recovery strategies that have been identified by KVH, in consultation with industry. Industry performance under each of the scenarios has been compared with the expected level of performance under a Status Quo scenario that is based on industry development plans formulated by ZESPRI.

1.2 Background to the study

1.2.1 The New Zealand kiwifruit industry

The New Zealand kiwifruit industry has been regarded as a horticultural success story. It is New Zealand's largest horticultural export industry, exporting more than 100 million trays during the financial year ending March 31 2011, and generating export returns of nearly one billion dollars. Green kiwifruit (*var* Hayward) is the mainstay of the industry, comprising 79 percent of exports by volume and 67 percent of exports by value. Gold kiwifruit (*var*. Hort 16A) production has increased rapidly in recent years. Although it comprises only 21 percent of exports by volume, gold kiwifruit accounts for 33 percent by value, since its returns are almost double those of Hayward (MAF, 2011e). The industry has developed a number of new varieties of kiwifruit in recent years but these are not yet produced in significant volumes.

The kiwifruit industry structure is unique among New Zealand horticultural industries, in that almost all export fruit is marketed by a single global marketing organisation, ZESPRI International. ZESPRI is a public company with shares owned by eligible kiwifruit growers, past and present.

ZESPRI has "single-point-of-entry" (SPE) status that was established under the Kiwifruit Export Regulations 1999 (SR 199/310). Under these regulations ZESPRI has the right to market all kiwifruit with the exception of fruit sold in the domestic and Australian markets, although other export entities may export kiwifruit under collaborative arrangements with ZESPRI. Turners and Growers, a large New Zealand fruit marketing company (now taken over by German company Bay Wa) has mounted a series of legal challenges to ZESPRI's SPE status in recent years, but has discontinued these in the meantime in the light of the Psa-V crisis facing the industry (Fox, 2011).

The New Zealand Kiwifruit Board was established to monitor and enforce ZESPRI's compliance with the regulations and to approve other exporters who wish to export kiwifruit in collaboration with ZESPRI (MAF, 2011f). The legislation defines a number of "checks" on the SPE system that should ensure that the SPE system does not lead to inefficiency. These include collaborative marketing procedures, which allow a number of other companies to export kiwifruit; an active grower organisation known as New Zealand Kiwifruit Growers Inc. (NZKGI); competitive domestic post-harvest services; and international competitive pressure from other products and producing countries.

Considerable structural change has taken place within the industry during its development and the Psa-V incursion, which is the subject of this report, is not the first time the

industry has faced potential disaster. The industry structure, development, and place in world markets are well described in Kilgour et al(2008).

In 2010 (ZESPRI 2010) ZESPRI announced an ambitious plan for industry development, setting a target of three billion dollars in export revenue by 2025, almost tripling current returns. In order to do this ZESPRI stated its intentions to

- Increase industry productivity;
- Broaden the product portfolio;
- Continue to invest in marketing and innovation;
- Increase the area of land in kiwifruit production;
- Maintain current marketing arrangements, in particular the stability that the SPE system allows.

1.2.2 The discovery of Psa-V

These plans were dealt a severe blow when a virulent strain of the disease *Pseudomonas syringae pv. actinidiae* (Psa-V) was first identified on a New Zealand kiwifruit orchard in November 2010. A similar strain of the disease was already known to have severely damaged the kiwifruit industry in the Latino region of Italy. First discovered in 1992, the incidence of Psa-V remained low until 2007/08 but it has caused serious damage in the Latina region since that time. In February 2012 it was estimated that only 28 of 680 hectares of gold kiwifruit in that region would be harvested in 2012. Lower levels of vine removal are reported in the other growing regions in Italy. Positive tests have also been reported in all growing regions in France and in South Korea, Portugal and Chile. Anecdotal evidence suggests that the disease has affected Chinese orchards for some time (KVH, 2012b).

Psa-V poses a significant risk to kiwifruit orchards across New Zealand. It has severely affected vines and orchards in the Te Puke area. It has spread across the Bay of Plenty kiwifruit growing region and has also been detected on a small number of orchards in Franklin, South Auckland.

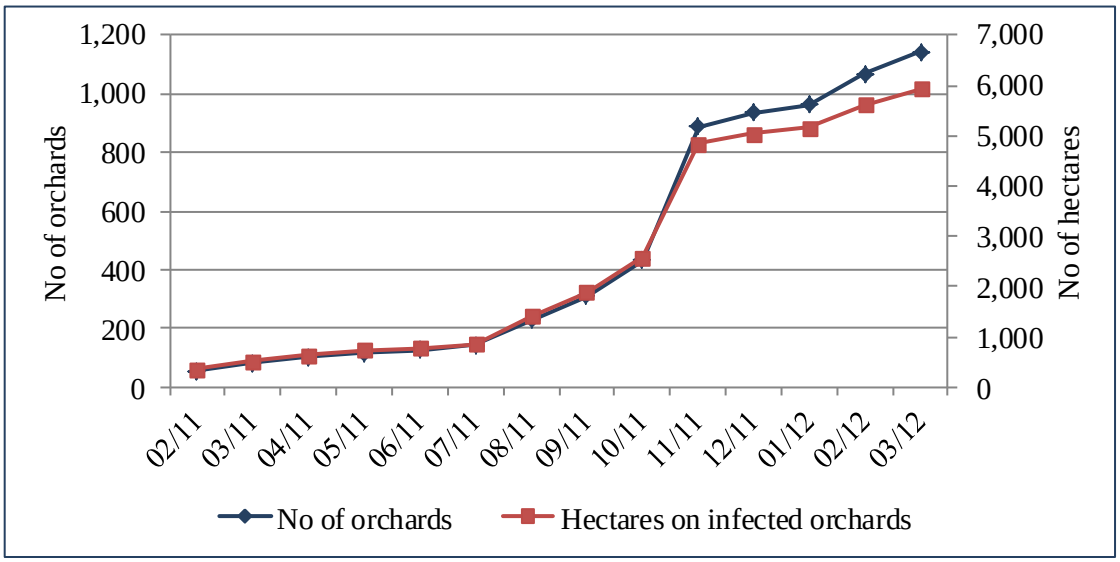
In response to the threat of Psa-V the kiwifruit industry immediately organised an industry-wide response. Initially its intent was to contain and eradicate the disease. Once that was found to be impossible, the industry has worked to minimise the damage to the industry and identify a pathway for recovery. That response is described in Chapter 1.2.

The numbers of orchards that tested positive for Psa-V rose steadily through autumn and winter 2011, then sharply during spring of that year when the sap rose in the vines. In August industry fears were further fuelled by the identification of Psa-V symptoms on a Hayward orchard. Infected orchards were apparently confined to the Te Puke area until spring 2011, but from September to December the disease spread rapidly through the Bay of Plenty. As yet there have been no positive test results on orchards outside the Bay of Plenty and South Auckland regions. Figure 1 shows the increase in orchards testing positive for Psa-V.

As at 21 March 21 2012, KVH statistics indicated that:

- 1141 orchards had been identified with Psa-V with the majority in the Te Puke region and the remainder in other Bay of Plenty growing areas. No positive test results have been received from orchards outside the Bay of Plenty/South Auckland region to date;

- 43 percent of New Zealand's kiwifruit hectares were on an orchard identified with Psa-V (once a positive test result has been received the entire canopy area of the orchard is included in this figure although not all vines may be infected);
- 80 percent of New Zealand's kiwifruit hectares were in a Priority Zone (see map at www.kvh.org.nz/maps) (KVH, 2012a).



Source: KVH

Figure 1: Infected orchards and hectares on infected orchards Feruary 2011 to March 2012

When more Hayward orchards began to exhibit signs of leaf-spotting and, in some cases further damage, in spring of 2011, industry confidence that it would survive Psa-V was seriously reduced. By December 2011, observations indicated that the management of Hayward orchards through Psa-V was a possibility, even in areas where there was a heavy localised burden of inoculum, and confidence improved a little.

It is expected that 500 hectares of Hort 16A round Te Puke will have been cut out before the 2012 harvest (400 had been removed by February 2012), and that the remaining gold vines in Te Puke will be harvested, but with heavily reduced yields on average, then cut out. The progress of the disease through the remainder of the Bay of Plenty Region is expected to be a year behind Te Puke with other central and upper North Island regions experiencing a further year's delay, and the lower North Island and Upper South Island following (John Burke, KVH, pers. comm.).

In many orchards, Psa-V first appears as brown leaf-spotting. In severe cases the vines develop cankers (welts) that produce a reddish-brown exudate. The disease can cause new shoots to wither and die as the bacteria invades and blocks vascular tissues. Vine death appears an inevitable outcome on gold Hort 16A vines. There are indications that Hayward, the primary green variety, G3, a new gold variety, and G14 a new green variety can be managed through Psa-V with appropriate changes to orchard management systems.

1.3 The kiwifruit industry response to Psa-V

The organisational structure of the kiwifruit industry, and the relationships between kiwifruit sectors, has undoubtedly facilitated the rapid industry-wide response to the discovery of Psa-V.

The organisation representing growers, New Zealand Kiwifruit Growers Inc. (NZKGI) is actively involved in industry decision-making, and there is a close relationship between the marketing agency, the industry body, the post-harvest sector and the primary research organisation, Plant & Food Research Ltd.

When Psa-V was discovered to be present on New Zealand orchards, the initial response was managed by the Ministry of Agriculture and Forestry (MAF, now the Department for Primary Industries) Biosecurity New Zealand and ZESPRI, which implemented an aggressive containment strategy. Kiwifruit Vine Health Inc. (KVH) was established in December 2010 as the agency responsible for managing the disease on behalf of the industry; for developing a pathway for the re-establishment and future growth of the industry; and to consider, prepare and, if ratified, implement the *Kiwifruit Industry National Psa Pest Management Strategy* under Section 84 of the Biosecurity Act 1983. The primary objectives of KVH are:

- "**Prevention** – to use biosecurity measures to prevent the establishment of Psa-V in Psa-V free areas;
- **Readiness and response** – early detection of any new outbreaks of Psa-V and a rapid effective response;
- **Containment** – to contain Psa-V by reducing and controlling inoculum through industry best practices;
- **Solutions** – to manage a world-class research and development programme and to capture grower innovation to result in effective solutions;
- **Recovery** – to enable orchards affected by Psa-V to return to viable production. To develop a pathway for the re-establishment and future growth of the industry" (KVH, 2011a).

KVH was established with a working budget of $50 million, of which half was contributed by industry and half by Government.

In working towards its objectives KVH has been active in a number of operational and research areas, including a six million dollar, globally resourced research and development programme, contracted by KVH and overseen by ZESPRI; technical transfer of the scientific knowledge gained from research into orchard best practices; biosecurity measures; orchard protection programmes including coordinated spraying initiatives and a suite of weather forecasting tools developed for growers to assist in planning orchard management activities; and a comprehensive communications, information and education programme. Full details of these can be found on the KVH website at www.kvh.org.nz.

1. **Biosecurity control measures** have included:
    - Establishment of systems of disease surveillance and the management of an infection data base;
    - Organisation and funding of the disposal of infected plant material that is cut out of orchards;
    - The implementation and funding of Psa-V testing;

- The establishment and notification of biosecurity zones that determine the limits on plant material and machinery movement, the availability of subsidies for testing and spraying, etc.;
- The implementation of border controls including wash-down facilities for machinery and vehicles and road signs advising motorists of the risks of spreading Psa-V;
- The implementation of controls on plant material movements;
- Financial compensation for growers who agreed to cut out infected orchards to reduce the inoculum burden and control disease spread in the early stages of disease management. These have since been discontinued.

2. A second operational are has been **co-ordinated spraying and the development of weather forecasting tools.** This has included efforts to encourage adoption of the pest management measures most likely to succeed in containing Psa-V, minimising the risks of residue issues in overseas markets and environmental damage in New Zealand, and limiting the level of financial cost incurred by growers. Measures have included:
   - Subsidies for pest spraying at targeted times (concluded late in 2011);
   - The organisation of coordinated spraying by growers in local areas;
   - Provision of National Institute of Water and (NIWA) weather forecasts on the KVH website (weather is a critical determinant of orchard management activities and plant protection requirements);
   - Funding the development of a disease risk model, the KVH Psa-V Risk Model, soon to be available on the KVH website. This model combines an epidemiological model developed by Plant & Food Research Ltd with a range of climate forecasting information from NIWA.
3. The **technology transfer** programme has implemented a wide range of approaches to the provision of information and decision support tools including:
   - Grower field days and meetings covering, among other subjects, the visual identification of Psa-V, seasonal crop protection programmes, research and development updates, and orchard best practice;
   - Grower information packs sent out by packhouses to orchards newly diagnosed as Psa-V positive;
   - Meetings with technical representatives from post-harvest facilities and other stakeholders to keep them up-to-date with the latest research findings, etc.;
   - Workshops on orchard cut-out and recovery pathways;
   - An "ideas bank" to capture ideas and suggestions for the research and technical teams to consider;
4. A considerable commitment by KVH has been made to the **research and development** programme implemented to find solutions to Psa-V and developing a recovery pathway for the industry. Research and development funding has also been provided by ZESPRI; Plant & Food Research Ltd from its own core funding; post-harvest operators; and contributions from other sources. ZESPRI has spent over three million dollars on research during the 2011/12 financial year and anticipates similar expenditure in 2012/13, with expenditure continuing into the

future (Shaun Gardner, ZESPRI, pers. comm.). More than 80 projects have been, or are being, undertaken in eight key areas including:

- Psa detection
- Epidemiology
- Genetics of Psa-V
- Control options;
- Product testing;
- Orchard management;
- New cultivar and rootstocks;
- Supply chain and consumer actions.

5. KVH **communications** has established a vigorous extension and information programme. As well as workshops and meetings, KVH has developed a wide range of grower resources, most of which are available on the website. These include seasonal management programmes, which have also been sent directly to growers. A weekly bulletin contains updated statistical information; technical information; summarised research results; advice on where to go for additional help, links to resources provided elsewhere, and advance notice of up-coming events and deadlines. There has been a regular programme of interviews in and press releases to, the news media.

6. A draft Psa National Pest Management Strategy has been prepared after industry consultation during 2011. This has been submitted to MAF (now the Department for Primary Industries) for a review that was completed in November 2011. MAF's comments have been incorporated in the draft and the industry is now engaged in further consultation to prepare for formal regulatory process hearing.

7. A **grower support programme,** in collaboration with NZKGI has provided pastoral and financial information; initiatives and presentations to discuss coping with stress, support contacts and financial modelling examples for growers, their families and affected communities, and played an active role in financial advocacy with the banking sector. These efforts have been supplemented by a number of initiatives undertaken by packhouses and others.

8. A final area of KVH activity has been its **engagement with other organisations** working with, or on behalf of industry to obtain financial support for affected growers.

   A group of local accountants worked with MAF (now the Department for Primary Industries) and IRD on issues relating to the Income Equalisation Scheme, under which farmers may deposit funds for a minimum of 12 months and a maximum of five years. Tax is not paid on the funds deposited until the year in which they are withdrawn, so the scheme allows farmers to even out fluctuations in income and taxation levels. As a result of the industry approach, IRD has agreed to accept late deposits into the Income Equalisation Scheme for the 2011 income year until 30 April 2012, regardless of the date on which the tax return has been filed. In addition, growers who qualify as "suffering serious hardship" will be able to make withdrawals from the scheme of funds that were deposited within the past year (IRD, 2012a). This will allow growers to reduce their tax liability on income received in the 2011 and 2012 years, without limiting their ability to access those

funds to meet the expenses of orchard re-establishment. A number of other taxation issues have also been clarified (IRD, 2012b), including issues round the circumstances in which replanting or regrafting kiwifruit may be deducted as repairs and maintenance expenditure, not subject to tax as capital transactions, and the write-off on Hort 16A licences, the value of which has been severely reduced.

KHV has also worked with New Zealand Kiwifruit Growers Inc. (NZKGI) and the Western Bay of Plenty District Council to develop a rates relief process for affected growers. Other Bay of Plenty District Councils have also adopted the scheme. Under this process growers who have removed or cut back vines may apply for an orchard revaluation. Any resulting changes will lead to a reduction in the general-rated portion of the 2012/13 rates bill, and will automatically trigger a request for a partial write-off of rates in the current season. This will be considered on a case-by-case basis (KVH, 2011b).

NZKGI and KVH have jointly requested that biosecurity incursions as well as adverse climatic events be included in the eligibility criteria for Rural Assistance Payments. These payments can be paid to farmers by Work and Income New Zealand (WINZ) in financial difficulties and with no significant off-farm income or assets, after the Government has announced that the region has been subject to an adverse event. In addition, where a farmer leaves farming because the operation is no longer viable after an adverse event, MAF (now MPI) may approve a one-off grant to assist them with the costs of leaving. As a biosecurity incursion is not classified as an "adverse event" at present, kiwifruit growers whose orchards are affected by Psa-V are not eligible for this assistance. However, in the light of the expected consequences of Psa-V, MAF (now MPI) is currently formulating policy advice on this issue to present to the government.

- KVH and NZ Kiwifruit Growers Incorporated have set up a financial advocate service, designed to assist PSA-V affected growers to make suitable arrangements with banks so that they are able to continue operate their orchards. The advocates are qualified in the finance field and are experienced in dealing with banks. After an initial discussion with growers to assess whether their services will be of value, this service will be provided on a paid basis with payment being made by the grower or the bank (Chapman, 2012).

NZKGI has appointed a kiwifruit employment coordinator. The coordinator, who is funded by the Ministry of Social Development, will focus on matching those who have lost their jobs as a result of Psa-V with other employment opportunities in the kiwifruit industry. The position was established to assist in retaining skilled kiwifruit industry workers in the region to support the recovery strategy. In addition the coordinator will be responsible for identifying the training required for workers whose jobs have been lost to meet the requirements of the positions on offer. Where the requisite training opportunities are not available, development work will be undertaken and the coordinator will work closely with training providers in the region. In addition to the work directly undertaken by the employment coordinator, his appointment is believed to have been of value in maintaining industry and community morale in the Te Puke area (Chapman, 2012).

1.4 The Psa-V recovery strategy

The KVH Board recently passed the following resolution with regard to KVH's pan-industry position:

"*To give effect to the Objectives in KVH's strategic plan, KVH calls on ZESPRI and all the industry to facilitate the removal of Psa-V infected and at-risk Hort 16A vines by developing then implementing a recovery pathway using varieties with greater Psa tolerance as a matter of absolute urgency"* (KVH, 2012c).

On March 21, 2012, ZESPRI announced that the start of the recovery pathway would involve the wide-scale release of licenses for the new gold kiwifruit variety G3, which has exhibited intermediate tolerance to Psa-V, but has not yet been grown commercially on a large scale and a limited release of licences for the new green variety G14 (ZESPRI, 2012c). With a similar level of Psa-V tolerance to that of Hayward green kiwifruit, it is believed that G3 can be managed through Psa-V, while G14 exhibits an even higher level of tolerance. G3 has high orchard yields and is also easier to harvest, store and pack than Hort 16A. Hort 16A has a relatively soft skin and a small protruding beak which make it susceptible to damage during post-harvest processes. The objective of the recovery pathway is to "replace gold (Hort 16A) volumes and continue to provide opportunities for new entrants to the gold category" (ZESPRI, 2012a), while also providing opportunities for expansion of green kiwifruit production through the release of G14 licences. To achieve this ZESPRI considers that a staged removal of Hort 16A vines from orchards at high risk of Psa-V is necessary.

The main features of ZESPRI's final release mechanism for allocating new variety licenses are that:

- All current Hort 16A growers affected by Psa-V will be able to purchase G3 or G14 licenses at a cost of $8,000 per hectare on the surrender of existing Hort 16A licenses. Hayward growers who were requested by KVH to remove their orchards in early 2011 will be offered G3 and G14 licenses on the same terms as Hort 16A growers. These licences will allow them to graft G3 vines onto existing root stocks if these remain in the ground, or to replant if rootstocks have been removed;
- Growers of the gold G9 variety affected by Psa-V will have the choice of changing to G3 or to green G14 under the same terms as Hort 16A growers;
- Partial transfers of existing Hort16A/Gold9 (Psa-V affected) licences are allowed in addition to allowing the relocation of the licensed variety to another KPIN under the same legal ownership;
- A hardship clause has been introduced for Hort 16A/G9 growers that allows deferral of the new variety license deposit for growers who have received no income from the 2011 and 2012 harvests, and those with rootstocks requiring removal in 2012.
- In addition, an extra 400 hectares of G3 licences will be allocated to other growers. Three hundred hectares will be allocated by means of fixed price bid and 100 by means of a closed commercial tender (Shaun Gardner, ZESPRI pers. comm.).

