

ANNUAL UPDATE 2020/21

New Zealand's Triple Layered System

How we manage biosecurity risk for all kiwifruit growers

Kiwifruit's Biggest Threats

Finding and fighting pests and diseases

A Year to Remember

Our biosecurity events

Proposed New Pathway Plan

Better protection and more value

Innovation

The science behind our progress



KO TĀTOU

THIS IS US BIOSECURITY 2025

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Fast facts from the last 12 months



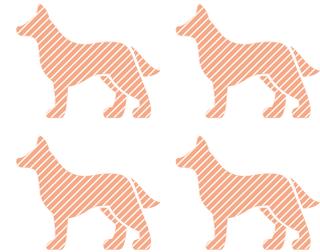
48 live Brown Marmorated Stink Bug (BMSB) finds during the 2020/21 high-risk season

24

industries now signed up to the Government Industry Agreement for Biosecurity Readiness and Response (GIA), and **KVH was the first**

3,700

uses of the KVH Psa Risk Model and Weather & Disease Portal



FOUR detector dogs trained to sniff out BMSB, and they are **the first of their kind in the Southern Hemisphere**



TWO awards accepted by the kiwifruit industry at the 2020 New Zealand Biosecurity Awards

57

nurseries are members of the Kiwifruit Plant Certification Scheme (KPCS) and have either Full or Restricted certification

132,244 fruit fly trap inspections during the 2020/21 high-risk season



71

skilled KiwiNet members from across the industry trained and ready to help resource a biosecurity incursion



Twitter users saw KVH tweets **61,100 times** and Facebook users saw KVH posts **17,860 times**



38 unusual pest and disease reports to KVH

14,000

wild kiwifruit vines controlled across 103 properties in growing regions



13 is the highest number of **different species identified** from a single 'unusual symptom' report sample



87 orchard visits by the KVH team

Foreword from the Board Chairman

Over the last 18 months there's no denying that COVID-19 has been top of mind for us all.

Like growers and others throughout the kiwifruit industry, KVH has adjusted where necessary and worked through the changes and impacts of the pandemic.

We've also taken the opportunity to use the parallels between COVID-19 and biosecurity as a way of highlighting that if a kiwifruit industry incursion were to occur now - while the country is trying to manage an unprecedented economic and public health challenge - the impact could be severe.

Although many borders are still closed, cruise ships laid up, and incoming trade patterns not quite what they used to be, biosecurity risk still exists, especially from the spread of kiwifruit pathogens that may already be here in their latent (not showing symptoms) form, or from pests such as Brown Marmorated Stink Bug (BMSB) because trade in the ecommerce/online shopping pathway has increased. COVID-19 has clearly illustrated the challenge of managing pathogens during the latency period, where they can spread silently between asymptomatic hosts. The same logic applies to plant pathogens except the latent phase can be much longer than 14 days and extend out to months or even years.

For some of our most significant threats (like *Ceratocystis fimbriata*, the pathogen impacting kiwifruit in Brazil) we don't even know how long the latency period in kiwifruit is. Our challenge is to apply biosecurity practices at all times so that if this or any other pathogen were to arrive, we would reduce the risk of spreading it around unknowingly.

We can't afford to lock down plant material movements, these underpin the growth of our industry. But, by applying certification standards and embedding biosecurity practices across the plant production chain we can increase our confidence that these movements are safe. We can do the same for people and machinery movements by embedding hygiene and cleaning into our biosecurity practices.

Should failures occur, we need robust traceability systems to track people, tools and machinery, and plant material backwards and forwards. These are some of the key principles behind the proposed new National Pathway Management Plan for the kiwifruit industry, to ensure safe movement of risk goods across our internal pathways.

The proposed Plan was consulted on with growers and industry throughout 2019 and 2020 and amended based on the feedback received. It was then submitted to the Minister for Biosecurity for review, and we now await his approval via a detailed parliamentary process expected to take

12 months. More detail about this process and next steps can be read on pages 18-19.

The KVH Board views the Plan, and the work now underway to prepare for proposed implementation, as the organisation's highest priority. It is of great importance because it clearly aligns with and reflects the organisation's goal of ensuring the New Zealand kiwifruit industry is committed to biosecurity excellence, with everyone working together in partnership, taking collective ownership.

I would like to personally thank Matt Dyck for his leadership in the development of this proposed Plan. Along with his team, they have created a new approach to biosecurity risk management in collaboration with the Ministry for Primary Industries (MPI) that will form the template for others to follow.

Everyone will have a clear role to commit to within the framework of the Plan, helping sustain a culture of accountability. This culture isn't new to the industry. Just over 10 years ago, on 5 November 2010, we learnt about the discovery of PsA in New Zealand and had to come together as one like never before to support each other and work as one big biosecurity team, determined to do whatever we needed to do to get through the potential disaster we were facing. On pages 8-9 we've gone into more detail about recent events acknowledging the PsA response, and the recovery and regrowth journey growers and the wider industry have been on over the last decade.

This last year, I was proud to represent KVH and the Board at a range of events, but especially the New Zealand Biosecurity Awards where KVH accepted a Special Award on behalf of the kiwifruit industry for its commitment to biosecurity.

The award celebrated the partnership approach which has ensured the industry is better placed for any future biosecurity event and it was an honour to accept it (alongside former Chief Executives Stu Hutchings and Barry O'Neil) on behalf of all our growers and those across the kiwifruit industry who support KVH's work.

It was also special at this particular event, to have the Minister acknowledge one of the longest serving staff members of KVH, Linda Peacock with his personal award in recognition of her commitment to biosecurity over the past 10 years.

Stu Hutchings left KVH in April to take up the role of New Zealand's first Chief Biosecurity Officer with MPI. I thank him for his dedication and hard work during his three years at the helm, and warmly welcome Leanne Stewart who moved into the role in late May. Thank you also to the KVH team and my fellow Board members for their continued commitment and expertise.

I firmly believe that the organisation is set up strongly to deliver a biosecurity resilient and well-prepared kiwifruit industry and I look forward to the years ahead with the team being as focussed as 2020/21.



Foreword from the Chief Executive

Looking back over the past year, KVH has achieved many things – not least the development and submission in April 2021 of the proposed new National Pathway Management Plan for the kiwifruit industry.

Although I'm new to the organisation, the concept of the proposed Plan is something I have been aware of – and a supporter of – through my close relationship with KVH while in my former role at Horticulture New Zealand. I'm incredibly impressed with what the KVH team has achieved in this space over the last year and the innovative and constructive thinking from across the industry that went into the feedback and submissions during the consultation phase.

As the Board Chairman mentions in his Foreword on the previous page, there are key principles behind the proposal that ensure safe movement of risk items across our internal pathways and robust traceability. These two things are absolutely fundamental to biosecurity resilience, and I look forward to working with growers and the wider industry as we create practical tools and resources that will help with implementation of the proposed Plan.

While the Pathway Plan is a priority area of work, it by no means results in any less focus for KVH on other areas of biosecurity. This is an important point to make and I'm pleased that the overall biosecurity system is the theme of this Annual Update because it provides us the opportunity to highlight to everyone the breadth of KVH's work and the consistent effort the organisation puts towards advocating for kiwifruit growers – much of which can often go unseen but deserves to be talked about.

There are three well known integrated parts or layers to the New Zealand biosecurity system (known as pre-border, border, and post-border), and KVH works across each of them for the benefit of the kiwifruit industry.

The case study about White Peach Scale on pages 12-13 is a perfect example of the ongoing, longer term work of the team to advocate for stronger pre-border measures when risk scanning and data monitoring shows that there is heightened risk of a potential incursion. It also demonstrates the proactiveness of the organisation to build relationships with others and work in partnership for the betterment of all – something central to the example used on pages 14-15 to explain KVH's input into the border space.