There are both production and market risks associated with implantation of the recovery pathway. The production risks include the fact that Psa-V is new to New Zealand, and the industry is still researching the management techniques required to maintain plant health in the changed production environment. While there is still much to be learnt from

research and orchard monitoring, there has been considerable progress towards understanding the most appropriate plant protection and other management strategies for Psa-V. With respect to the other aspects of G3 management, the industry has comparatively recently been through the process of learning how to manage gold Hort 16A on-orchard and during post-harvest to meet market requirements with respect to taste. There is confidence that the process will be much faster for G3, because the techniques required have already been developed (Stuart Kay, Plant & Food Research Ltd). In other respects, G3 is known to be an easier plant both to grow and to pack than Hort 16A and the industry is confident that the technology is available to manage G3 successfully.

There is conflicting evidence about the market acceptability of G3 at present. A number of the growers interviewed cited anecdotal evidence that in the Japanese market (in which the highest returns for New Zealand kiwifruit are achieved) consumers do not regard G3 as favourably as Hort 16A. However, consumer research conducted by ZESPRI has found that G3 has performed well across different markets and supply windows during the last four seasons. The "average overall liking index" has been 99 percent compared to Hort 16A (Shaun Gardner, ZESPRI, pers. comm.). While an important criterion for a replacement gold variety in a non-Psa-V environment would be superiority to Hort 16A, the expected removal of Hort 16A from the market in a short period means that comparisons will no longer be available. While G3 has had a lower average dry matter (which is correlated with taste) in 2010 and 2011 than Hort 16A, the industry has made considerable advances in managing for high dry matter during recent years and the technologies developed are likely to be readily adaptable to G3 (Stuart Kay, Plant & Food Research Ltd).

1.5 The study methodology

The impacts of Psa-V on the kiwifruit industry have been evaluated under two recovery scenarios. The first of these assumes that the proposed recovery pathway can be implemented immediately and the finance required for industry redevelopment will be available to growers, irrespective of their current levels of indebtedness. The second recognises that in December 2011 many gold kiwifruit growers, particularly in the area round Te Puke (44 percent of the total gold production area in 2011) were found to be already very highly indebted and may have difficulty obtaining redevelopment finance. As a result industry redevelopment is likely to be delayed and there may be considerable turnover of gold orchards in the area.

The study involved a number of stages. The first was a survey of trading banks in November and December 2012 to determine the current levels of debt secured against kiwifruit orchards. The objective of the survey was to enable the industry to determine what proportions of growers are likely to have difficulty obtaining finance for redevelopment, since this is expected to have a significant effect on the outcomes of any recovery strategy (Chapter 2).

Also during November and December 2012 a series of interviews was held with industry participants. The information from these provided insight into the range of industry experiences since Psa-V was first identified in New Zealand, and assisted in formulating both the assumptions and estimates on which the impact models were based. The results of these interviews are reported in Chapter 3.

This was followed by the definition of three scenarios (see Chapter 4), under each of which the costs of, and returns to, kiwifruit production have been evaluated. The

scenarios, which were defined by KVH in consultation with industry, are fully described in Chapter 4 and include:

- The Status Quo scenario (SQ), based on the area changes implicit in ZESPRI's plan to achieve export revenues of three billion dollars by 2025 (ZESPRI, 2010). The ZESPRI target was acknowledged to be an ambitious one, and for purposes of the cost benefit analysis, the changes in production areas on which the ZESPRI analysis was based have been assumed to take an additional five years to achieve under the SQ scenario. Production areas and volumes under this scenario stabilised in 2030, although the analysis period was extended for an additional ten years to allow all scenarios to converge and all areas planted and grafted to reach full maturity.
- The Assisted Recovery scenario (AR) based on the industry's expectation of the outcomes of the proposed recovery strategy if finance for redevelopment is not constrained by bank lending criteria with respect to debt:equity ratios. Under this scenario it has been assumed that growers are able to graft G3 onto existing rootstocks in the season after the full impacts of Psa-V are experienced, and that the 400 hectares of G3 licences available to other growers are taken up immediately.
- The Unassisted Recovery Scenario (UR) under which a proportion of kiwifruit growers are unable to proceed with orchard redevelopment immediately, despite the ability to defer payment for G3 licenses, because they are unable to obtain the necessary finance for redevelopment because of their existing debt levels.

Each scenario was modelled using data and assumptions that are described in Chapters 2 and 3 to estimate changes in costs, production areas, and export yields and returns.

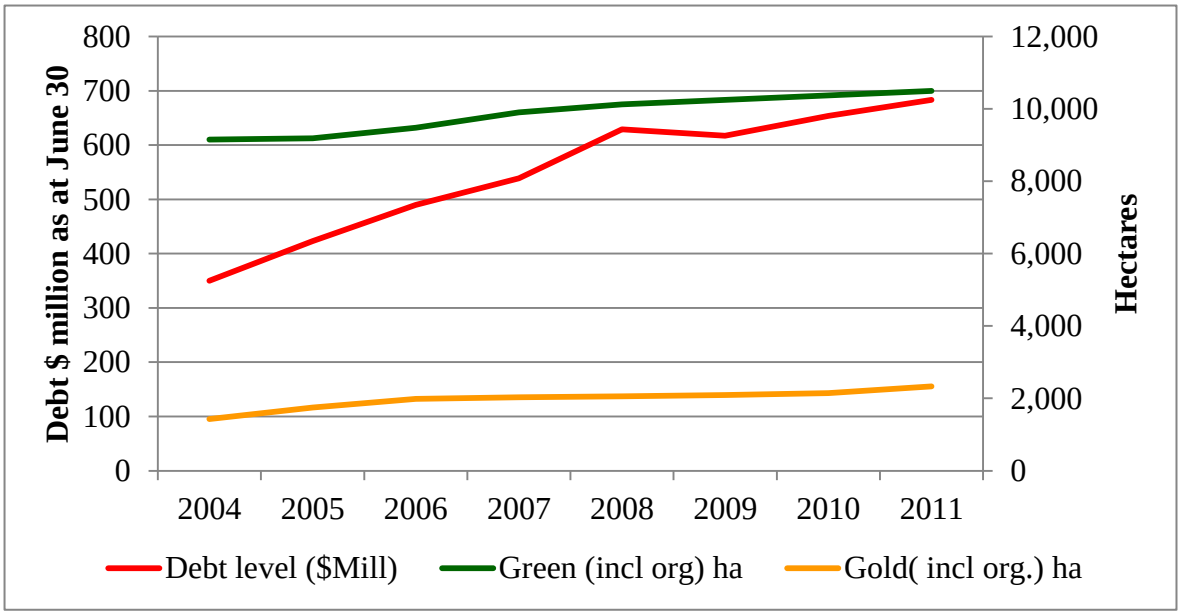
The estimates generated by the scenario models were used to calculate Net Present Values of the differences in costs and the values of exports to New Zealand between the Status Quo scenario and each of the recovery scenarios. Regional and national multipliers were used to calculate the regional and national economic impacts of the orchard-level changes expected. The results of these analyses are presented in Chapter 5.

In addition, a series of 27 interviews with representatives of local government (five) and the community, including businesses directly affected by the downturn in the kiwifruit industry (eight) and those less directly affected (five), representatives of churches and other community organisations (five), schools (two), and economic development organisations (four) was conducted. The views of these are summarised in Chapter 6.

Chapter 2
Kiwifruit Industry Indebtedness to Trading Banks

Information on current levels of debt secured against kiwifruit orchards was required in order to estimate the proportions of orchardists likely to be constrained with respect to redevelopment finance because they do not meet bank lending criteria.

The only publicly available data on kiwifruit orchard debt is collected by the Reserve Bank of New Zealand (RBNZ). RBNZ data on the credit extended to kiwifruit growers by trading banks shows that the level of borrowing has increased relatively steadily since 2004 (RBNZ, 2011). The rate of growth in debt owed to trading banks has considerable exceeded the rate of growth in productive hectares during that period, as Figure 2 shows. Debt levels increased by 95 percent over the period, while the production area of green kiwifruit increased by 15 percent, and the area of gold production increased by 63 percent (ZESPRI, 2007; 2011a). No national timeseries data are available on loans to kiwifruit growers from sources other than trading banks (e.g. family, finance companies, overseas institution, etc.), or on the proportion of orchards without debt.



Source: RBNZ

Figure 2: Debt levels and production areas on New Zealand Kiwifruit Orchards 2003/04 – 2010/11

Because the RBNZ data does not include information on the distribution of debt amongst orchards, KVH decided that as part of the economic evaluation of the Psa-V recovery strategy, a survey of the six major trading banks involved in the kiwifruit industry should be conducted in late 2011. The objective of the survey was to collect information on the distribution of debt amongst kiwifruit orchardists who are indebted to banks. This included a breakdown of debt by area, by region, by variety and by age of growers. The banks surveyed included:

- ANZ
- National Bank
- Bank of New Zealand
- Rabobank

- ASB
- Westpac Bank

The survey was sent out and collated on behalf of KVH by Ingham Mora Ltd, an accountancy firm based in Tauranga that also collects industry data on behalf of ZESPRI on a regular basis. The results have been released by Ingham Mora in aggregate form only.

Banks were requested to report on orchards on the basis of individual entities, where an entity could include more than one KPIN (Kiwifruit Production Identification Number assigned by ZESPRI). Where more than one financial entity is involved in a single orchard (e.g. a trust as landowner and a partnership as the operating entity) they were combined. Where an orchard grows both green and gold kiwifruit, the loans associated with each were separately reported. In total, banks reported that there are 775 indebted orchards in the kiwifruit industry. Of these 185 grow both green and gold kiwifruit, 427 grow green kiwifruit only and 163 grow gold only. In addition, banks were asked to report only on kiwifruit orchards whose debt must be serviced out of orchard returns, i.e. those whose debt-servicing ability is likely to be significantly affected by Psa-V. Growers who have sources of income independent of their orchards, and sufficient to service orchard debt, were excluded.

Data were obtained on debt levels, areas and the age of borrowers. In the case of green/gold orchards the age of the orchardist was reported in both the green and gold datasets so the sum of these is greater than the total.

2.1.1 Results of the bank debt survey

In total, 4767 canopy hectares of green kiwifruit and 1979 canopy hectares of gold are considered to be dependent on kiwifruit returns to meet debt-servicing requirements. This represents 45 percent of the total planted area of green kiwifruit in 2011 and 61 percent of the total gold planted area. The percentages are highest in Te Puke, where loans are secured over approximately 78 percent of green kiwifruit area and almost 100 percent of the gold kiwifruit area. Indebtedness to trading banks is lowest in regions outside the Bay of Plenty in which only six percent of green area and 17 percent of gold area is mortgaged to banks. These differences reflect the greater ownership of orchards outside Te Puke by growers whose primary source of income is derived from other landuses, investments, or employment.

The total debt-serviced primarily by kiwifruit orchards, as reported by the major trading banks as at the end of 2011, was $804 million dollars, approximately $120 million more than was reported in the Agricultural Credit report as at June 30 2011.

Figure 3 shows the numbers of hectares of green and gold kiwifruit that are dependent on kiwifruit returns in each of the defined debt categories.

The median level of debt per green hectare lies between $40,000 and $59,000 per planted hectare in Te Puke and nationally. An estimated 58 percent of the total green canopy area planted in Te Puke, and 34 percent nationally, has debts of $40,000 per hectare or more, and thus must meet interest charges of approximately $2,600 or more (at an indicative rate of 6.5 percent). Seventeen percent of area in Te Puke, and nine percent nationally, must meet interest charges of $6,500 or more.

The minimum interest charges to be met out of orchard returns on the 75 percent of gold kiwifruit orchards with debts of more than $100,000 per hectare in Te Puke (61 percent nationally) is estimated to be $6,500 per hectare.

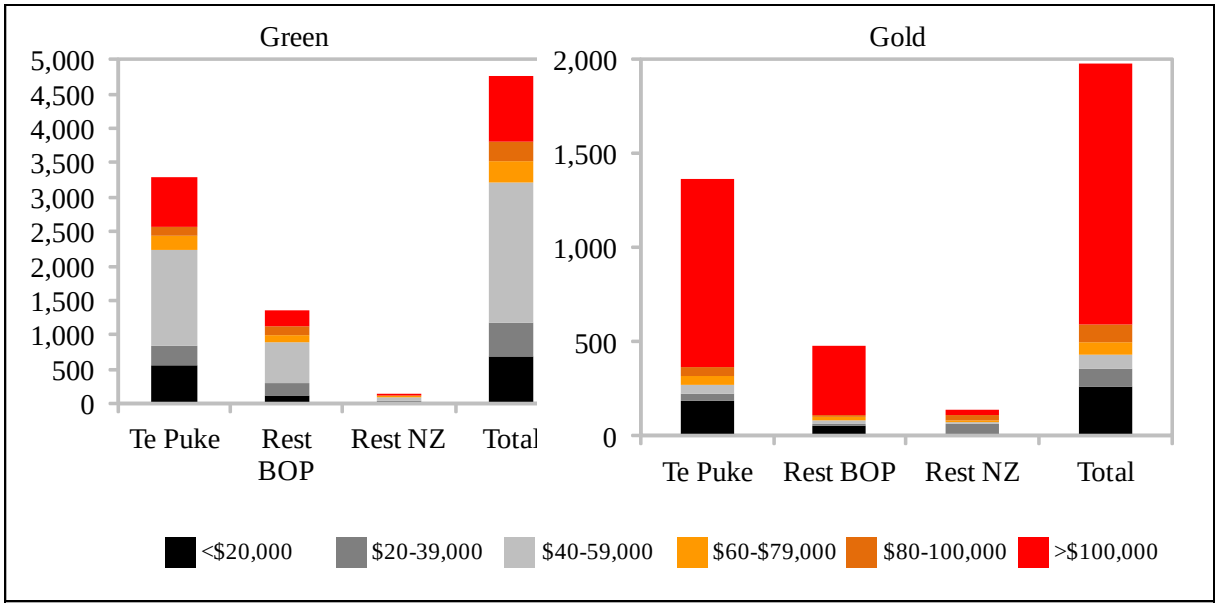


Figure 3: Debt levels of green and gold orchards 2012

The kiwifruit industry is widely recognised as having a relatively high average grower age. The proportions of total green area owned by growers sixty years old and over are 48 percent in Te Puke and 46 percent nationally, while the proportions of gold area owned by growers in this oldest age category are lower, at 33 percent for Te Puke and 35 percent nationally. The largest proportion of gold kiwifruit, which is associated with higher debt levels, is farmed by those in the 50 to 59 year age category (see Figure 4). As a proportion of growers, those in the 60 plus age group account for approximately 40 percent of all those reliant on orchard returns to service kiwifruit debt, both in Te Puke and nationally. For these growers, it is expected that the loss of equity, even in the short-term, that is a result of Psa-V will be of particular concern as they approach retirement age.

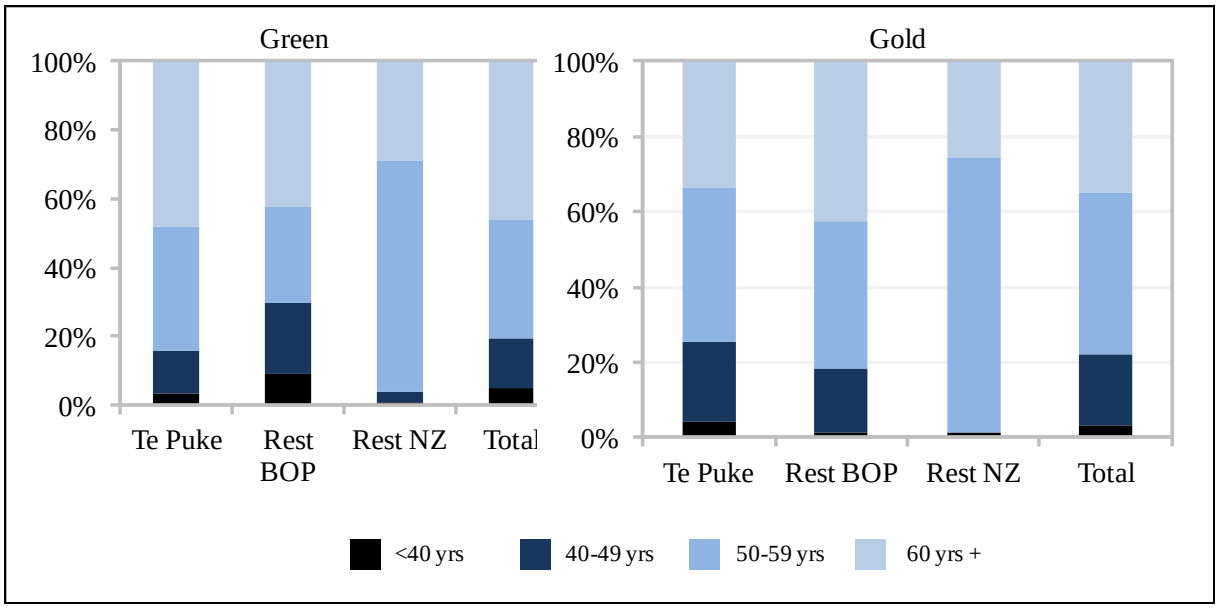


Figure 4: Debt levels of green and gold orchards by age of orchardist 2012

Representatives from four of the trading banks involved in the kiwifruit industry in the Bay of Plenty were interviewed in November and December of 2011. All the bank representatives interviewed reported that they were monitoring both the development of the recovery strategy plans and the impacts on the industry, closely. At that time there had been almost no approaches to these banks by growers seeking additional finance, and all banks reported that they intended to assess the situation on a case-by-case basis, rather than implement an overall policy with respect to Psa-V affected clients.

Overall the banks had two objectives with respect to the Psa-V situation. These were to minimise losses to their wider investor base and to assist clients. No suggestions were made that interest rates paid by kiwifruit growers would be raised to reflect a higher level of risk, or that banks would be revaluing orchards to assess equity levels at this stage. However, the situation was changing rapidly and no predictions of future policy changes were made. One of those interviewed acknowledged that requests for additional finance would be assessed on the basis of the changes that have occurred in asset and equity values.

Bank staff are being encouraged to maintain regular contact with growers, particularly those severely affected, and are being supported themselves with access to EAP programmes and other initiatives such as discussions with psychologists on how best to deal with stressed clients.

In general, banks want their clients to be pro-active in obtaining all the information required for financial planning, involving professionals including accountants and lawyers in that process and bringing that information to the banks, rather than waiting for problems to develop.

Chapter 3
The Impacts of Psa-V on the Kiwifruit Industry

In order to determine the impacts of Psa-V on the kiwifruit industry as a whole, a series of interviews was held with industry participants. These were conducted in person, or by telephone with orchardists (12), post-harvest operators (seven),and a wide range of other industry participants including consultants (three) contractors (three), transport operators (three), an apiarist, and accountants who include significant numbers of orchardists among their clients (three).

The impacts of Psa-V on kiwifruit production and profitability will be felt throughout the industry. For the majority, the impacts of Psa-V on business performance to date have not been great. However, it is widely recognised that the greatest impact will be felt following the 2013 harvest in Te Puke. As Chapter 4 describes, it is expected that the full impacts in other regions will be delayed until subsequent seasons, following the pattern of spread of the disease. On orchards, the main effects of the disease are expected to be:

- The removal of some or all vines and a significant the yield of vines on affected gold orchards and a reduction in yield on severely affected green orchards;
- A large increase in the costs of plant protection regime (dependent on region – see 3.1.1) immediately and in future;
- Increased costs of vine management as a result of Psa-V hygiene precautions immediately and in future;
- One-off costs of vine removal and re-establishment;
- Reduction in harvest costs in the short term;
- Other smaller cost adjustment to the short-term.

It is expected that the impacts of Psa-V on the post–harvest sector will include the rationalisation of the structure of the sector, with mergers and/or takeovers of some operations and the closing of less efficient plants. Employment levels have already been significantly reduced. The post-harvest costs of packing and cool-storage per tray will increase while fruit volumes are low, and capital investment programmes are likely to be stalled. Additional costs associated with Psa-V hygiene have already been incurred.

The kiwifruit contracting sector has been hard hit, and further rationalisation is to come as the full effects of Psa-V are experienced. A significant number of the regular casual staff employed by contractors has already been advised that no work will be available for them, and the hours of work available to those still in employment will be reduced.

ZESPRI will face the challenges of rapid changes in fruit supply, and the need to establish G3 fruit in the market as a substitute for Hort 16A, while maintaining the premium price achieved by New Zealand gold kiwifruit. Changes in fixed and variable costs of marketing have been incorporated in the analysis, and within the organisation staff have been diverted from other activities to focus on the recovery pathway. There has been significant investment in research and development to support the recovery pathway.

Other industry participants including transport firms and beekeepers have, in general, been less severely affected to date. Details of the costs incurred by sector participants are provided in the remainder of this chapter.

3.1 The impacts of Psa-V on growers

Interviews were held with twelve growers, from the areas surrounding Te Puke and Katikati. In addition, many of the representatives of the post-harvest sector, accountancy firms, service industries, and staff from both ZESPRI and KVH are growers as well as having a less direct link with the sector as part of their roles in other organisations. The interviewees included both gold and green growers, those severely affected by Psa-V, those less affected, and those whose orchards have not yet been found to have the disease.