The incredibly successful Port of Tauranga Biosecurity Excellence programme is a partnership between KVH, the Port of Tauranga, the Tauranga Biosecurity New Zealand office and local government and industry groups, to ensure those who work at and around the port are aware of biosecurity risk and the impact they have at the frontline towards keeping us all protected from biosecurity threats. Backed by research this partnership is proven successful and is seen as a model that hopefully other ports and regions will look to pick up.

If something were to get past our border, the third and final layer of the system, post-border, would kick in and again, this is an area where KVH has led the way over the years in terms of working in partnership and understanding the benefits that come from collaboration. As detailed in pages 16-17, KVH was the first industry organisation to sign up to the Government Industry Agreement for Biosecurity Readiness and Response (GIA), which helps ensure we can respond efficiently and effectively to any incursion by pre-agreeing aspects such as roles, responsibilities, cost-sharing, and how decisions will be made about goals of responses.

The things I've mentioned are by no means reflective of the volume of work KVH undertakes within the national biosecurity system, and are just a selection of the work mentioned within each article, but they are tangible and practical examples of what can be achieved by a committed team with growers at the forefront of their minds, who want to ensure best biosecurity practice by everyone, for the benefit of all.

The Minister for Biosecurity made similar points when he awarded KVH and the kiwifruit industry the Special Award at the last Biosecurity Awards in 2020. I think the fact that the resilience and unity demonstrated by the industry over the years (particularly since the Psa incursion) is still evident today and plays such a big part in driving the collaborative approach to biosecurity, is incredibly special and exciting.

It is a privilege to have been welcomed so warmly, and I'm thankful to the KVH team and Board for their guidance and encouragement. The last 12 months provide us with the perfect foundation to keep building on so that we can continue to support the kiwifruit industry to protect itself from biosecurity threats and ensure a prosperous future.



A handwritten signature in black ink that reads "Imi Stewart". The signature is written in a cursive, flowing style.

What's happening around the world?

USA

- Spotted Lanternfly (SLF) continues to spread in the USA, most recently to Connecticut and Ohio in late 2020. Isolated findings or interceptions have also been reported from New York state, Maine, Massachusetts, and Oregon, but no established populations are confirmed.
- There is a reported decline in Brown Marmorated Stink Bug (BMSB) impacts in many parts of the USA, including in the Mid-Atlantic states which was the epicentre of BMSB invasion, leading many to believe there is a population decline.

EUROPE

- BMSB populations are growing and expanding in Europe, with the pest present in 31 countries and recorded interceptions in another four.
- While BMSB has been caught hitchhiking into the UK several times, it was found in surveillance traps for the first time in a nature reserve in Essex late February 2021.
- SWD continues to expand its range in Europe and was newly reported in Israel and Morocco in 2020 – the first report from the African continent.
- 2020 was declared the International Year of Plant Health (IYPH) by the United Nations. This was a great opportunity to raise global awareness on the importance of plant health, of which minimising the impacts of pests and diseases is at the core.

SOUTH AMERICA

- Spotted Wing Drosophila (SWD) is spreading in Chile and is now known to be present in seven regions. Not believed to be a pest to kiwifruit but could impact softer varieties such as kiwiberry.
- Six years after BMSB was first discovered in Chile it has not yet been reported from agricultural regions outside urban Santiago. If true, this is encouraging as a significant southern hemisphere population would greatly increase the risk to New Zealand.



Keeping pace with change: Biosecurity risk constantly changes as new organisms are discovered, expand their host range, or invade new geographic areas. This map illustrates some of the key events over the past 12 months that influence risk for the New Zealand kiwifruit industry.

ITALY

- Losses due to BMSB in Europe are low where effective control measures are being utilised. This includes use of side and overhead netting, and boundary and block spraying.
- The first three rounds of a Samurai Wasp biocontrol programme have been completed across 712 sites in northern Italy. In the Trentino area, post-release evaluation shows the Samurai Wasp has settled in around 30% of sites where it was released. Approval for another release is being sought.
- Kiwifruit Vine Decline Syndrome (Moria disease) remains an ongoing issue for Italian growers, especially Hayward. An industry taskforce is undertaking a range of research activities. A key focus is on improving soil drainage which had been identified as sub-optimal in many orchards.
- White Peach Scale (WPS) interceptions on imported Italian kiwifruit remain low with only two border interception for the most recent (2020/21) season.