The growers interviewed were at differences stages of the "cycle of grief". This is concept that is widely accepted by psychologists and counsellors, and based on a model for death and bereavement counselling developed by Elizabeth Kübler-Ross (Kübler-Ross and Kessler, 1969). Amongst the growers interviewed these stages were observed:

- Shock and disbelief that their orchards and lifestyles are so severely threatened by something that had not been foreseen;
- Denial that Psa-V would reach their orchards; of the potential severity of the impacts on Psa-V on the industry; and of the need to change management practices in the future;
- Anger about their perception of the manner in which Psa-V entered New Zealand, and the failure of the industry as a whole to anticipate Psa-V given that it was known to be causing severe losses in kiwifruit industries elsewhere, particularly in Italy;
- Despair, depression and an inability to see a path forward for their orchards and families. In some cases grief at the loss of many years' commitment to vines that will not survive Psa-V, that is akin to the grief experienced by livestock farmers who must destroy capital stock;
- Reconstruction. A number of growers reported that they had formulated a plan. While that plan may not be the final one, and there was no guarantee of success, its existence gave them something positive to focus on;
- Acceptance that Psa-V is here now, and that the industry will have to find a management solution that minimises disease impacts and establishes a pathway to restored profitability.

When the first interviews were conducted during November 2011 the recovery strategy, which has now been finalised by the industry, had not yet been proposed. The likelihood that the impacts would not be severe on most Hayward orchards was only just gaining recognition, and the suggestion that the G3 variety might be sufficiently tolerant of Psa-V to replace Hort 16A had yet to be widely made. By the time of the final round of interviews in early March 2012, the basis of the strategy was widely known after the release of an industry discussion document by ZESPRI (ZESPRI, 2012a), and the level of confidence in the industry appeared to have increased.

There was widespread concern amongst growers about loss of equity, as reports circulated that kiwifruit orchards were selling for $80,000 per canopy hectare during 2011. In February 2012, however, a single green kiwifruit orchard without a house sold for $162,000 per canopy hectare. This had been widely discussed, and had helped fuel industry optimism, although similar orchards were selling at up to $250,000 per canopy hectare at the peak of the market (Skellern, 2012).

A number of growers expressed as much concern about the impacts of Psa-V on their permanent, or long-term casual, workforces as on their own families. They valued experienced workers highly, and were actively seeking outside work for them to

supplement the reduced hours of work available on-orchard, in order to retain their staff in the industry to assist with the recovery process. The loss of intellectual property to the industry as experienced workers move to other industries and sectors was seen by a number of those interviewed as a serious consequence of Psa-V for the industry as a whole. The impacts on the broader local community were also discussed by several of those interviewed and they cited anecdotal evidence of reduced school roles, a downturn in local business and mental health issues developing in the Te Puke area.

All of the growers interviewed had changed their management practices since the advent of Psa-V. However, the nature of those changes, and the impacts that these changes had had on orchard working costs and yields were highly variable, and no general pattern emerged. The range of changes in individual management practices and the approach to estimating the costs of these that has been undertaken in the analysis is discussed in the following sections. Changes include:

- Changes in pest control regimes;
- Changes in pruning and vine management;
- Implementation of Psa-V hygiene regimes on orchard;
- Changes in artificial pollination practices;
- Changes in fertiliser regimes;
- Changes in repairs and orchard maintenance regimes;
- Removal of vines.

On many of the Hort 16A for the season will have already been incurred before the decision to cut out vines was made. These have been incorporated in the analysis by assuming that, on average, half of the total costs incurred per hectare on Hort 16A orchards that will be harvested in 2012, with the exception of pest management costs, will have been incurred on the area cut out. The approach to pest management costs on cut-out orchards is described in Chapter 3.1.1.

The kiwifruit production costs incorporated in the analysis of the costs of Psa-V are based on the ZESPRI data on orchard working costs (Sue Galpin, ZESPRI, pers. comm.) (see Appendix 1). For most of the costs not affected by Psa-V, cost levels are assumed to remain at 2011 levels in future. In some cases, where 2011 costs were unusually low compared to previous seasons, a long-term average value has been substituted. The ZESPRI data does not include data on rates, insurance, ACC costs and wages of management. These have been taken from the MAF Kiwifruit Monitoring Model for the 2011 season (MAF, 2011). The approach taken to estimating the orchard working costs that have been directly affected by Psa-V is described in the following sections.

3.1.1 Changes in pest control regimes.

The spread of Psa-V through the Bay of Plenty region has coincided with a season of unusually wet weather and, consequently, the cooler damp conditions under which Psa-V bacteria thrive. KVH has regularly updated its spray programme recommendations with respect to both appropriate products and the most effective spray techniques, as more knowledge of the efficacy of protectants and the nature of the seasonal conditions has been accrued.

An extension campaign has been implemented throughout the industry to assist growers in optimising their management regimes. As well as the advice provided to growers on Psa-V management practices by KVH and ZESPRI via their websites, at meetings and by

technical staff, individual post-harvest operators are also disseminating the latest results of research into management practices through regular grower updates, meetings and by staff. However, the most effective strategy for Psa-V protection is still being researched, and KVH advises that an integrated management approach to protecting and strengthening vines is the best approach to minimising risk.

The range of protection and disinfection regimes that has been followed by individual growers during the 2011/12 growing season is extremely diverse. On average, Psa-V has added considerably to the costs of pest control on kiwifruit orchards, particularly in the Bay of Plenty, but also in all other kiwifruit growing regions. ZESPRI spray diary data from 2010, 2011 and 2012 (John White, ZESPRI, pers. comm.) have been analysed in order to inform the analysis of changes in pest control regimes that have been incurred as a consequence of Psa-V during 2011 and 2012.

The growers interviewed had applied a wide range of agrichemical and other protectant, disinfection, and plant-health supporting materials during the season. The products used ranged from the products recommended by KVH to bin-sanitising products, colloidal silver and garlic extracts. The numbers of spray applications ranged from very few to as many as 30. Several larger scale orchards had purchased spray equipment in order to ensure that they are able to spray the entire orchards within 48 or fewer hours of an adverse weather event. Local spray contractors are not able to cover the orchard areas of all clients within this timeframe.

A difficulty for growers has been that decisions on the choice of Psa-V controlling products, several of which are very costly, were required in the absence of full information about the efficacy of these, which increased the financial risks under which growers have operated this season. Products to control Psa-V can be categorised as:

- Disinfectants/sterilants;
- Biological agents;
- Elicitors that induce the plant's own defence mechanism;
- Protectants, commonly copper sprays that coat the leaves to keep out infection;
- Antibiotics to kill the bacteria (which can only be used before December to minimise the risk of residues).

The recommendations on appropriate products for Psa-V control have changed during the 2011/12 growing season as more information on efficacy, adverse effects and timing has become available (Linda Peacock, KVH, pers. comm.). Early in the season there was widespread use of Liquicop, a low-dose copper leaf protectant, often in conjunction with Sporekill® to reduce inoculum levels. As the season progressed, signs of phytotoxicity were observed in some orchards where multiple sprays of this combination were applied. Initial product testing trials with both Hort 16A and Hayward indicated that higher levels of phytotoxicity occurred on leaves on which Liquicop had been applied at winter rates in accordance with the manufacturer's recommendations (KVH, 2012d). Consequently, the Liquicop and Sporekill® combination was used less commonly throughout the remainder of the 2011/2012 growing season. The observed phytotoxicity, and the lack of clear evidence of efficacy, resulted in the temporary removal of Liquicop from the recommended products list. However, in later trial work on potted plants, Liquicop (and other copper products) was shown to reduce leaf spotting and was reinstated on the list.

Nordox® 75 WG is a high-dose copper product that has provided a good level of protection in field trials throughout the season. In some orchards symptoms of

phytotoxicity developed when Nordox® was applied on a very regular basis through the spring growth period. Trials have shown it to be efficacious at lower application rates and/or with less frequent applications. It appears likely to be included in future recommendations.

Actigard®, an elicitor, has been more widely used on Hayward crops than on Hort 16A. Actigard® was initially approved for pre-flowering use only and many Hort 16A crops were already flowering by the time that approval was issued. Subsequently approval has been granted for the use of Actigard® until 70 days before harvest, and post-harvest use is also permitted. It has appeared to be efficacious in trials and its use in future is likely, particularly in spring and around the flowering period when the risk of copper phytotoxicity is greatest.

Serenade® Max is a biological bactericide product. Its mode of action is primarily through the extra-cellular secretion of a biological antibiotic substance during its production, rather than by than inhibiting pathogen growth by competitive colonisation. Its use has not resulted in symptoms of phytotoxicity and it has appeared to be useful in Psa-V control in initial Hort 16A trials. Further trials are planned to confirm this. The most commonly used products (on the basis of the cumulative numbers of hectares sprayed in the 2012 season) are shown in Table 1.

Table 1: Psa-V control products used on the highest cumulative proportion of production area 2012

	Action	Product $/ha	*Gold	*Hayward
Liqui-cop	Protectant	$22.01	16.3%	17.1%
Sporekill®	Protectant	$55.07	13.1%	15.5%
Nordox® 75 WG	Protectant	$10.55	12.5%	14.8%
Kocide® Opti®	Protectant	$23.30	10.5%	12.3%
Actigard®	Elicitor	$171.00	9.2%	14.8%
Serenade® Max	Biological	$15.41	10.3%	4.3%

Source: *ZESPRI

For the growing seasons 2010, 2011, and 2012 to March 17, ZESPRI data on the percentages of regional areas sprayed with Psa-V control products were multiplied by the average number of Psa-V protectant sprays applied to properties sprayed in the region (Table 2) to calculate the average number of spray rounds on the productive area in each region. In 2012 the total numbers of spray rounds and volumes of chemicals sprayed have been attributed to the area still expected to reach harvest, despite the fact that some of the early season costs will have been incurred on areas now cut out. This approach has been taken to ensure that the total costs incurred by the industry are included in the analysis. On average, one spray round was estimated to cost $105 per hectare, although the spray rounds post March 17 in 2012 were estimated to cost $125 because of the extra volume of water required in late season spraying (Linda Peacock, KVH pers. comm.). It has been assumed that on the area sprayed in 2012, one additional spray round will be undertaken on Hayward crops in 2012 and two additional rounds on Hort 16A crops.

The total volumes of each Psa-V control product material applied in each region during 2010, 2011 and 2012 to March 17 were valued at the lowest current retail price quoted for each, in order to estimate the total costs of Psa-V products sprayed. No attempt was made to incorporate discount rates paid by larger suppliers.

Table 2: Psa-V control products applied by region 2010 to 2012

	% of prod'n area sprayed with Psa-V products			Average no of sprays on area sprayed		
	2010	2011	2012	2010	2011	2012
Te Puke HW	0.5%	51.8%	90.3%	1.27	2.61	9.23
Te Puke Gold	0.0%	78.2%	94.6%	0.00	2.60	14.45
Region 2 HW	5.0%	5.2%	81.0%	1.00	1.04	6.61
Region 2 Gold	9.3%	16.6%	93.4%	1.00	1.04	11.40
Region 3 HW	0.7%	0.2%	28.8%	1.00	1.05	3.45
Region 3 Gold	3.8%	11.5%	44.9%	1.00	1.04	6.15
Region 4 HW	5.5%	3.7%	27.2%	1.00	1.00	2.69
Region 4 Gold	7.5%	6.9%	53.3%	1.00	1.60	2.96
Total HW	3.4%	23.9%	78.1%	1.02	2.40	7.57
Total Gold	4.6%	44.0%	89.5%	1.01	2.26	11.57

Note The number of sprays in 2012 has been adjusted to incorporate one additional spray on the sprayed Te Puke Hayward area and two additional sprays on the sprayed Te Puke gold area.

It has been assumed that an adjuvant has been included in only 25 percent of spray rounds, since the recommendations for Sporekill®, Nordox® and Serenade® Max exclude the use of adjuvants, and testing this year has found that adjuvants are unlikely to markedly increase or reduce Kocide® Opti's resistance to rain wash-off (Gaskin et al, 2011). They are not universally used with other protectant products.

Because some of the products used as Psa-V protectants are also used for other purposes (dropping the leaves after harvest and control of other bacterial diseases) by some growers, the change in costs from a pre-Psa-V season has been calculated for 2011 and 2012, by subtracting the 2010 costs. Total expenditures on Psa-V protectants were divided by the productive area in each season to estimate the changes in average expenditures, which are shown in Table 3.

Spray regimes in 2011 were very costly on average, and particularly on Hort 16A crops in Te Puke. It has been assumed that greater understanding of the efficacy of products, the development of a disease prediction model by KVH, and more typical seasonal conditions will lead to reduced application of Psa-V control products in future. It has been assumed that in 2013 the costs will be reduced to 75 percent of estimated 2012 levels, and beyond that time to 67 percent of 2012 levels. The four regions are described in Chapter 4.

Table 3: Costs of Psa-V protectants per hectare by region 2010-2012 growing seasons

	2010		2011		2012	
	$ per G prod'n ha	$ per HW prod'n ha	$ per G prod'n ha	$ per HW prod'n ha	$ per G prod'n ha	$ per HW prod'n ha
Te Puke	$0.00	$0.31	$356.63	$195.84	$1,715.10	$668.51
Region 2	$2.48	$1.45	$8.76	$2.49	$647.07	$189.35
Region 3	$2.52	$2.64	$85.26	$2.68	$420.79	$79.90
Region 4	$16.34	$2.19	$5.84	$1.40	$32.86	$9.14
Total	$1.58	$1.14	$176.58	$79.96	$989.18	$360.71

Notes: [1]The total spray volume in 2012 has been attributed to the area expected to be harvested. In fact more hectares will have been sprayed at a lower cost but the totals will be the same.

[2]An extra two Actigard® sprays have been added to the area of Te Puke gold kiwifruit that has been sprayed to date and is expected to be harvested. An extra copper has been applied to the Te Puke Hayward kiwifruit area to account for the remainder of the season.

The average cost of Psa-V control materials applied in each season was estimated by calculating the total volume of each protectant product recorded in spray diaries at the lowest retail price quoted.

3.1.2 Changes in pruning and vine management

The changes in pruning and vine management practices reported by the growers interviewed were as diverse as the changes to pest management regimes that they had reported. Some had taken the approach of "shutting the orchard gate" to all but the most essential operations and visitors. Both winter and summer vine management activities had been reduced dramatically in consequence. Others had continued with regimes that were much as usual but had implemented stringent hygiene regimes, including the use of pruning pastes on cuts, and spraying or soaking pruning equipment or changing to gel-pruners. For purposes of the analysis it was decided, in consultation with experienced industry consultants, to increase the costs of winter pruning by 20 percent on average from pre-Psa-V levels in the 2011/12 season, but to reduce these costs to 115 percent of pre Psa-V levels in subsequent seasons. The costs of other pruning and vine management practices remained unchanged except that a cost of $200 per hectare for Psa-V hygiene was added in 2011/12 and $100 per hectare in subsequent seasons. It was considered that the 2011/12 changes had been made without full knowledge of the relative importance of on-orchard practices in the transmission of the disease, and that greater knowledge will result in some reduction in the hygiene measures taken in future. Psa-V is, however, in New Zealand to stay, and permanent changes to orchard management regimes are inevitable.

3.1.3 Changes in artificial pollination practices

The analysis assumes that the majority of growers suspended artificial pollination for a season because of fears that Psa-V had been introduced to the industry by means of imported pollen. In fact, MAF (now MPI) has yet to identify the pathway by which the incursion occurred, and it may not be possible to do so. However, since research has indicated that there do appear to be risks associated with imported pollen, a review of

kiwifruit pollen importation processes is currently underway (MAF, 2011b). KVH has now produced protocols round pollination (KVH, 2011c), and for purposes of the analysis it has been assumed that artificial pollination will be resumed at pre-Psa-V levels in the next production season. KVH has funded research into treatment methods for pollen that will ensure freedom from Psa-V contamination, while maintaining pollen viability.

3.1.4 Changes in fertiliser regimes

As was the case with other orchard management practices, the impact of Psa-V on kiwifruit fertiliser regimes differed widely amongst those growers interviewed. Some had reduced fertiliser application rates in order to limit canopy vigour, particularly in the light of reduced winter pruning. Some Hort 16A growers had cut fertiliser use because they did not anticipate kiwifruit production from existing vines after the current season, and others had reduced fertiliser use as a way of reducing orchard working costs in the short term. Others, however, had maintained normal fertiliser application regimes and, in addition, were applying foliar fertilisers to support plant health in order to maximise crop volumes this season. In the analysis it has been assumed that, on average, a reduction of 120 kilograms of nitrogen per hectare will have been applied in the current season and that fertiliser levels will revert to normal in subsequent seasons.

3.1.5 Changes in repairs and orchard maintenance regimes

Orchard repairs and maintenance costs have traditionally been reduced or deferred during seasons of low profitability. In the analysis of the impacts of Psa-V it has been assumed that the ZESPRI estimate of repairs and maintenance expenditure will be halved for two seasons before returning to normal levels.

3.1.6 Removal of vines.

On Hort 16A orchards to be removed as a result of Psa-V infection, and orchards where Hayward vines are to be replaced with G3 or other new varieties, the costs of regrafting, or, where rootstocks are replaced, replanting, will be incurred. Vine removal costs have been valued in the analysis at $5,500 per hectare for vines cut off below the graft, and $7,000 per hectare where stumps are also removed. These estimates are based on the data provided by ZESPRI (ZESPRI, 2011b) and discussions with local contractors involved in vine removal.

3.2 The impacts of Psa-V on the post-harvest sector

The kiwifruit post-harvest sector is responsible for the packing, cool-storage, and transport of kiwifruit between the orchard and the point of export. The sector is characterised by a large number of operators with considerable diversity in terms of size; the number of operating sites; ownership and capital structures; investment in new technology; debt levels; and many other characteristics. ZESPRI has fourteen registered suppliers at present (Shaun Gardner, ZESPRI, pers. comm.), but in a number of cases a single supplier will submit fruit from more than one post-harvest firm. Of approximately 27 firms in the sector, 17 or 18 pack fewer than 2.5 million trays in a typical season (Tom Wilson, Satara pers. comm.). This diversity has made estimation of the impacts of Psa-V on the costs incurred by the post-harvest sector particularly difficult. The analytical approach employed has been validated with several sector participants.

3.2.1 Analytical approach

During this study, representatives of seven of the largest post-harvest facilities were interviewed about their companies' operating plans for the coming seasons in response to

Psa-V. These companies were responsible for packing 55 percent of the Hayward kiwifruit crop in 2011 and 68 percent of the gold kiwifruit crop. The majority of the financial data used to estimate changes in post-harvest costs with Psa-V were obtained from the annual reports of the three largest companies, Seeka, East Pack and Satara (EastPack, 2011; Satara, 2011; SEEKA, 2011).

Annual reports were available for two of the other companies, but separating the impacts of their avocado businesses from the kiwifruit financial outcomes was not possible. Information provided by other companies was used in the estimates of change described in this section, where possible.

All of the post-harvest representatives interviewed were of the view that there are likely to be major changes in the structure of the post-harvest sector as a direct result of the impacts of Psa-V. However, the uncertainty around the extent and the timing of the impact of the disease on crop volumes, as well as the short period between recognition of the disease and its impact, has meant that planning required for the 2012/13 packing season had not been finalised by the time of the interviews. It was far from clear what changes would be required for 2013/14 and beyond. As a worst case scenario two interviewees suggested that there may be as few as three post-harvest facilities operating between 2014 and 2017, although others believed that structural adjustment will be less severe than that. In general terms it appears that most firms are planning to reduce overheads severely to maintain profitability. Like the growers, post-harvest operators expressed concern about the loss of intellectual property associated with the loss of skilled workers.

It is clear that some of the costs usually regarded as "fixed" were being reduced within a very short period. With one exception, the companies had already reduced permanent staff numbers and reduced the hours or altered the contractual arrangements of others. Several foresaw a reduction in services other than those directly related to core business. The immediate response of a number of companies has been reduction in the number of shifts operating at individual plants, and the closing of the least efficient sites in cases where companies operate multiple facilities.

3.2.2 Estimation of post-harvest costs

In order to conduct a national economic costs benefit analysis (CBA) the total costs incurred by the post-harvest sector must be included, with the exception of financial transactions, such as capital charges and interest costs. These are excluded primarily because they are resource transfers from one part of the economy to another, rather than resource costs. Moreover, these charges are implicitly included in the discount rate so their inclusion would result in double-counting. Depreciation is also excluded from CBA because it is an accounting allowance not a true resource cost. Rather, the purchase costs of asset replacement should be included in the analysis during the year in which they are incurred (Treasury, 2005).

A standardised approach to estimation of the costs incurred by the post-harvest sector was developed in the early stages of the project, based on the assumptions detailed below. The representatives of the post-harvest sector who were interviewed agreed in principal with this approach.

These costs were estimated on a whole-of-sector basis and no assumptions have been made about the number of firms operating or the nature of any mergers, take-overs and closures that will occur.

Firstly the change in operating costs with a large decline in fruit volumes was estimated. The main assumption on which the post-harvest cost estimates are based is that the industry as a whole will attempt to maintain variable costs, plus fixed costs excluding interest and depreciation, at a constant level per tray as long as possible by divesting itself of fixed cost elements as far as possible. As fruit volumes decline, however, per tray costs will inevitably increase but Earnings before Tax (EBT) will not fall below zero. (The EBT measure has been used rather than the more familiar EBIT - Earnings before Interest and Tax - because firms will still need to meet debt servicing costs even though these are excluded from the analysis). This is because individual firms will exit the industry, merge, or be taken over, leaving only the most efficient firms or combinations of firms.

It has been assumed, on the basis of discussions with sector representatives, that EBT will decline to zero if fruit volumes decline to 60 percent of 2010 harvest levels. No attempt was made to estimate the reduction in costs per tray with an increase in volumes as the industry recovers, since the impact of economies of scale in the sector is very complex. Rather constant real costs were assumed to prevail with industry expansion.

The base-line cost calculation was undertaken using the financial results from the three largest post-harvest operators for the 2010 financial year. During that year SEEKA changed its balance date from March 31 to December 31 and reported a nine month financial result. However, since almost revenue is earned in the March to December period, and almost all cost (with the exception of depreciation and permanent staff salaries which occur throughout the season) is incurred during that time, the relationship between revenue and cost during that period is assumed to hold for the season as a whole (Geoff Carey; Seeka, pers. comm.).

For each company the EBT in 2010 was calculated on the basis of data contained in the 2010 annual reports, and the weighted average per tray was estimated to be $0.63 per tray. As this is the amount costs are assumed to increase when volumes decline to 40 percent of 2010 levels, the average increase in costs is estimated to be $0.015 per percentage decline in volume of Class 1 fruit packed.

The pre Psa-V post-harvest operating costs per tray of fruit packed (total costs less interest, depreciation and amortisation) were estimated to be $2.96 per gold tray packed and $2.61 per green tray. In addition there will be a change in operating costs associated with maintaining Psa-V hygiene which is estimated to be $0.03 per tray in the 2012 harvest season, reducing to $0.015 in 2013 and to $0.01 in subsequent years.

An estimate of the capital costs of setting up for Psa-V include the costs of bin sanitisers, laboratory set-up costs and dust extractors. The approaches taken and costs incurred have varied markedly between companies, but indicative costs of $.020 per tray over two seasons have been included in the analysis.

The kiwifruit post-harvest sector had some excess capacity before the industry was struck by Psa-V which, combined with the proposed change from Hort 16A to G3, which has less complex packing and storage protocols, means that the industry is unlikely to need to invest in new facilities until crop volumes exceed 2011 levels by at least 20 percent. From that time it is assumed that capital costs of $5.50 per tray packed will be incurred annually. This investment is assumed to take place in seasons immediately before capacity is exceeded and in blocks of expenditure sufficient for one million trays.

No estimates are available for the average annual costs of capital replacement in the kiwifruit post-harvest sector, but a number of firms have carried out extensive programmes of capital renewal and investment in modern packing technologies. However, it appears that capital expenditure has pretty well matched the provision for depreciation on a smoothed annual basis, and the estimate of capital replacement costs for existing capacity has been based on depreciation levels. It has been assumed that capital replacement will be discontinued in the short term and resume when crop volumes recover to 2010 levels. These costs have been included on an annual basis rather at an estimated time of replacement. The post-harvest sector cost assumptions are detailed in Table 4.

Table 4: Impacts of Psa-V on post-harvest costs

	$/tray
Operating costs 2010 average cost	
Green	$2.61
Gold	$2.96
Total	$2.71
Per % decrease in volume	$0.02
Psa-V hygiene requirements	
2011	$0.03
2012	$0.02
2013+	$0.01
Capital costs	
Psa hygiene -2011 and 2012 harvest	$0.20
Capital replacement from 2015	$0.42
Investment when volumes exceed 2010 +20%	$5.50

3.3 The impacts of Psa-V on ZESPRI

ZESPRI is faced with challenges on a number of fronts as a result of the discovery of Psa-V in New Zealand. At the outset, it was involved with MAF (now MPI) in managing the industry response to the incursion until KVH was established, and it has remained actively involved in most levels of the continuing response. ZESPRI was the agency responsible for the industry consultation process round the proposed recovery strategy, and will be responsible for rolling out the strategy that has now been adopted. It is very actively involved in the technology transfer and communication programmes with KVH, and has contributed significantly to the funding and commissioning of research and development into Psa-V control.

As the marketer of almost all of New Zealand's export kiwifruit, it will be ZESPRI's responsibility to manage the withdrawal of Hort16A, its premium product to date, from international markets and to develop and maintain market share for G3 once significant export volumes are produced.

ZESPRI has provided estimates of pricing and market shares at differing volumes of production and on its own cost structures that have been required for the analysis. In the interests of commercial sensitivity, however, this information cannot be published in this report.

3.4 The impacts of Psa-V on other kiwifruit industry participants

There are a number of other kiwifruit industry participants who have been, and will continue to be, affected by Psa-V. These participants include contractors and their staff, transport operators, and bee keepers, and representatives of these were interviewed as part of the study. Although the costs incurred by these participants are not assumed to be large in comparison to the costs incurred by the industry as a whole, and part of any additional cost incurred has been, or will be, passed on to other sectors, for some of these individual businesses the impacts of Psa-V have been devastating. No specific adjustment to industry costs has been included in the analysis to account for changes in the costs of these participants. This will have led to some underestimation of the total costs of Psa-V.

In particular the kiwifruit contracting industry in the Bay of Plenty region has experienced a major contraction in business with the discovery of Psa-V. The impact was not felt until the winter of 2011, when the costs of Psa-V hygiene regimes were first experienced. One contractor interviewed had absorbed these costs rather than pass them on to orchardists, but believed that the majority probably did not. The extra time required for pruning meant that some contractors required a larger than usual workforce by the end of the season, but others had already reduced staff numbers dramatically. Since winter, the reductions in contracting staff have been severe, and there is anecdotal evidence that some smaller contracting firms have stopped operations altogether. One large contractor reported that he had already reduced staff numbers by almost 50 percent. The majority of the workers who have been laid off have been Pacific Islanders and Indians. When the normal volume of work was still available in Hort 16A kiwifruit orchards, the staff employed by this contractor had work available for fifty weeks a year and were working 60 to 70 hours a week during peak periods. The staff remaining will have 30 or fewer weeks of work this year. Because Hort 16A kiwifruit is an earlier crop than Hayward it extended the period of employment. Without it, there will be a period from mid-September to early/mid-November with no work for contractors.

The two large transport operators interviewed had not experienced major business change as a result of Psa-V, although a small operator reported that costs of acquiring a curtain-sider truck in order to contain inoculum had been significant in his business. One company that has been involved in the transport of vines to destruction sites had had more business than usual from the kiwifruit sector in 2011, and did not expect any real downturn in turnover from kiwifruit transport until 2013. The large operators reported that the expected reduction in business from the kiwifruit sector could usually be readily substituted by business from other sectors, but acknowledged that this may be more difficult in times of general economic downturn. Minor capital expenditure had been required for purchase of sanitising equipment by transport operators, and additional time has been required for sanitising vehicles. It is expected that the extra operating costs incurred will be passed on in future seasons.

One beekeeper was interviewed about the impacts on his business of Psa-V. It was his opinion that, for the beekeeping industry, the impacts of Psa-V will not be severe as long as "Hayward gets through". The pollination of gold kiwifruit provides a useful source of

cashflow, and hives used for gold pollination can be used for Hayward pollination later, significantly increasing the annual return per hive. However, the loss of revenue from gold pollination is considerably lower than the impacts of other seasonal fluctuations, particularly fluctuations in the manuka crop. Hayward pollination is the "bread and butter" of many beekeeping businesses in the region and its loss would have severe impacts on this sector.

The costs incurred by beekeepers have been higher since Psa-V was discovered because beekeepers have greater distances to travel between gold hives. Most have not attempted to pass these on to growers because of a sense that "you can't kick a bloke while he's down". For the first time, testing for streptomycin in honey has been introduced by at least some honey exporters, over and above the normal programme of residue testing of honey, carried out by the MAF (now MPI) which randomly tests all export honey for a range of residues including antibiotic residues. The official export and domestic honey residue testing programme has not been modified in response to Psa-V (Susan Morris MPI, Jim Sinn MPI pers. comm.). For example, Comvita (a large Bay-of-Plenty-based Manuka honey exporter) has implemented a regime of testing every vat of honey at a cost of $125 per vat. While this has been passed on to the beekeeper, the company has paid a premium of $0.10 per kilogramme to help offset this cost (Jenny Brodie, Comvita, pers. comm.).

Chapter 4
The Production Area and Volume Scenario Models

On the basis of the most recent information about the expected spread and impacts of Psa-V; the announcement of the proposed industry recovery pathway; and the current levels of indebtedness amongst growers, KVH, in consultation with industry defined the two recovery scenarios to be evaluated. The Status-Quo scenario was based on ZESPRI industry development plans. The analysis period evaluated under each scenario was 2011 to 2040. While this is a very long period, it was the period required for all scenarios to converge. The analysis has been undertaken on the assumption that there will be no further industry development once ZESPRI's export revenue target has been met. Although this will not be the case, it is not unreasonable to assume that any change that occurs after that will occur concurrently under all scenarios, so its exclusion will not alter the results of the analysis.

The scenarios include:

- The Status Quo scenario (SQ), based on the area changes implicit in ZESPRI's plan to achieve export revenues of three billion dollars by 2025 (ZESPRI, 2010). The ZESPRI target was acknowledged to be an ambitious one, and for purposes of the cost benefit analysis, the changes in production areas on which the ZESPRI analysis was based have been assumed to take an additional five years to achieve.
- The Assisted Recovery scenario (AR) based on the industry's expectation of the outcomes of the proposed recovery strategy if finance for redevelopment is not constrained by bank lending criteria with respect to debt:equity ratios;
- The Unassisted Recovery Scenario (UR) under which a proportion of kiwifruit growers unable to take advantage of the proposed roll out of G3 licenses because they are unable to obtain the necessary finance for redevelopment because of their existing debt levels.

Four regional models of the spread of Psa-V were developed, reflecting the rates at which the impacts of Psa-V are expected to be experienced in different parts of New Zealand (John Burke, KVH, pers. comm.). They include models for Te Puke; the remainder of the Bay of Plenty and Auckland (Region 2); Waikato, Coromandel, Whangarei, Kerikeri, Hawke's Bay and Poverty Bay (Region 3); and the lower North Island and Nelson (Region 4). The full impacts of Psa-V (i.e. when the removal of all Hort 16A becomes necessary) are expected to be experienced in Te Puke in 2013, Region 2 in 2014, Region 3 in 2015 and Region 4 in 2016. All models incorporate the baseline industry development assumptions provided by ZESPRI (Shaun Gardner, ZESPRI, pers. comm.).

From these models the total changes in production areas, export volumes and rates of grafting and planting under each of the scenarios were estimated.

In developing the regional models it was assumed that the regional proportions of production would be maintained through time. In fact this may not be feasible. In particular, the proportion of national production based in Te Puke may well decline in future as the supply of suitable production land is constrained, or as a result of climate change. However, for the purposes of this analysis this will not matter as the total areas and production levels were aggregated to national levels in the analysis. The regional models were required only to reflect the spread of the disease.

Table 5 shows the areas of kiwifruit in these regions at harvest 2011. In this analysis yields, data and returns are expressed in terms of growing seasons, so all costs and returns related to the crop harvested in 2012 are attributed to the 2012 year.

No attempt was made to evaluate the potential economic impacts of the failure of the recovery strategy if the gold G3 variety proves to be less Psa-V tolerant than the current evidence suggests. In that case, industry redevelopment would almost certainly be suspended until a highly tolerant variety can be bred and tested, which may be expected to take between six to eight years (Stuart Kay, Plant & Food Research Ltd). The production of gold kiwifruit in New Zealand would cease almost entirely as the spread of Psa-V through regions outside the Bay of Plenty proceeds and kiwifruit exports would consist almost entirely of the Hayward variety. Hayward is regarded as "marginally viable" for a significant number of growers by many people in the industry and the loss of gold varieties could be expected to result in the exit from the industry of large numbers of growers, postharvest operators and others.

In addition, the challenges of keeping markets for gold kiwifruit open in the almost total absence of supply would be insuperable, and much of ZESPRI's marketing effort over the last decade wasted. The costs of re-establishing market share once gold production from a Psa-V resistant variety was established would be extremely high.

Increasingly, however, the evidence suggests that appropriate management techniques will ensure that G3 will provide the industry with a viable option for the medium term – at least until more Psa-V tolerant varieties can be established.

Table 5: Kiwifruit areas by variety and region as at harvest 2011

	Total ha	Hayward ha	Total gold ha	Hort 16A ha	New gold varieties ha	Other new varieties ha
Te Puke	5154	3974	1158	1140	17	23
Tauranga	1783	1494	287	281	6	2
Katikati	1451	1240	201	183	18	11
Waihi	196	173	23	20	3	0
Whakatane	691	606	84	81	4	1
Opotiki & Te Kaha	873	590	278	266	12	5
Auckland	505	420	84	80	4	1
Total Region 2	5501	4523	957	910	47	20
Waikato/Coromandel	471	381	90	85	5	1
Whangarei/Kerikeri	458	240	218	216	2	0
Hawkes Bay/Poverty Bay	460	249	208	194	14	2
Total Region 3	1389	870	516	495	21	3
Nelson & Lower North Island (Region 4)	592	544	46	44	2	2
Total	**12635**	**9911**	**2676**	**2589**	**87**	**48**

Source Zespri

All four models have been based on the yield assumptions detailed in Tables 6 and 7. The actual regional yields have been used in 2011 (Sue Galpin, ZESPRI, pers. comm.), which is the base year of the analysis. The expected Hort 16A yields in 2012 are based on ZESPRI's February 2012 crop estimates (John White, ZESPRI, pers. comm.). These reflect the impacts of Psa-V on the yields of remaining vines and the removal of individual vines on hectares still expected to be harvested in 2012. The average Hayward yield over all regions was used in the analysis. Other yield estimates in all scenarios are based on conservative industry averages for vines of differing ages throughout the industry. Industry averages, rather than estimates of individual regional yields, have been used because the regional distribution of future production areas is not certain. These yields are not identical to those used in the ZESPRI analysis, which estimated yield on the basis of the total production area in each year. Because the Psa-V analysis requires differing age distributions of vines under each scenario, the yields have been disaggregated by age of vines.

Table 6: Regional kiwifruit yields in 2011, expected yields in 2012 and four year averages

	Hort 16A		Hayward		4 year average	
	2011	2012	2011	2012	Hort 16A	Hayward
Te Puke	13,015	6,212	9,291		11,537	8,850
Region 2	11,768	10,946	8,500		11,009	7,983
Region 3	9,587	10,789	6,759	8,139	8,978	6,250
Region 4	9,585	10,529	6,837		9,412	5,703
Total	11,864	8,963	8,573		10,834	8,040

Source: ZESPRI

Table 7: Average kiwifruit yields by age of vines (trays per hectare)

	Gold varieties		Hayward		Other new varieties	
	Grafted	Planted	Grafted	Planted	Grafted	Planted
Year 1	-	-	-	-	-	-
Year 2	4,290	-	900	-	1,000	-
Year 3	9,750	4,290	4,500	900	5,000	1,000
Year 4	12,000	9,750	6,750	4,500	7,500	5,000
Year 5	12,000	12,000	9,000	6,750	10,000	7,500
Year 6	12,000	12,000	9,000	9,000	10,000	10,000
Year 7	12,000	12,000	9,000	9,000	10,000	10,000

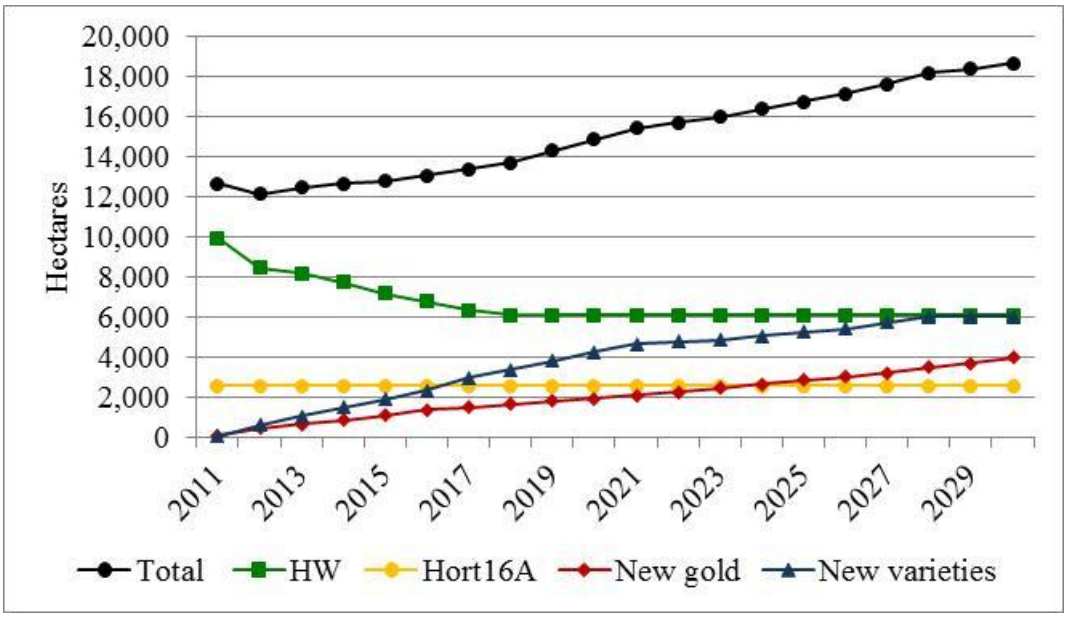
4.1 The Status Quo scenario (SQ)

The Status Quo scenario is based on ZESPRI's expectations of industry development by 2025, modified so that production levels take an additional five years (until 2030) to achieve.

Under the SQ scenario it is anticipated that the total area of kiwifruit grown in New Zealand will increase by 48 percent by the end of the analysis period. This reflects a decline in the area of Hayward grown from approximately 10,000 hectares to six thousand; a 150 percent increase in the total area of gold kiwifruit grown with the

increases attributable to new gold varieties (including G3) rather than Hort 16A; and a very large increase in other new variety areas from less than 100 hectares in 2011 to approximately 6,000 hectares in by the end of the period. Constant areas and volumes are assumed under the SQ from 2030 until the end of the analysis period, which is from 2011 to 2040, to allow the three scenarios to converge.

In volume terms, even at the conservative yield estimates employed in the analysis, total kiwifruit volumes are expected to increase approximately 70 percent, with a significant change from Hayward green towards new gold and other varieties that attract higher prices. Figures 5 and 6 show the expected changes in production areas and fruit volumes from 2011 to 2030.



Source: ZESPRI

Figure 5: Kiwifruit areas by variety 2011 to 2030 (Status quo)

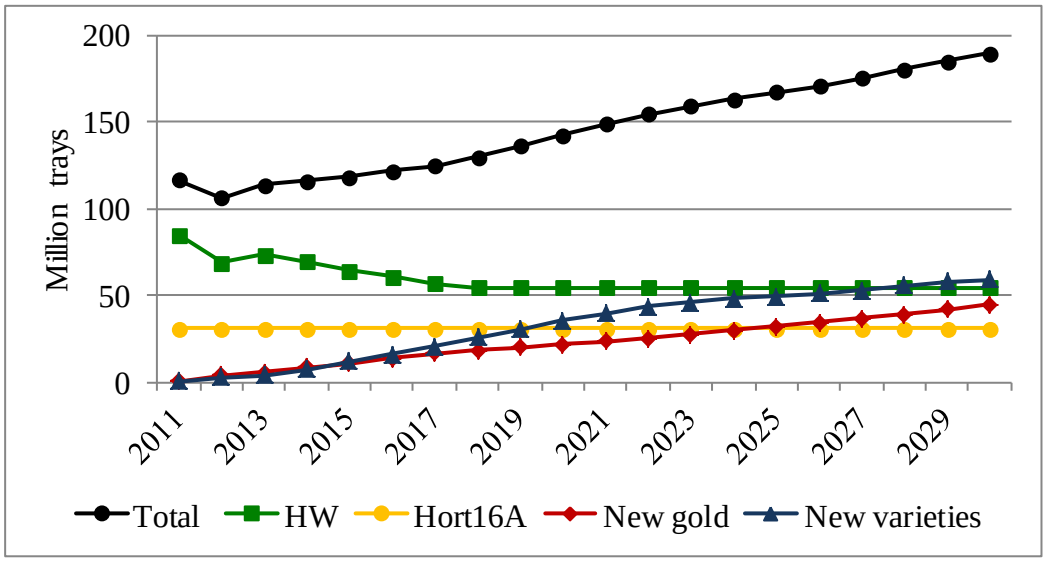


Figure 6: Kiwifruit volumes (million trays) by variety 2011 to 2030 (Status quo)

4.2 The Assisted Recovery scenario (AR)

Under the Assisted Recovery scenario it is assumed that the recovery pathway, set out by ZESPRI on March 21 2012 (ZESPRI, 2012c), will be successful and that affected growers will take up the offer of G3 licenses immediately. The main assumptions incorporated in the AR scenario include:

- The removal of all Hort 16A remaining Hort 16A vines in Te Puke immediately after the 2012 harvest (90 percent cut to graft and 10 percent stumps removed);
- Access to the finance require for redevelopment will be available;
- For regions outside Te Puke the pattern of vine removal will be delayed. In Region 2 the delay will be one year; in Region 3, two years and Region 4, three years;
- The pattern of uptake of G3 licenses after the initial uptake in other regions follows that of Te Puke;
- The pattern of industry development included in the SQ scenario is delayed until two years after

These assumptions are described in greater detail below.

Under the AR scenario, infected Hort 16A will be removed and replaced by G3, either by regrafting onto existing stumps or by replanting areas on which severely infected *Chinensis* rootstocks will have been removed completely. In Te Puke, recent crop estimates collected by ZESPRI (John White, ZESPRI, pers. comm) suggest that approximately 400 hectares of Hort 16A have been removed by February 2012. Of these vines it is estimated (John Burke, KVH, pers. comm.) that approximately ten percent have been completely removed and the remainder cut out below the graft. In addition, on many orchards growers have been progressively removing infected vines as the infection spreads, and this is reflected in the large (53 percent from 2011 yields) reduction in gold yields from the remaining area that is expected at the 2012 harvest.

For purposes of the analysis it has been assumed that the remaining Hort 16A in Te Puke will be removed after the 2012 harvest (90 percent cut to the graft, 10 percent removed entirely). Grafting of G3 onto the rootstocks of the area cut to below the graft will take place during winter of 2012, and the first fruit will be harvested from these vines in 2014. The remaining area will be replanted in winter 2013, when growers have further evidence of G3 tolerance to Psa-V. It is also ZESPRI's intention to release licenses for 400 ha of G3 to Hayward growers during winter 2013. As there is evidence of a strong desire on the part of Hayward growers to take up these licenses (John Burke KVH, pers. comm.), the AR scenario model assumes that they will be taken up immediately.

Although there is anecdotal evidence that small areas of kiwifruit have been removed, and the land returned to dairying or other land uses, these areas are believed to be insignificant and have not been included in the analysis of the AR scenario.

This scenario is based on the assumptions of very high levels of grower adoption of the proposed recovery strategy (100 percent over two years). However, the industry faces a unique situation. There are no alternative landuses from which the level of returns even approaches the returns from gold kiwifruit production and, while there remain a few gold orchards round Te Puke that have not yet been diagnosed with Psa-V, it is unlikely that they will remain healthy beyond the 2012 harvest. The industry expectation (Mike Chapman, NZKGI, John Burke, KVH) is that, under an AR scenario, most existing

orchards will have re-established existing canopy areas, and the property market should have stabilised within two years. Growers who had purchased land for kiwifruit development before Psa-V was found (and whose planned developments have been stalled as a result of Psa-V) should have their confidence in the industry restored and proceed with development. This will be possible as banks resume lending because of stable security values, and perhaps with additional investor funding. The majority of existing growers will remain on their orchards, and new entrants are likely to resume conversion from other landuses to kiwifruit production because of a shortage of existing orchards available for purchase (as was occurring before the discovery of Psa-V).

As the results of the bank debt survey show, the majority of gold kiwifruit growers are heavily indebted and their only real opportunity to meet their debt-servicing commitments is by returning their orchards to gold production as soon as possible. Access to the finance required to re-establish orchards is implicit in the AR scenario. While there are undoubtedly high levels of market and production risk associated with adoption of the strategy, KVH and NZKGI believe that the vast majority of growers will do so as soon as possible, provided the finance for purchasing new licenses and re-establishing the orchard is available.

For regions outside Te Puke, the assumption has been made that in Region 2 (Bay of Plenty outside Te Puke and Auckland), the pattern of vine removal is delayed by one year with only 10 percent of vines removed after the 2012 harvest, 40 percent after the 2013 harvest and the remainder in the following season. In Region 3 (remainder of the upper and central North Island) the process has been delayed by an additional season; and in the lower North Island and Nelson a three-season delay is expected.

In Te Puke, 40 hectares of Hayward kiwifruit were also cut out before the 2012 harvest, before it became apparent that that most Hayward orchards, with the exception of some based on *Chinensis* rootstock, could be managed through Psa-V. No reductions in Hayward area as a result of Psa-V are included in the analysis of other regions.

Under the AR scenario, the direct changes as a result of Psa-V are included in the analysis as described. The less direct effects include delay in the rate of industry growth expected to meet the three billion dollars in export revenue by 2025 target, apart from the initial G3 license uptake by Hayward growers. It has been assumed that with the successful implementation of the AR strategy, the industry development assumed under the SQ scenario will be delayed until the season after gold orchards have been re-established, and conversion from Hayward to new varieties will be slower than assumed under the SQ. The ratio of conversion to G3 and to other new varieties is unchanged. Figures 7 and 8 show the patterns of area and volume change under the AR scenario.

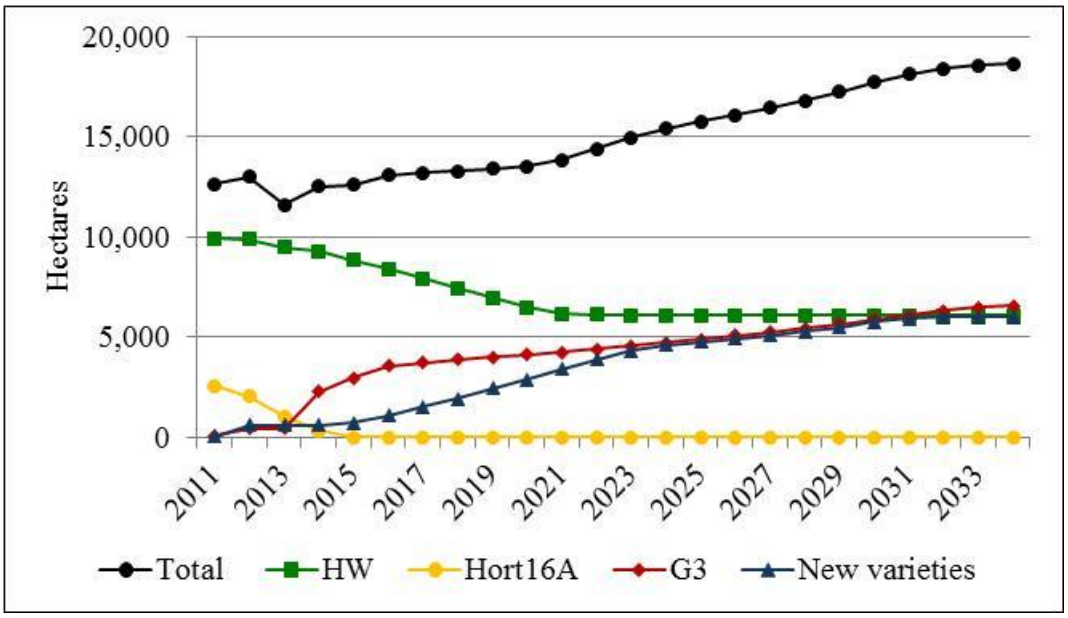


Figure 7: Kiwifruit areas by variety 2011 to 2030 (Assisted Recovery)

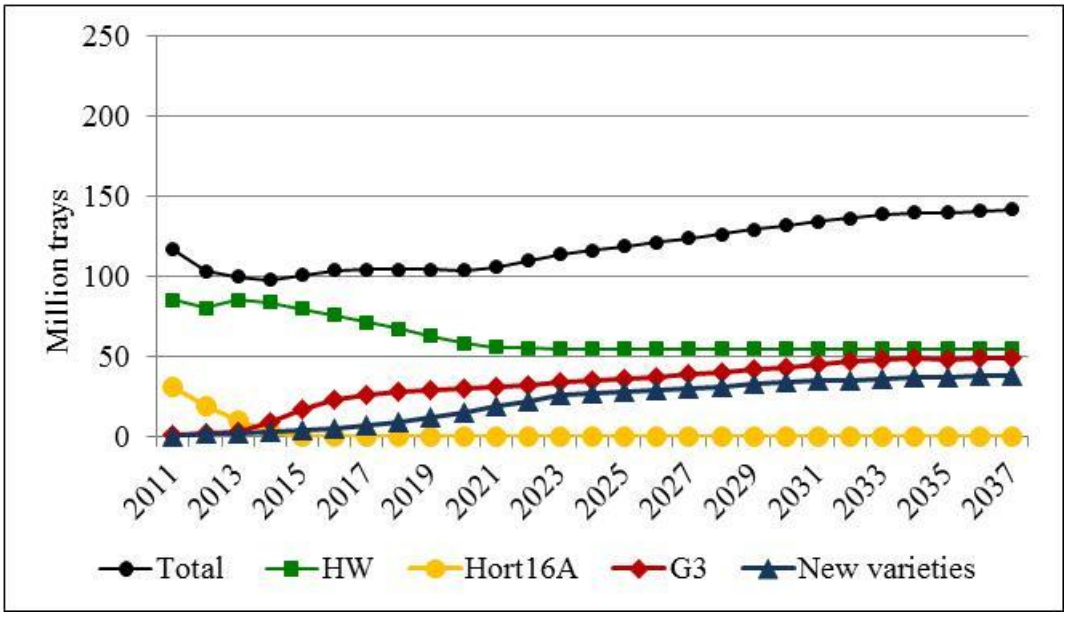


Figure 8: Kiwifruit volumes by variety 2011 to 2037 (Assisted Recovery)

Although the kiwifruit industry is of the same scale at the end of the analysis period under the AR scenario as it is under the SQ scenario, the patterns of area and volume change differ. In the AR scenario, Hort 16A is replaced entirely with new gold varieties

The small difference in total production areas between the SQ and AR scenarios in 2034 closes by 2037 when all areas planted come into full production. The relative patterns of expansion in production volumes are shown in Figure 9.

As this comparison shows, the estimated impact of Psa-V, under the expected scenario outcomes, on total export kiwifruit volumes is significant, as a result of the delayed planting of new varieties.

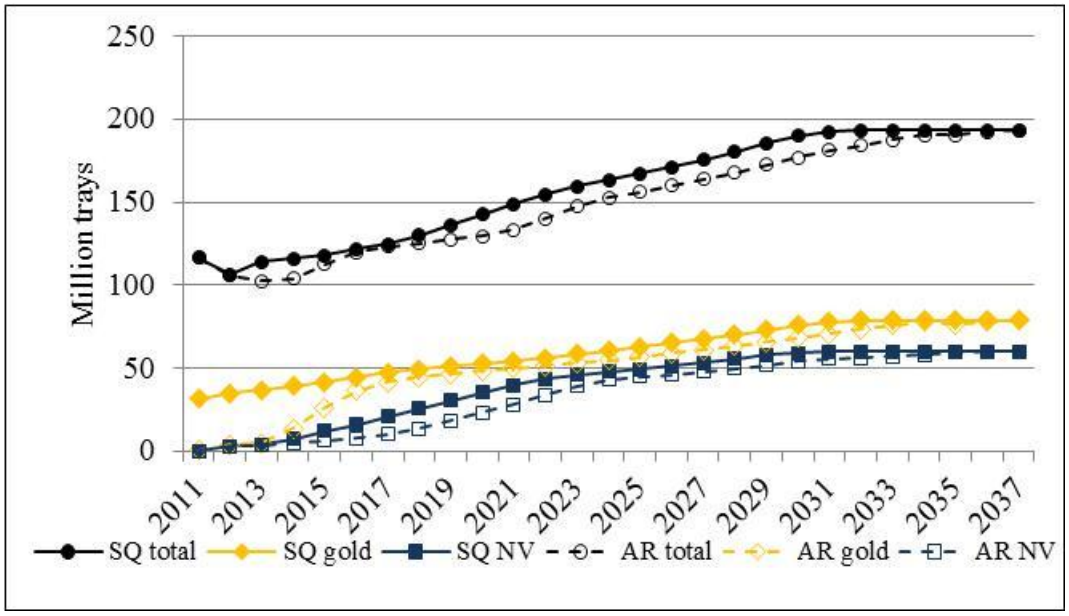


Figure 9: Comparison of total, gold and new variety volumes SQ and AR

4.3 The Unassisted Recovery scenario (UR)

Under the Unassisted Recovery scenario, some Hort 16A growers will be unable to take up the offer of G3 licences immediately because their poor financial position means that they will be unable to obtain the finance required for orchard redevelopment. In addition, the acceptance of the additional G3 licences by Hayward growers will be delayed because the impacts of lack of industry confidence on land values will limit the access to the development finance for these growers as well. The main assumptions of the UR scenario include:

- In Te Puke 75 percent of 663 hectares (400 cut out without compensation and 263 with yields under 6212 trays per hectare), 497 hectares, will be unable to secure finance for re-establishment in 2013. Consequently only 57 percent of the total area will be able to take up G3 licenses in the 2013 growing season.
- The pattern of adoption of the recovery strategy as orchards sell and banks recover confidence is assumed to be that over three years the areas not initially converted to G3 will be re-established;
- In regions outside Te Puke, the impacts of Psa-V on the yields of Hort 16A, follow a similar pattern to that of Te Puke; i.e. yields decline to 54 percent of long-term average yields in the year in which the full impacts of Psa-V are felt.
- The licenses for 400 hectares of G3, made available to Hayward growers by ZESPRI will be taken up more slowly, as the overall impact of Psa-V on kiwifruit orchard prices, and the consequent reduction in equity ratios has a negative impact on the ability of green growers to obtain finance for redevelopment. It is assumed that these licenses are taken up over three seasons.
- In regions outside Te Puke the percentages of area carrying debt of over $100,000 per hectare for those regions from the bank debt survey are used to estimate the proportion of farmers unable to re-establish orchards in the season following vine removal using the same approach as was used for Te Puke (Table 8).

- The pattern of uptake of G3 licenses after the initial uptake in other regions follows that of Te Puke.
- Industry development resumes in each region at similar levels to the SQ four years later than under the AR scenario.

Under any Psa-V scenario, the growers worst affected will be those who have had to cut out gold vines before the 2012 harvest and who have debt levels of $100,000 per hectare or more. These growers will have no income for the following season to provide funds for orchard re-establishment or to service debt, and the market value of their orchards will have declined sharply. Many are likely to be in a low, or even negative, equity position in the short-term, although a positive cash-flow situation may be achieved within a few seasons. Consequently, trading banks can be expected to have difficulty justifying additional credit to these growers under normal lending criteria.

Almost all of the growers in this position are in the Te Puke area. In February it was estimated that approximately 400 hectares had already been cut off and vines continue to be cut out. For the purposes of the analysis it has been assumed that a further 100 hectares will be removed before harvest. Compensation was paid to growers who cut out 106 of these hectares (Jo Simmons, KVH; pers. comm.).

In addition to those growers who will not harvest a gold kiwifruit crop in 2012, most gold growers have incurred very high operating costs while attempting to produce a gold crop in 2012. February crop estimates indicate that gold kiwifruit yields in the Te Puke area are likely to be little more than half of normal yields (6,212 trays per hectare compared with a four year average of 11,500 trays per hectare). The approximate returns and expenses during 2012 and 2013 associated with a hectare of Hort 16A kiwifruit yielding only 6,000 trays per hectare even at a markedly increased orchard-gate return of $9.70 ($2.10 higher than in 2011) per tray of gold kiwifruit in 2012 are shown in Table 8. This shows that assuming debt servicing costs of $6,500, and no other sources of funds, the orchard would have a cash-flow deficit before meeting family living costs of over $25,000 per hectare by the end of the 2012/13 season if it proceeded with redevelopment, even if the license payment isdeferred until production resumes.

Table 8: Costs and returns 2011/12 and 2012/13 on a highly indebted, low yielding Psa-V affected Hort 16A orchard

2012		
Yields (trays per ha)	6,000	
Return	$58,200	
Working costs (incl. overheads & Psa-V costs)	$35,184	
Net		$23,016
Debt servicing	$6,500	
Surplus for family living costs and subsequent season		**$16,516**
2013		
Vine removal and re-establishment	$25,200	
1st year operating costs (incl. overheads)	$10,000	
Debt servicing	$6,500	
Deficit before family living costs		**-$25,184**

Further costs of development and increased debt-servicing costs will be incurred in the season after regrafting. The capital costs of re-establishment will be higher, and the period without cashflow will be longer, for those who must replace rootstocks. For those gold growers whose 2012 yield is lower than the expected average, the position will be even worse, and a proportion may have been in a stronger financial position had they cut off vines earlier in the season, thus minimising orchard operating costs.

A conservative estimate suggests that perhaps forty percent of Te Puke growers whose vines remain will achieve yields per hectare of below 6,200 trays per hectare, which would mean they would not meet normal bank criteria for credit extension if existing debt levels are above $100,000 per hectare. This assumption is based on the fact that the estimated Net Present Value over five years of an orchard, a proxy for orchard value, which achieves a yield of 6,000 trays per hectare and is cut out and re-established in 2013 is $140,000. This estimate has been derived from the KVH financial orchard model (John Burke, KVH. pers. comm.), which is based on a financial year, rather than the production year used in this analysis, and incorporates some minor differences in the cost assumptions employed. The KVH model has been based on estimated orchard-gate return of $7.60 per tray in 2011 (Shaun Gardner, ZESPRI, pers. comm.). With existing debts of $100,000 per hectare, the debt:asset ratio on the model orchard would be 75 percent or higher and unlikely to meet bank lending criteria. This estimate of the proportion of farmers unable to secure credit is consistent with anecdotal evidence from the Te Puke area.

For the purposes of the UR scenario analysis it has been assumed that on the gold kiwifruit area where vines have been cut out without compensation, or on which viable levels of production will not be achieved in 2012, growers will be unable to secure funding for re-establishment if existing debt exceeds $100,000 per hectare. In total 394 hectares are expected to be cut out without compensation by the 2012 harvest, and 263 (40 percent of 657) hectares will not achieve viable production levels. Of these, 75 percent, 496 hectares, (see Chapter two) carry debt of $100,000 or more. As the average area of producing hectares in Te Puke in 2011 was 4.78 hectares (Sue Galpin, ZESPRI, pers. comm.), 104 growers are estimated to be in this position. These assumptions are summarised in Table 9.

Table 9: G3 license uptake assumptions

	Cut pre-harvest without compensation in year of full impact	% Debt > $100,000	Yield insufficient to support debt	% immediate uptake of G3 license
Te Puke	500	75%	263	51%
Region 2	413	33%	199	78%
Region 3	214	4%	113	98%
Region 4	19	4%	10	98%

In the analytical framework employed these orchards will not be re-established until they are sold and taken over by growers with access to the finance for redevelopment, or until property values recover sufficiently to restore bank confidence and credit provision. In practice, the former scenario is more probable as growers who are unable to meet their debt-servicing obligations will fall further into arrears, and will be forced to sell their

orchards. In the short-term the increased volume of forced orchard sales will further depress orchard values and delay the recovery of bank confidence.

Under the UR scenario the expansion of both gold and other new kiwifruit variety areas and yields are delayed more than in the AR scenario as Figures 10 and show. There are only small differences in the total areas of kiwifruit production as Hayward production declines less rapidly, and the largest differences reflect the delays in the production of other new varieties as the industry concentrates on re-establishing gold production. In all scenarios, new variety development is rapid once it gains momentum, so even a short delay reduces areas and volumes markedly in the short term.

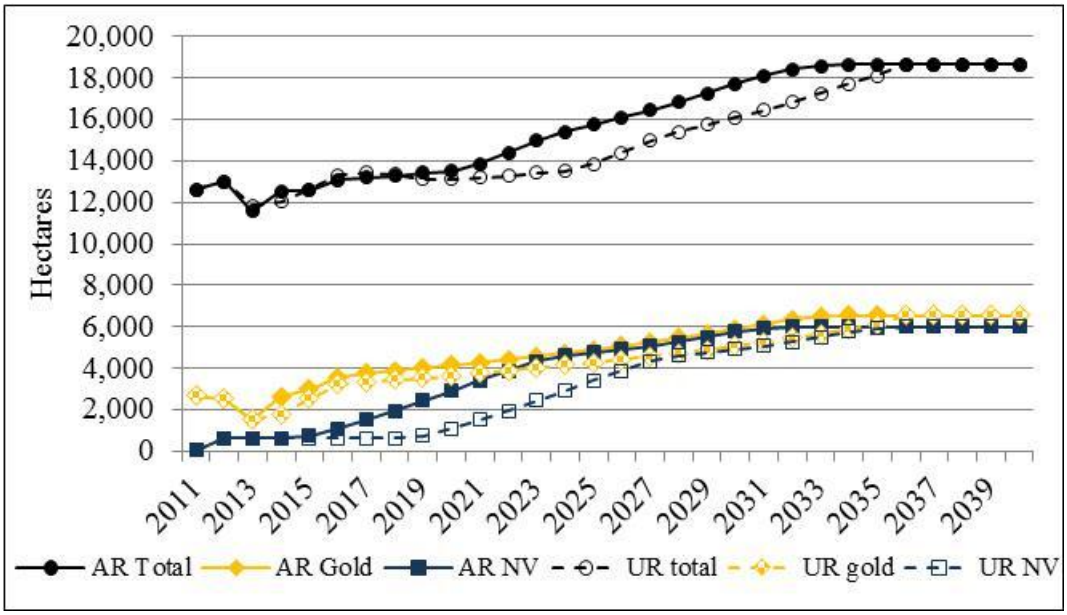


Figure 10: Comparison of total, gold and new variety areas AR and UR

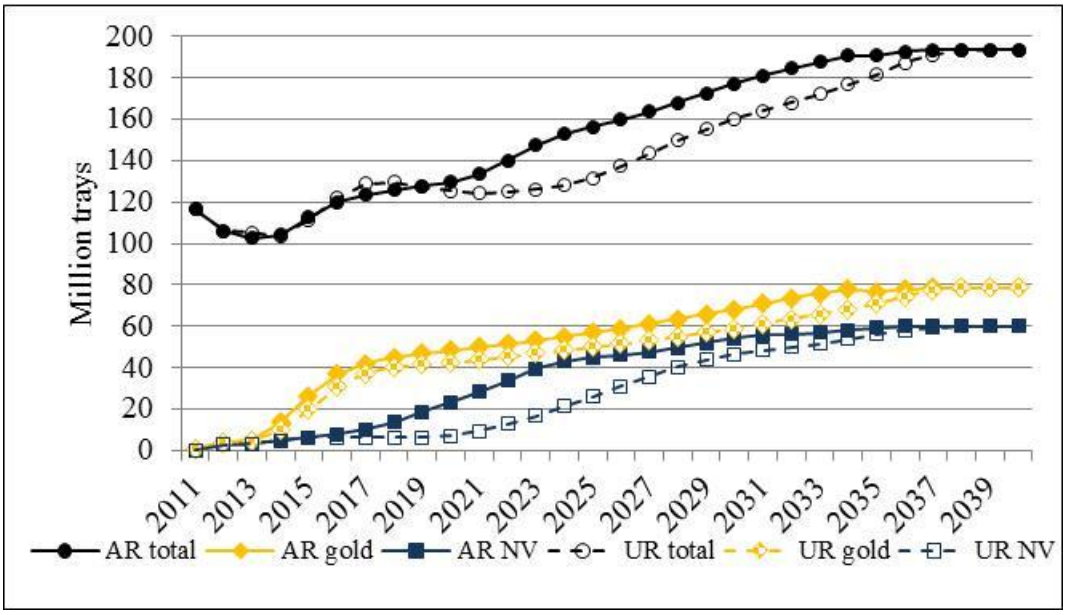


Figure 11: Comparison of total, gold and new variety volumes AR and UR

Chapter 5
Total Impacts of Psa-V on the New Zealand Kiwifruit Industry

The analysis of the economic impacts of Psa-V on the New Zealand kiwifruit industry has been undertaken in several stages. The changes in export yields under each of the scenarios were calculated, and price and market share estimates were supplied by ZESPRI (Shaun Gardner, ZESPRI, pers. comm.) in order to estimate the changes in total export returns under each. Additional returns for Class 2 fruit supplied were included on a "per-export-tray" basis. The total changes in industry costs were estimated in the manner described in Chapter 3. From these a stream of net returns was calculated for each scenario from which Net Present Values were calculated over differing time horizons. Finally regional and national output and employment multipliers were used to calculate the expected impacts of Psa-V under the two recovery strategies on the Bay of Plenty and national economies.

5.1 The impacts on export yields

Psa-V is expected to have a significant negative impact in the medium term (to 2021) both on the total volume of New Zealand kiwifruit exports, and on the varietal distribution of exports under both of the Psa-V recovery scenarios. The differences between scenarios reflect the immediate impact of Psa-V on the industry under both recovery scenarios; the delay in restarting the industry expansion forecast under the SQ scenario in the AR scenario; and the additional four years required to restart industry development in the UR scenario. The export volumes of Hayward, gold and other new varieties of kiwifruit between 2011 and 2021 are shown in Figure 12.

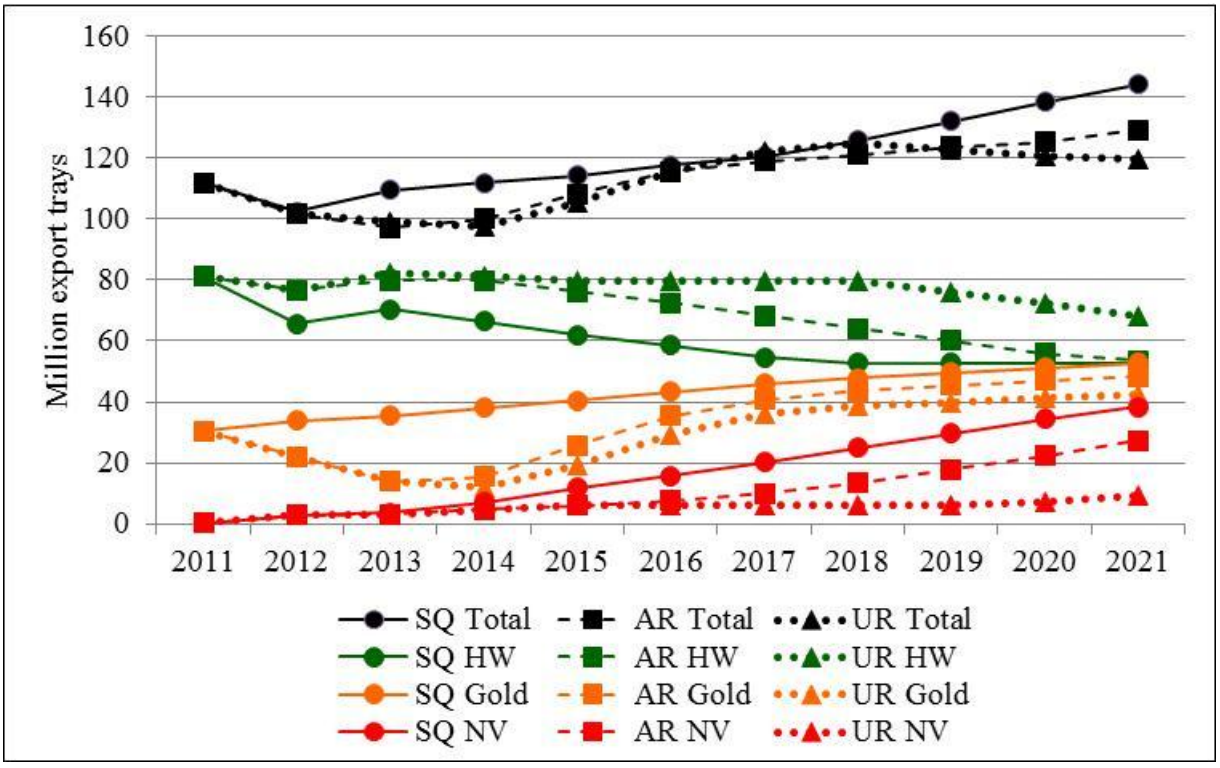


Figure 12: Expected export kiwifruit yields by variety 2011 to 2021

Under the SQ scenario, the total export yields of kiwifruit are expected to increase by 29 percent (to 144 million export trays) by 2021. Under the AR scenario the increase in total volume of exports during the medium term (by 2021) is expected to be only 15 percent, while in the UR scenario total export volumes are expected to increase by seven percent. Under the industry growth assumptions employed in the analysis (see Chapter 4) it will not be until 2026 in the AR case, and 2030 in the UR case, that export volumes return to within ten percent of volumes predicted under the SQ.

The varietal mix of exports also differs markedly under the three scenarios. In the SQ scenario there was expected to be a significant increase in the proportions of total production that comprised gold and other new varieties (from 27 to 37 percent and from zero to 27 percent respectively), which attract higher market returns than Hayward, over the decade from 2011. In contrast, the Hayward proportion of total exports was expected to decline from 73 percent to 37 percent. In the AR scenario the proportion of Hayward declined only to 41 percent, and in the UR scenario to 57 percent. In the AR scenario the slower reduction in Hayward is attributable more to the slowing of "other new variety" development than to a reduction in the rate of gold kiwifruit development, since it has been assumed that replacement of Psa-V affected Hort 16A crops will precede any expansion of new varieties. In the UR scenario new variety development is considerably slower. The relative varietal proportions of the total kiwifruit export crop under each scenario in 2011, 2012, 2015 and 2021 are shown in Figure 13.

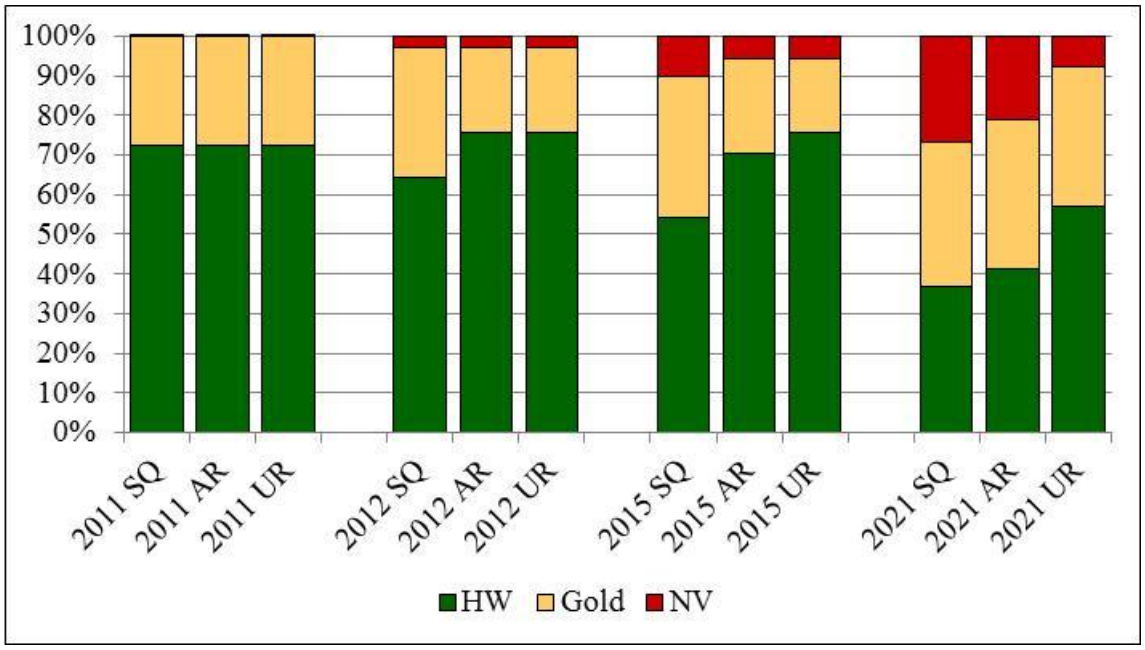


Figure 13: Kiwifruit varieties by proportion of total exports 2011 to 2021

5.2 The impacts on export returns

Using the fruit loss and market price information provided by ZESPRI, the total export market returns from kiwifruit in each season of the analysis period were calculated in real 2011/2012 dollars. The values in the medium term are shown in Figure 14. Anticipated impacts of changes in market supply and distribution were incorporated in the prices provided by ZESPRI.

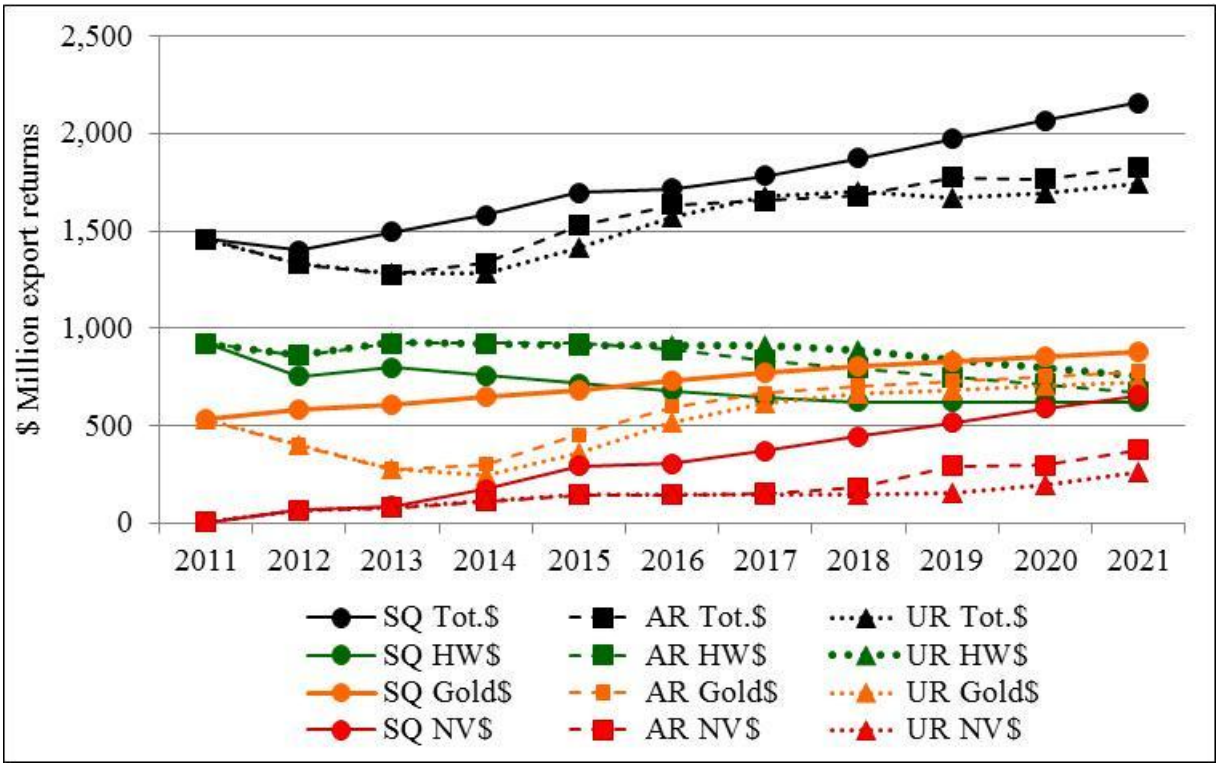


Figure 14: Expected export kiwifruit returns by variety 2011 to 2021

In the medium term, export returns in total, and by variety, are highest under the SQ and higher under the AR scenario than under the UR scenario. The sharp decline in export returns from Hayward in the SQ scenario from 2013 occurs later in the AR scenario, and is further delayed in the UR scenario. The values of gold and other new varieties do not reach SQ levels in the recovery scenarios by 2021. In the AR scenario, export values are restored to almost 95 percent of SQ levels in 2032 and are not restored until 2036 in the UR scenario.

Figure 15 shows the extent to which export returns under the SQ scenario over the medium term would have been expected to exceed the returns that can now be expected under an AR or UR scenario.

The differences between export returns under the AR and UR scenarios peak in 2024. By that time the first yields from gold grafted after the 2012 harvest would be realised but as a lower proportion of Hort 16A has been replaced immediately in UR scenario, and industry expansion is considerably slower, both gold and new variety production is lower than would be expected under the AR scenario. In 2018-2019 export returns are higher under the UR scenario because less Hayward land is out of production while it is converted to higher valued varieties. In 2013, as only a third of the G3 licenses available for Hayward growers are assumed to have been taken up, Hayward production is higher under the UR scenario.

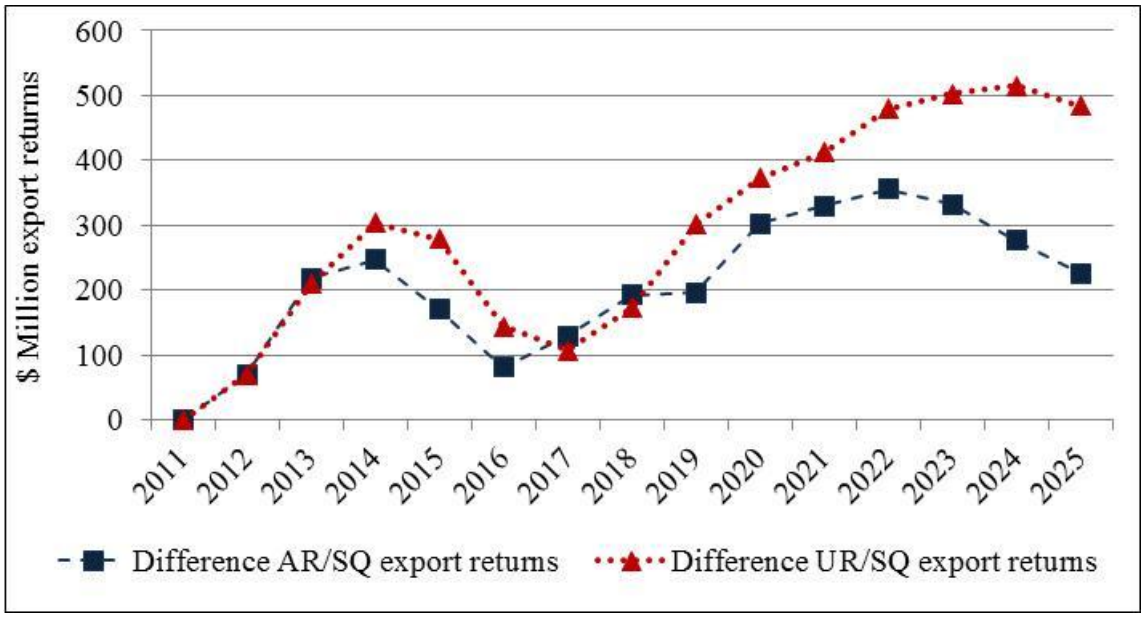


Figure 15: The differences in export returns between the AR and UR scenarios

5.3 The impacts on industry costs

The total costs under the three scenarios do not converge completely at the end of the analysis period because the presence of Psa-V will always require additional pest management and hygiene costs on-orchard. Hygiene costs during post-harvest processes will also be higher. However these differences are not sufficiently large to significantly affect the relative Net Present Values calculated over the entire analysis period.

The impacts of Psa-V on the total costs incurred by the kiwifruit industry include:

- Changes in grower costs as result both of the direct impacts of Psa-V on the areas and volumes harvested, and of the differences in the varietal proportions of production areas and volumes amongst scenarios during the analysis period;
- Changes in the costs of the post-harvest sector including changes in the total costs per tray as export volumes change; changes in average cost per tray since Hort 16A is more costly to pack than G3 and other new varieties; changes in hygiene requirements as a result of Psa-V; and changes in the rates of capacity expansion and capital replacement required;
- Changes in marketing costs, reflecting changes in total export values and differing pool costs by variety and market;
- Additional research and development expenditure and research expenditure diverted from other uses that are assumed to have an opportunity cost at least equal to expenditure;
- Additional costs of wild kiwifruit control incurred by the Bay of Plenty Regional Council, on top of the costs normally incurred for control of kiwifruit as a pest species;
- The operational costs of KVH, which will be met from industry and government contributions to a value of $50 million. Once that fund is exhausted, they will be met by industry. (Note: Subsidies paid to growers have been deducted from these

since the full costs of disease protection, loss of crop income and vine removal have been included in growing costs);

- Excluded from the analysis, because there is insufficient information about their extent, are additional costs incurred by the transport industry that are not passed on to the post-harvest sector; additional costs of Psa-V hygiene incurred by contractors; and costs borne by nurserymen over and above the costs reimbursed by KVH. In aggregate these are not expected to have a significant impact on overall national economic outcome, although they are unquestionably high for some of those affected.

The differences in total costs by sector at four intervals during the medium term are shown in Figure 16. This shows that there are not marked differences in the relative proportions of costs incurred by the three largest sectors over time, or by scenario.

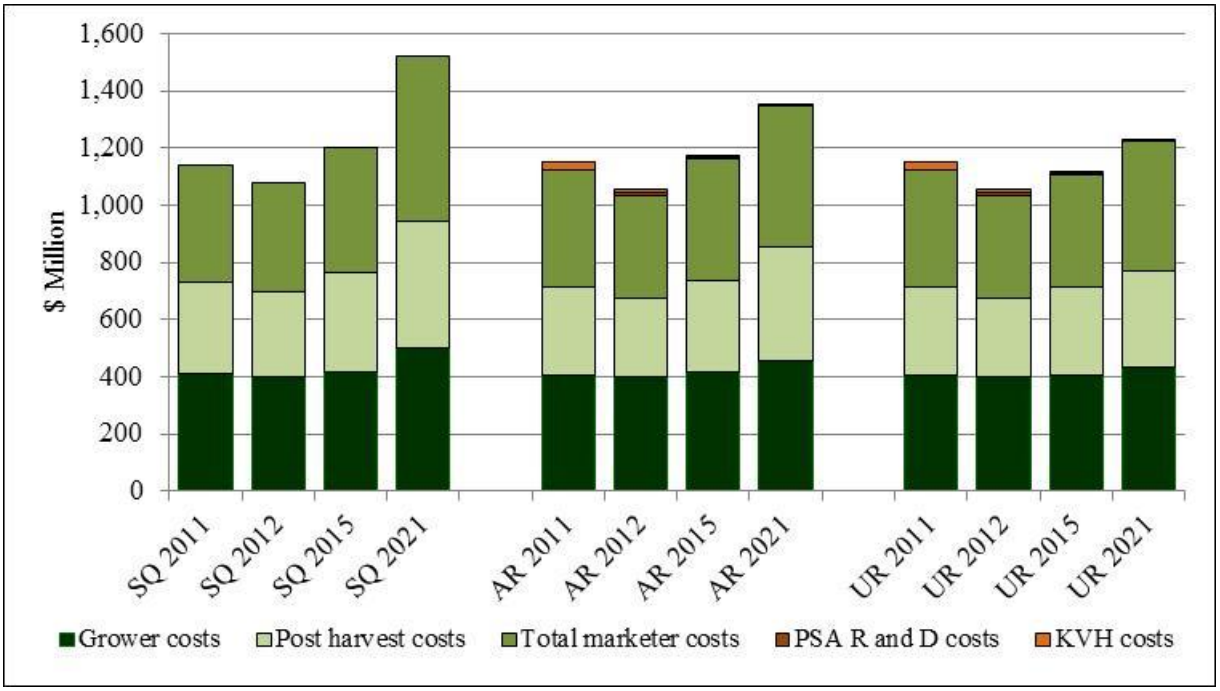


Figure 16: Relative costs by sector 2011, 2012, 2015 and 2021

5.4 The impacts of Psa-V on net industry returns

The total Net Present Values (NPVs) of the impacts of Psa-V on the New Zealand kiwifruit industry as a result of Psa-V were calculated from the streams of returns and industry costs under each scenario.

The land removed from other land uses has been valued at $343 per hectare (the average of Net Farm Profit before Tax less Wages of Management on the Waikato/Bay of Plenty intensive sheep/beef and the Waikato/Bay of Plenty dairy MAF Farm Monitor Farms in 2011 (MAF 2011a and 2011b). This was deducted from the net returns from kiwifruit under each scenario. While land converted to kiwifruit will come from a range of other landuses, some of which have higher returns than sheep/beef or dairy grazing, the areas involved are small in comparison to the scale of these industries. Moreover, it is probable that at least some of the land from which kiwifruit is removed will be converted to lifestyle blocks that do not generate economic output.

Under the AR scenario, the $NPV_{(.10)}$ of the total costs of Psa-V to the New Zealand is estimated to be approximately $300 million over the five years post 2011, $500 million over the ten years post 2011, and almost $740 million by 2025.

The differences in Net present values between the two recovery scenarios and between each of these and the SQ are shown in Table 10.

Table 10: Net present values at 10 percent discount rate of scenario differences

	5 yrs	10 yrs	15 years
Diff AR & SQ	$313.7	$494.6	$739.6
Diff UR & SQ	$407.6	$605.2	$885.2
Diff AR & UR	$93.9	$110.6	$145.6

The reductions in annual net returns from kiwifruit as a consequence of Psa-V are derived both from the initial impact of the disease and the costs of managing it and, to a larger extent, from the delays that Psa-V imposes on expected industry development.

The largest reduction in annual net returns under the AR scenario does not occur until 2031, or until 2032 in the UR scenario. In the medium term the largest differences directly resulting from the impacts of Psa-V occur in 2015 as Figure 17 shows. In 2018 the net returns under the UR scenario are marginally higher than those of the AR scenario, which reflects the differing patterns of the resumption of industry expansion under the Psa-V scenarios.

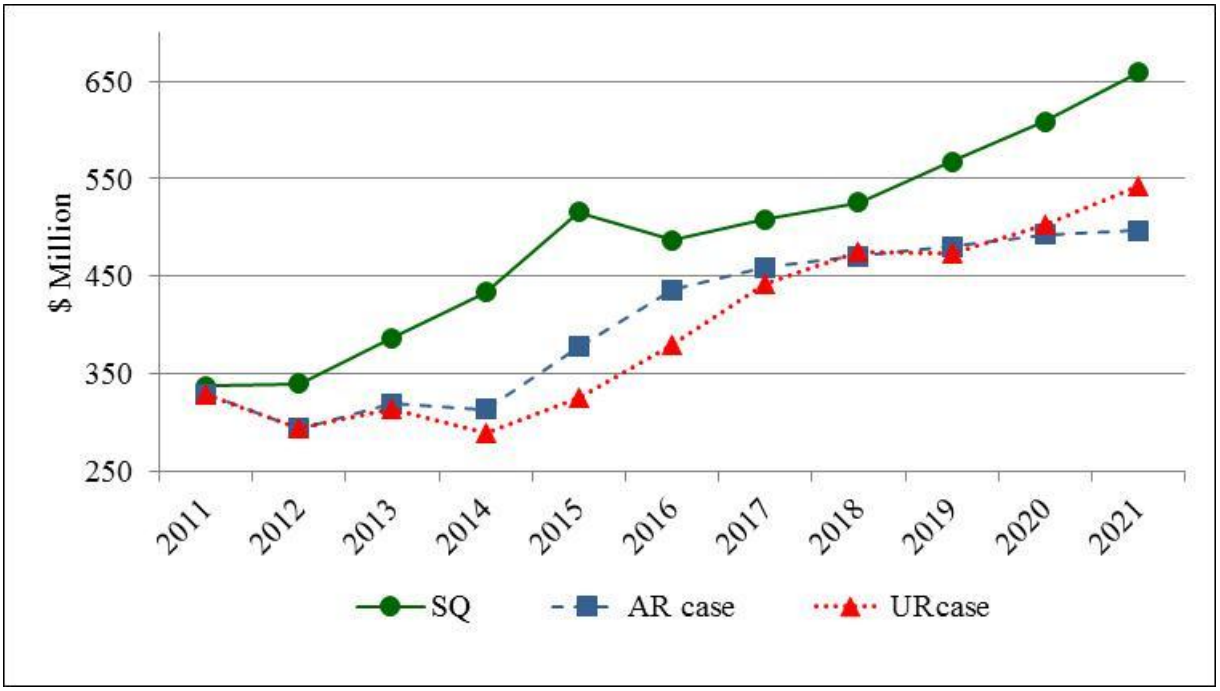


Figure 17: Estimated net returns to the New Zealand kiwifruit industry 2011 to 2025

Figure 18 shows the differences between the AR and UR scenarios in the NPVs of the net returns from kiwifruit production over three time periods. The largest differences between AR and UR scenarios occur in the medium term, as a result of delayed industry

expansion, rather than as a direct result of Psa-V on existing areas of kiwifruit. These are reflected in the five, ten and fifteen year NPVs, which capture most of the economic impact of Psa-V. By the end of the analysis period (2040) the difference between the recovery scenarios increases only an additional 17 percent to $172 million.

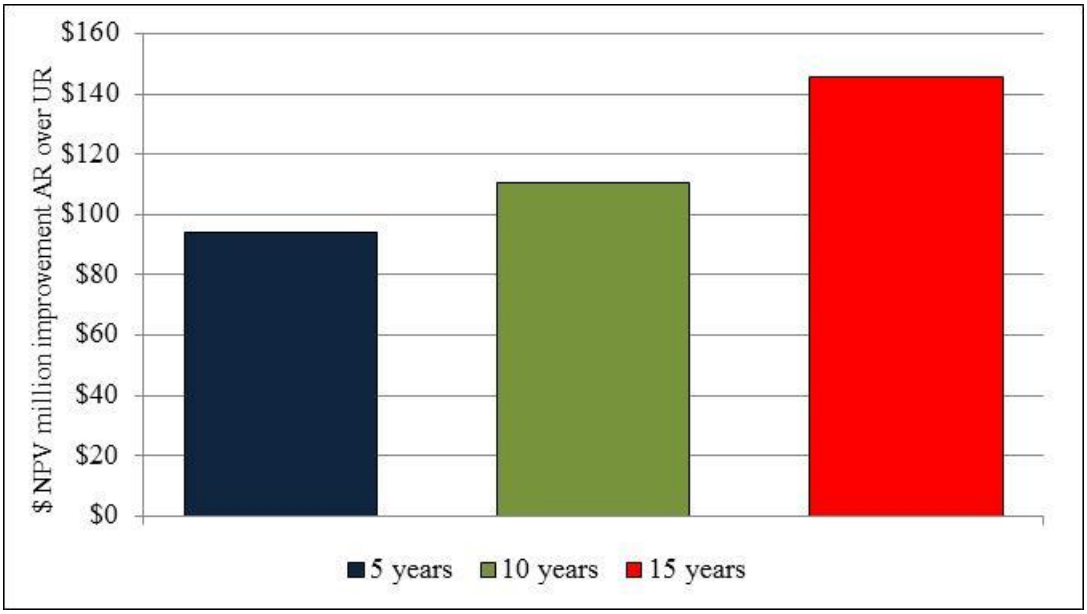


Figure 18: Differences in $NPV_{(.10)}$ of net returns between AR and UR scenarios

5.5 The indirect and induced impacts of Psa-V on the Bay of Plenty and New Zealand economies.

Kiwifruit is a very important contributor to the Bay of Plenty regional economy, and even more important to the economy of the Western Bay of Plenty. In 2004, Hughes estimated that the kiwifruit sector contributed 19 percent of the Western Bay of Plenty GDP and a similar percentage of regional employment. Its export earnings were forecast to exceed one billion dollars in 2012, before the discovery of Psa-V, and it is the country's largest horticultural export industry (MAF, 2011e).

As well as the "direct" effects of Psa-V on output and employment in the kiwifruit sector, there will also be "indirect" effects on output and employment in the sectors supplying the kiwifruit industry. In addition, as these direct and indirect reductions affect the levels of household income in the economy, the demand for the goods and services of other industries will be affected. This is known as the "induced" effect.

Professor Warren Hughes of the Waikato University School of Business Management has provided input-output models of the New Zealand (2010) and Bay of Plenty (2009) economies. From these, multipliers have been derived for the estimation of the indirect and induced changes to output and employment in the Bay of Plenty and nationally, that are the result of changes in kiwifruit orchard output. The multipliers, which reflect the cumulative effect at each level, are shown in Table 11. The multipliers relate output and employment changes in the economy to a change of one million dollars of output at the orchard level.

Table 11 : Ouput and employment effects multipliers for Bay of Plenty and New Zealand

	Output			Employment		
	Direct	Indirect	Induced	Direct	Indirect	Induced
Bay of Plenty Region	1.00	1.63	1.79	2.91	5.75	6.45
New Zealand	1.00	1.69	1.89	2.73	6.08	6.98

The direct value of output used in the analysis of regional and national output and employment changes was the estimated orchard-gate return (OGR) to growers. Estimates of expected OGRs in 2012 have been provided by ZESPRI (Shaun Gardner, ZESPRI, pers. comm.), but commercial sensitivity precludes publication of these data. Actual returns have been used in 2011 under all scenarios, and in all scenarios it has been assumed that reduction in the supply of Hayward kiwifruit will keep OGRs at 2011 levels until export volumes are below 60 million trays, at which point there will be a significant increase. In the Status Quo scenario, the returns to all gold kiwifruit return to five year average levels from 2012 onward, while in the Psa-V scenarios the short-term reduction in gold volumes leads to an increased OGR until volumes are restored to 2011 levels, after which five year average prices are used. Trends in new variety prices follow those of gold kiwifruit. This analysis covers the five years from 2012 to 2016.

5.5.1 Differences in output

In 2012 the OGRs, in total, are higher under the Psa-V scenarios than under the Status Quo. This reflects higher orchard-gate returns for Hayward in 2012 than in 2011, and the fact that the area of Hayward to be harvested would have been lower in 2012 had the advent of Psa-V not slowed the conversion of Hayward orchards to gold and new varieties. In the following three seasons, but particularly in 2013, total orchard-gate returns are expected to be markedly higher under the Status Quo.

The $NPV_{(.10)}$s of the total differences between the contributions of the kiwifruit sector to the total output of the Bay of Plenty regional economy and the national economy under differing scenarios, over the five years from 2012 to 2016, have been calculated. The differences between the SQ and AR scenarios, the SQ and UR scenarios and the AR and UR scenarios are shown in Figure 19. The $NPV_{(.10)}$s of the total differences in value of output between the AR and UR scenarios are estimated to be approximately $70 million both to the Bay of Plenty Region and to New Zealand. This similarity between the New Zealand and Bay of Plenty in the losses of output between the AR and UR scenarios reflects the changing distribution of production as Psa-V spreads throughout New Zealand's kiwifruit production regions.

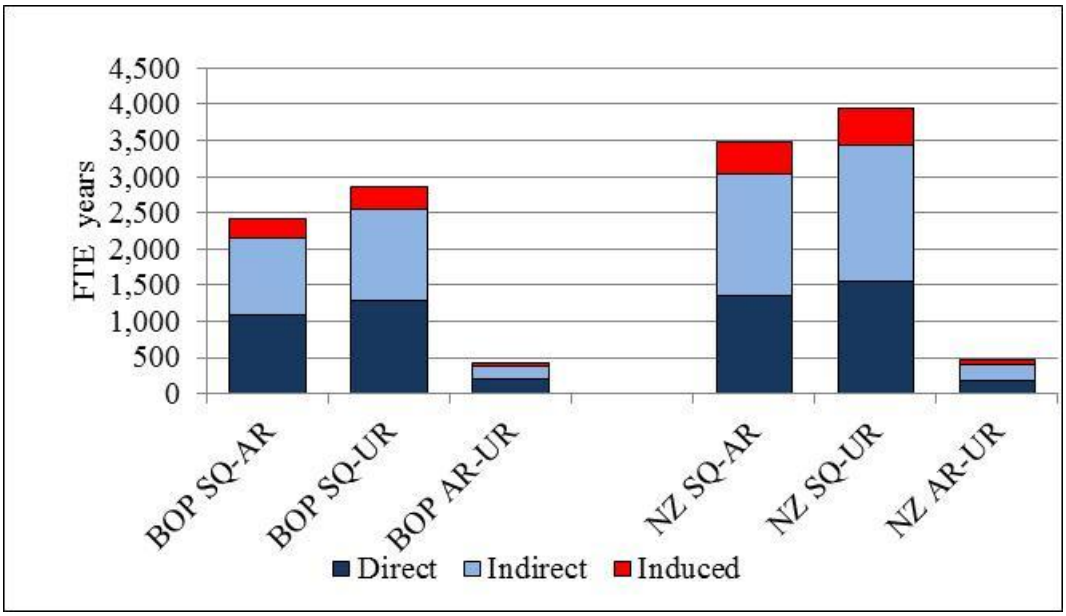


Figure 19: NPV(.10)s of between scenario differences in the value of total output (2012-2016)

5.5.2 Differences in employment

In order to compare the differences in employment under different scenarios it has been necessary to recalculate output values using constant prices. This has been undertaken so that the calculated employment effects reflect the changes in the volumes of kiwifruit, rather than the changes in prices that will occur as a result of reduced kiwifruit crop volumes. The differences in the total number of full time equivalent (FTE) years (i.e. difference in FTEs in each year summed across five years) worked in the kiwifruit industry during the five years from 2012 to 2016 are shown in Figure 20.

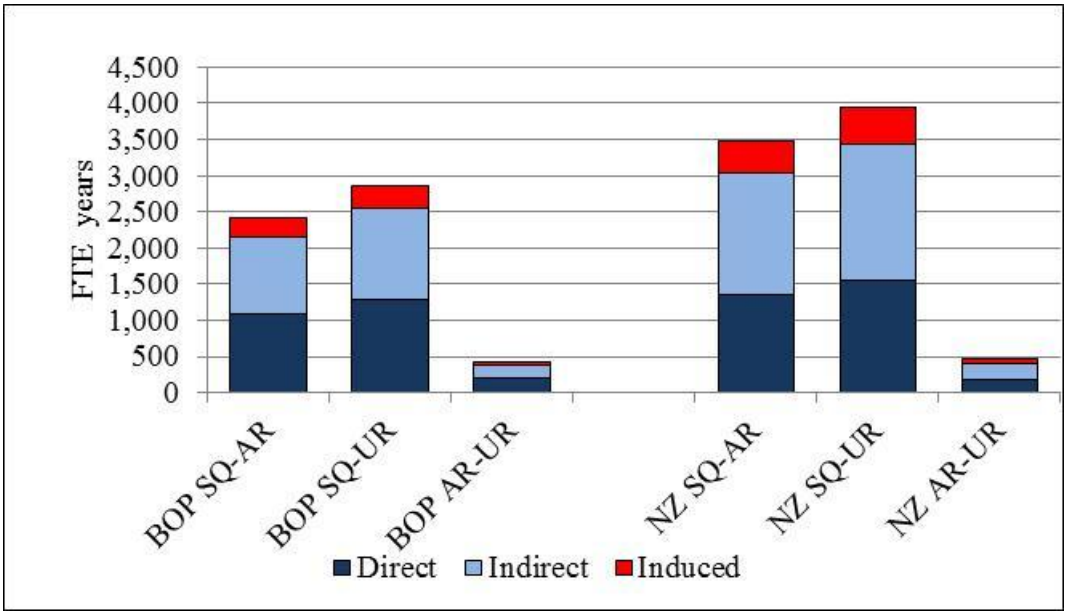


Figure 20: Differences in employment between scenarios (total FTE years over five years 2012-2016)

The loss of employment in the Bay of Plenty between 2012 and 2016 under the AR scenario was equivalent to 2,422 full-time person years, or an average of 605 jobs per

year from 2012 to 2016 when job losses would be experienced. Under the UR scenario, job losses during the period are expected to be more severe. Total job losses are estimated to be 2,894 or 712 per year from 2012 to 2016, while the expected difference between the AR and UR scenarios is estimated to be 428 FTE years in total or 106 per year in the Bay of Plenty region. Nationally job losses under the AR scenario are expected to be 3,483 (870 per year on average); under the UR scenario expected job losses are 3,943 (985 per year on average) and the difference between the AR and UR scenarios to be 460 (115 per year).

Chapter 6
The Impacts of Psa-V on the Wider Bay of Plenty Community

The Western Bay of Plenty district economy is heavily dependent on the kiwifruit industry for its economic well-being. Hughes (2004) estimated that almost 20 percent of the area's GDP is based on kiwifruit production. While the immediate impacts of Psa-V are, or have been, felt in the industry itself, impacts on the wider economy are inevitable. However, as the 2011 harvest was an excellent one and growers are still receiving the last of their returns from this, it was recognised at the outset that most of the community impact was yet to be experienced.

As part of the research KVH requested that a series of interviews be conducted with representatives of a wide range of stakeholders from outside the kiwifruit industry to investigate the wider impacts of the Psa-V situation.

In total, twenty seven personal or telephone discussions were held with members of the Bay of Plenty Community whose business, organisational or personal interests are likely to be affected by the Psa-V outbreak.

The majority of these interviews were held in the Western Bay of Plenty, in Te Puke, where the greatest impact on orchards has been felt to date, and Katikati during February and early March 2012. Interviewees were asked to describe the impacts of Psa-V in their own spheres of interest and whether they had taken, or expected to take, an active role in the recovery process.

Many of those interviewed were anticipating that Psa-V would have very serious impacts on the wider community, but realised that these would not be felt in full until later in 2012 and beyond. Most felt that until it is clear exactly what the impacts of Psa-V will be on the industry itself, they were unable to foresee the extent of community impacts.

In assessing the wider community impacts of Psa-V on Bay of Plenty communities it is very difficult to separate its impacts from those of the wider economic downturn, and a depressed tourism season because of unusually bad weather. The dispute between meat company AFFCO and its workers at Rangiuru, near Te Puke, that has resulted in 213 workers' being barred from the Bay of Plenty plant indefinitely (Boyer, 2012), is also expected to have an adverse effect on the Te Puke local economy.

In February and early March of 2012, when the community interviews were undertaken, most representatives of community agencies and groups confirmed that the main impacts of Psa-V on the wider Bay of Plenty community were yet to come, but that where possible, mechanisms had been established to assist local communities to minimise these impacts. The most significant exception to this been the impacts on businesses that deal directly with the kiwifruit sector, and whose involvement with the sector generates a large proportion of turnover. These businesses experienced a severe business downturn as soon as the discovery of Psa-V was announced.

A comprehensive series of meetings throughout the Bay of Plenty have been organised by KVH and others to bring together both helping agencies and affected groups to ensure that pastoral support is available when it is needed, and the attendance at these meetings has generally been excellent. Some owners of smaller businesses felt ill prepared to deal with the stresses likely to be imposed by Psa-V, both on their own business and on customers expressed the view that a workshop or seminar specifically for local business owners would be of value.

The remainder of this chapter summarises the results of discussions held with business and community representatives.

6.1 Businesses directly affected by Psa-V

The group most affected by Psa-V to date were businesses, outside the kiwifruit industry but directly affected by the fortunes of the industry to at least some extent. The survey included two farm supplies businesses, an irrigation supply business, two light engineering businesses, a farm equipment supplier and two real estate agents heavily involved in the sale of orchards. It is not possible to quantify the impacts on these businesses, for reasons of commercial sensitivity and because the survey was not large enough to allow aggregation to district level. However, it is clear that the continued viability of some businesses is under threat and, while business owners are trying to maintain staff levels, some redundancies have already occurred, and more are expected.

Business supplying a range of orchard inputs have experience significant impacts as a result of Psa-V. While sales of pest protection products have soared during the 2011/12 season, sales of many other farm inputs have been reduced markedly as orchardists seek to minimise costs where possible. Pastoral support has been provided for field and shop staff, who deal with affected growers on a daily basis and, in many cases, are growers themselves. This has taken the form of the provision of EAP support services and group meetings with psychologists and counsellors to discuss approaches to dealing with client and personal stress.

Supplies of specific inputs such as irrigation and post-harvest equipment, were affected immediately after the first positive test results for Psa-V were reported. They experienced cancellation of almost all the orders on their books (worth hundreds of thousands of dollars) and there has been little improvement in business since. Those businesses that have a more diverse client base have suffered less than those with a single industry or regional focus. Others are now diversifying into products for a wider range of industries, or into other geographic regions to reduce reliance on the kiwifruit industry. Provided that these businesses can diversify rapidly enough to ensure their survival, they will be more resilient in future.

There are anecdotal reports that a number of small businesses including smaller engineering business and electricians have been very severely affected by a reduction in work from the kiwifruit industry, and that some of these have gone out of business or have shifted their business activities to other areas.

Two real estate agents who have been responsible for a high proportion of kiwifruit orchard sales in the Bay of Plenty for many years, reported a massive downturn in orchard sales since Psa-V was discovered. This had cost them the commission on many millions of dollars of sales, at a time when the real estate market is generally slow. While a large number of orchardists are trying to sell orchards, there have been very few buyers. One agent attributed the lack of buyers, at least in part, to the reluctance of some banks to lend money for orchard purchases. There have been some signs of increased buyer confidence since news of a potential recovery strategy was first released.

6.2 Other businesses

The owners or managers of five other Te Puke businesses were interviewed in order to understand the extent of the impacts on business less directly involved with the kiwifruit sector. These businesses included retailers (of food and beverages, hospitality, apparel,

and giftware) and two commercial landlords whose tenants include a number of retailers and service providers. While Te Puke business has been experiencing a downturn recently, most attributed only a small part of that to the impacts of Psa-V and related most of the downturn to the general economic downturn, and the poor season for tourism in the Bay of Plenty. They agreed that only those businesses directly involved with the kiwifruit industry had been severely affected by Psa-V as yet, although most expected that the impacts will be greater during the next two seasons

6.3 Local Government

Discussions were held with representatives of the Bay of Plenty Regional Council, the Western Bay of Plenty District Council, the Whakatane District Council and the Opotiki District Council. Like many others, these organisations are in "wait-and-see" mode.

The Bay of Plenty Regional Council is "acutely interested" in issues, such as Psa-V, that are likely to impede economic development, and in removing impediments to development. At the outset, the Regional Council worked with MAF (now MPI) and the industry to develop protocols round the disposal of infected vines, using emergency powers under the Resource Management Act (1991). Since that time the Regional Council has invited the industry to bring to Council attention specific issues with which assistance is required. These may include the removal of barriers to implementing appropriate management strategies, or the facilitation of partnership with government agencies. To date that assistance has not been required. There are issues such as "fee holidays" for irrigators paying water rates on orchards that have been cut out to consider, but no decisions had been made at the time of the interviews (Warwick Murray, Bay of Plenty Regional Council, pers. comm.).

The existing wild kiwifruit control programme was intensified in the 2010 and 2011 financial years as a direct result of the discovery of Psa-V. These additional costs, which are included in the analysis, amounted to $65,000 in 2010 and $10,800 in the first half of 2011. The Regional Council has requested $70,000 from industry in the 2011/12 year as a contribution to the extra costs of removal of wild kiwifruit control (John Mather BOPRC, pers. comm.). In total the wild kiwifruit control programme cost $97,209 in the 2009/10 year and $128,356 in the 2010/11 year (Brad Siebert KVH, pers. comm.).

The main impacts of Psa-V on-orchard to date have been experienced in Western Bay of Plenty District. The Western Bay of Plenty District Council (WBOPDC) released its three-yearly property revaluations in November 2011. These showed that as at July 31 horticultural land values had declined by 38 percent in the district since the previous revaluation. However, dairy land prices declined by a similar proportion, reflecting the general economic downturn. The small number of sales of kiwifruit orchards during the preceding seven months means that the impacts of Psa-V are not likely to have been captured entirely in these valuations (Miriam Taris, WBOPDC, pers. comm). As has been described in Chapter 1, the WBOPDC has offered affected kiwifruit growers the opportunity for orchard revaluation and an associated rates relief package. Other Bay of Plenty district councils have followed suit, although the numbers of growers affected in other areas are very much lower as yet. As this is a recent initiative, it is not yet known how many orchardists are likely to apply for this assistance.

Otherwise, district councils are waiting to see what, if anything, will be required of them to mitigate the impacts of Psa-V on their communities. A Mayors' Taskforce has been formed that will consider the wider implications of Psa-V for affected communities, and whether any intervention is appropriate for local government. There is a strong desire to

ensure community well-being through this period (Glenn Snelgrove, WBOPDC, pers. comm.). There are unlikely to be any "kneejerk" reactions to subdivision rules because of Psa-V.

6.4 Economic Development Agencies

A number of organisations are actively involved in the economic and social development of Te Puke.

Priority One is an economic development organisation concerned with development in Tauranga and the Western Bay of Plenty. Andrew Coker, CEO of Priority One considers that in the region as a whole most people are waiting for the impacts of Psa-V to be felt. The role of Priority One, which is contracted to the Tauranga City Council, WBOPDC and private businesses, is to help the region build an economy that is not dependent on a single industry. While the impacts of Psa-V on the economy of Te Puke are likely to be severe in the short-term, developments in the wider region of the tertiary education sector, Hi-Tec industries, aqua-farming and other initiatives mean that the wider Bay of Plenty economy will survive the impacts of Psa-V.

Te Puke Fast Forward was established in 2004, as a result of the Te Puke 20 year development plan, to advocate for Te Puke in plans for the economic development of the wider Bay of Plenty. Focus Te Puke was established to promote Te Puke and foster local business. Mark Boyle (Focus Te Puke) reported that 2011 had been a very difficult year for retail business in Te Puke, despite the fact that the kiwifruit industry had experienced a very good season. While this is attributable largely to the general economic downturn, the knowledge of the expected impact of Psa-V has adversely affected business confidence and reduced the incentive for people to invest in local initiatives. These local economic development groups are now focussed on attracting industry to the significant area of land zoned as "industrial" in Te Puke to reduce reliance on a single industry for the district's economic welfare.

Karyl Gunn, chair of the Te Puke Community Board, and a Te Puke retailer, considers that the impacts of Psa-V have affected a number of the town's retail businesses to some extent already, and will continue to do so in the immediate future. The impacts of the wider economic downturn have been compounded by the reduction in kiwifruit sector spending, and have emphasised the need for the development of Te Puke as a "destination town" that attracts people from other areas by offering a range of cultural and recreational activities and specialised retail services.

In Katikati, Jackie Knight of Katch Katikati, a community development organisation, observed that while the Katikati community had prepared itself to step in to assist those worst affected by Psa-V, and there was high attendance at support meetings facilitated by KVH, the low incidence of the disease in the area means that those impacts have yet to be experienced. News of the proposed recovery strategy has increased local confidence, and the Katikati community is beginning to believe that the impacts in the area will be less than expected. Katikati is less dependent on the kiwifruit industry than Te Puke and has greater reliance on the avocado industry and other business ventures.

None of the economic development agencies included in the survey had identified specific initiatives to minimise the impacts of Psa-V on the region in the short term.

6.5 WINZ and community support agencies

Work and Income New Zealand (Tuahu Watene, Regional Labour Market Manager WINZ, pers. comm.) deals with displaced New Zealand resident workers seeking work and/or social welfare support, and oversees the Recognised Seasonal Employer (RSE) scheme in the region. The RSE scheme allows workers from the Pacific Islands including Kiribati, Samoa, Tuvalu, Tonga, the Solomon Islands and Vanuatu, to enter New Zealand temporarily in order to plant, maintain, harvest and pack horticultural crops. WINZ has observed significant changes as a result of the spread of Psa-V but to date these have generally been limited to the area round Te Puke.

In response to the Psa-V situation the kiwifruit industry, both out of concern for long-term employees and in order to retain the skills required for recovery within the industry, has endeavoured to retain as many as possible of the permanent staff. There has, however, been a major decline in the numbers of RSE workers brought in to meet demand from the kiwifruit industry. Amongst New Zealand-resident kiwifruit industry employees, many of those who have lost permanent or seasonal jobs in the kiwifruit industry are believed to be part of families that have two income earners, so they have not been eligible for social welfare assistance, although they may be suffering significant hardship. In a normal season the kiwifruit industry employs approximately 8,000 seasonal workers at peak times and between 2,000 and 2,500 people are usually shifted from the unemployment register into kiwifruit employment. Approximately 80 percent of these re-register as unemployed when the season ends. In 2011 WINZ placed only 1,600 to 1,800 people in the kiwifruit industry - the lowest number in many years. By implication, between 400 and 700 workers and their families are living on lower annual incomes because they are unable to work for part of the year in the kiwifruit industry.

The Community Care centre in Te Puke has noticed a small increase in the demand for food parcels and the speed with which "free fruit" donations are taken from the basket in the centre's reception area. However, staff observed that migrant or temporary workers are often reluctant to come to agencies they regard as "official". Staff at the Katikati Resource Centre had also noticed little change, although they had some anecdotal evidence of mental health issues developing in some orchard families.

However, the impacts of Psa-V are being felt keenly by voluntary social welfare organisations, which do have contact with those who are reluctant to approach official agencies. A very marked increase in the demand for assistance has been recorded by the Salvation Army Territorial Community Ministries in both Tauranga and Mount Maunganui. As Te Puke does not have a Community Ministries office, residents in need of help must go to one of these offices. At both centres, a decline in the need for assistance was recorded in the December quarter of 2012, after a year of rising demand. It is unusual for demand to decline during the Christmas quarter. During the quarter to March 31, 2012 the increase in demand for food parcels over the previous quarter was 51 percent in Tauranga and 11 percent in Mount Maunganui. It is expected that this increase is from families who will need long-term, rather than one-off assistance. The increase in families requiring food parcels was 38 percent in Tauranga and 16 percent in Mount Maunganui. More importantly, from the Salvation Army perspective, the number of new families requiring assistance increased by 55 percent in Tauranga and 33 percent in Mount Maunganui. Demand for social work, including budgeting and other advice has risen by even greater proportions - 266 percent in Tauranga. The resources of the Salvation Army are already stretched, and demand is almost certain to increase further (Anne Waugh, Salvation Army Territorial Community Ministries Secretary, pers.

comm.). Increased overcrowding, the need for teenage family members to stay home from school to look after younger siblings while parents work, and increased numbers of homeless people are all to be expected in the light of this additional demand for assistance.

In Katikati the demand for food parcels supplied by an inter-church group that runs the Christian Helpline Foodbank has doubled, at a time when donations to the Foodbank have declined. This has been attributed, in part, to the loss of seasonal work in the kiwifruit industry. The people who have been most affected in the area are Pacific Island, Indian and Asian workers and their families. However, Katikati is a "town of volunteers" and it is expected that the community will work together to help those affected most by Psa-V.

A volunteer at a Te Puke opportunity shop had observed a much higher level of hardship in the sectors of the community with which she engages. She noted that some of those worst affected were already "marginalised" – migrant workers whose children are not attending school because parents cannot afford to enrol them, or to equip them appropriately for school, and those working illegally in New Zealand. She was aware of an increased number of women with small children looking for work to supplement reduced family incomes, with older family members or teenage siblings called on to provide childcare. The shop turnover had declined because fewer people were able to afford even the low prices charged for second-hand goods.

The ministers of the Baptist Church of Te Puke and St Peter's Anglican Church in Katikati were also interviewed as part of the study. In the Baptist Church of Te Puke community some kiwifruit industry families had been directly affected by Psa-V, but no cases of extreme hardship have been brought to the Church's attention as yet. However, the fact that the town of Te Puke is highly dependent on the kiwifruit industry is likely to mean that the Church's ability to support its community is under threat as it is wholly reliant on donations from the congregation for its income. In Katikati, the church had noticed relatively little effect on its community to date.

6.6 Schools

Neither Te Puke High School nor Te Puke Primary school have experienced significant roll changes as families leave the area following job losses associated with Psa-V as yet. Both principals considered it likely that the families who have left town to date have been those without school-age children. Never-the-less both schools are well aware that PSA-V is likely to have a major effect on their school communities and Te Puke High School has already held a staff meeting to consider the potential issues that may arise, and to work out an appropriate school response to these. The KVH pastoral care coordinator, Ian Greaves, has spoken to staff and the principal has attended a KVH support meeting. An existing Principal's Hardship Fund may be used to assist with meeting school costs in cases of extreme hardship. Both school principals believe that recent changes in the overall approach to school and staff involvement with pupils and wider school communities will ensure that problems are identified early, and appropriate steps taken to mitigate these.

6.7 Conclusions

Like the kiwifruit industry itself, the wider Bay of Plenty community has yet to experience the full impacts of Psa-V and there is considerable uncertainty about what those impacts will be. The rate of industry recovery will depend not only on the success

of the recovery strategy but also on the level of confidence that growers have in the recovery pathway, and on their ability to obtain redevelopment finance.

The longer the time required for industry recovery, the more likely it is that skilled workers will leave the industry, and quite possibly the Bay of Plenty, permanently and the greater the loss of intellectual property that was noted as a concern by both growers and post-harvest operators. This in turn may further inhibit the rate of recovery and exacerbate the adverse impacts of Psa-V on both the kiwifruit industry and the wider Bay of Plenty community.

Although estimation of the impacts of the failure of the recovery strategy fail to restore industry profitability, because the tolerance of G3 to Psa-V is found to be much lower than expected, was not part of the research brief, it is certain that the impact on the industry of an almost complete loss of gold production for a protracted period would be extremely high and the impacts on the Bay of Plenty economy even greater.

The analysis described in Chapter 5.5.2 shows that under the AR scenario 2013 will be the year in which the greatest employment impacts of Psa-V are experienced both in the Bay of Plenty and nationally. In that year it is expected that 370 FTE jobs will be lost in the kiwifruit orcharding sector, 361 in the industries indirectly involved with the sector and an additional 79 in the wider Bay of Plenty community. The Household Labour Force Survey (Statistics New Zealand, 2012) shows that in December 2011 the total labour force in the Bay of Plenty region was approximately 128,000 and, of these, 10,600 were classified as unemployed. Thus the loss of 820 jobs in one year may be expected to increase unemployment in total by almost eight percent, and to have a significant effect on the poorest families in the community. During 2011 between the family incomes of between 400 and 7000 people who had been registered unemployed did not receive a boost from a period of employment in the kiwifruit industry.

In the Bay of Plenty community outside the kiwifruit industry, two groups have been hardest hit by the impacts of Psa-V to date. The first group comprises the businesses whose business turnover is highly dependent on the goods and services they provide for the kiwifruit industry. Those who are able to diversify their client bases, geographically or in terms of the nature of client businesses, are most likely to survive the full impacts of Psa-V, and to emerge more resilient as the effects of the disease on the regional economy diminish. Others will struggle to survive.

The second group comprises the most economically disadvantaged families in the community. The loss of a second family income, or a seasonal job that lifts annual income above the level provided as social welfare assistance, will be a significant blow to the welfare of these families. There are already signs of a much greater demand for assistance from these families and this is expected to increase. The risk of increased crime and mental health issues in the wider community has been recognised by the industry, and liaison with the police and other community agencies has been part of the overall pastoral support initiative.

Businesses less directly involved with the kiwifruit industry generally believe that the business downturn recently experienced is more the result of the general economic downturn than of the impacts of Psa-V as yet. However, the most recent MYOB Business Monitor survey has reported that more Bay of Plenty small business owners have reported working increased hours this year in order to keep their businesses successful than in any other region (Voxy, 2012).

While local authorities are monitoring developments in the kiwifruit industry closely, and offering rates relief to affected orchards, it is not yet clear what, if any, other local government initiatives will be required to support local communities

Overall, Bay of Plenty communities are poised for the impacts of Psa-V that are yet to occur. In the absence of a clear understanding of the expected impacts of Psa-V on local communities, the analysis does not include estimation of the likely scale of community impacts in future, although they are expected to be considerable. Detailed social impact assessment and monitoring, particularly of the lowest income groups, may well be justified both from a community health and well-being perspective, and as a guide for future support initiatives.

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APPENDIX 1
Orchard Working Expenses
Hayward Orchard Working Expenses

Based on weighted average cost data provided by ZESPRI for 2011, data from the 2011 MAF Kiwifruit Farm Monitoring Report and calculations as reported in Chapter 3.

	2011 WAC	2012 Estimate	2013 Estimate	Future Estimate
		As described in Chapter 3.1.2		
Winter Pruning	$4,590	$5,508	$5,278	$5,278
Summer Pruning	$2,860	$2,860	$2,860	$2,860
Male Pruning	$1,081	$1,081	$1,081	$1,081
Total pruning	**$8,530**	**$9,448**	**$9,219**	**$9,219**
Thinning	$2,293	$2,293	$2,293	$2,293
Girdling - Trunk	$386	$386	$386	$386
Girdling - Cane	$0	$0	$0	$0
Mowing and Mulching	$300	$240	$300	$300
Shelter Trimming	$203	$162	$203	$203
Pest, Disease, Foliar	$849	As described in Chapter 3.1.1 - differs regionally		
Spray Application	$938			
Psa hygiene	$0	$200	$100	$100
Hi Cane	$323	$323	$323	$323
Weed Spraying (4 yr average)	$186	$186	$186	$186
Plant Health	$36	$36	$36	$36
Fertilizer and Application	$1,451	As described in Chapter 3.1.4		
		$1,262	$1,357	$1,451
Hive Hire	$1,276	$1,276	$1,276	$1,276
Artificial Pollination	$122	$0	$0	$122
Kiwi Green Monitoring	$38	$38	$38	$38
Irrigation	$40	$20	$40	$40
Harvest		Varies with yield		
	$3,568	$3,780	$3,780	$3,780
R & M	$499	$250	$250	$499
Management Salaries	$0			
Accountants Fees	$93	$93	$93	$93
Consultants Fees	$35	$35	$35	$35
Other	$1,237	$1,237	$1,237	$1,237
	Taken from MAF farm monitoring			
Rates	$900	$900	$900	$900
ACC	$350	$350	$350	$350
Insurance	$920	$920	$920	$920

Hort 16A Orchard Working Expenses

Based on weighted average cost data provided by ZESPRI for 2011, data from the 2011 MAF Kiwifruit Farm Monitoring Report and calculations as reported in Chapter 3.

	2011 WAC	2012 Estimate	2013 Estimate	Future Estimate
		As described in Chapter 3.1.2		
Winter Pruning	$5,721	$6,865	$6,579	$6,579
Summer Pruning	$4,862	$4,862	$4,862	$4,862
Male Pruning	$940	$940	$940	$940
Total pruning	**$11,523**	**$12,667**	**$12,381**	**$12,381**
Thinning	$2,388	$2,388	$2,388	$2,388
Girdling - Trunk	$425	$425	$425	$425
Girdling - Cane	$23	$23	$23	$23
Mowing and Mulching	$273	$218	$273	$273
Shelter Trimming	$383	$306	$383	$383
Pest, Disease, Foliar	$2,033	As described in Chapter 3.1.1		
Spray Application	$2,349			
Psa hygiene	$0	$200	$100	$100
Hi Cane	$193	$394	$638	$193
Weed Spraying	$102	$102	$102	$102
Plant Health	$406	$406	$406	$406
Fertilizer and Application	$1,398	As described in Chapter 3.1.4		
Hive Hire	$1,499	$1,483	$808	$1,499
Artificial Pollination	$22			$22
Kiwi Green Monitoring	$66	$0	$0	$66
Irrigation	$34	$17	$34	$34
Harvest	$6,464	Varies with yield		
R & M	$229	$115	$115	$229
Management Salaries	$0	$0	$0	
Accountants Fees	$157	$157	$157	$157
Consultants Fees	$130	$130	$130	$130
		Taken from MAF farm monitoring		
Other	$1,280	$1,280	$1,280	$1,280
Rates	$900	$900	$900	$900
ACC	$350	$350	$350	$350
Insurance	$920	$920	$920	$920