CHINA

- KVH and Zespri are working to better understand what pests and pathogens may be present on kiwifruit in China, by translating Chinese literature, which has highlighted several pathogens not previously reported in English literature. We now have additional work to better understand the potential impacts of these.
- This year some new science viruses were discovered in kiwifruit in China. Impacts are not well understood but research is continuing.
- KVH and Zespri are also continuing to collaborate and fund research based in China. Projects include understanding impacts of SLF on kiwifruit and the release of the Samurai Wasp in kiwifruit to help inform a control programme for BMSB.

AUSTRALIA

- Adelaide (South Australia) continues to battle multiple Mediterranean Fruit Fly (Med Fly) and Queensland Fruit Fly (QFF) outbreaks. Ongoing in the South Australian response is the release of 100 million sterile fruit flies to manage these populations.
- Since arriving in Australia in February 2020, Fall Armyworm has been detected in almost every state, most recently, in Tasmania. This is a significant biosecurity threat to many crops, but kiwifruit is not a known host.

NEW ZEALAND

- COVID-19 has decreased the number of incoming passengers to New Zealand, resulting in a decreased risk of undeclared fruit and fruit fly entering. There was only one QFF and one Pacific Fruit Fly interception during the most recent (2020/21) season, compared with eight various exotic fruit fly detections the previous season.
- BMSB remains a high-risk with 48 live interceptions during the most recent (2020/21) season. With 57 found the previous season, we continue to see numbers go down due to increased efforts to keep risk offshore.
- The BMSB surveillance programme for 2020/2021 started the first week of November and ran through to April. There was one positive detection of BMSB from the programme, in January 2021 near a transitional facility which was thoroughly investigated with no further sign of any bugs.



A year to remember: events and awards



Minister's Biosecurity Award recipient Linda Peacock with Hon. Damien O'Connor, Biosecurity Minister.

INDUSTRY APPLAUDED AND AWARDED

In 2020, representatives from the kiwifruit industry were awarded in recognition of their outstanding contributions towards protecting New Zealand from exotic pests and diseases.

At the annual New Zealand Biosecurity Awards in November, Linda Peacock was awarded the Minister's Biosecurity Award for services to the kiwifruit industry, and KVH accepted the Special Award for outstanding commitment to biosecurity on behalf of the kiwifruit industry.

In awarding Linda, who is a long-standing industry liaison and technical specialist at KVH, Minister for Biosecurity Damien O'Connor said she has worked tirelessly with growers and technical teams from across growing regions for more than 30 years, taking science-based lessons and turning them into easily understood, practical solutions.

In presenting the Special Award to KVH, Minister O'Connor said the New Zealand kiwifruit industry has demonstrated exceptional leadership in the face of biosecurity incursions, driving research and managing impacts, while also ensuring the welfare of growers.

"The resilience demonstrated by this industry during earlier responses has carried through to today; it continues to pride itself on driving a collaborative approach to biosecurity."

Stu Hutchings, KVH Chief Executive at the time of the awards, added that there is no doubt that by working in partnership, better biosecurity outcomes can be achieved.

"The entire industry has embraced this approach for many years and it's great that our efforts - and those of the people who work with us - have been recognised with this award."

PSA 10 YEARS ON

The date was 5 November 2010, the time was 4.45pm and the message would rock the kiwifruit industry to its core - the discovery of Psa in New Zealand.

The day is etched in history and the feeling of emptiness was shared by industry members the length and breadth of New Zealand.

From that moment the kiwifruit industry and partners worked tirelessly to rebuild, re-graft, and ensure the industry recovered and prospered. The mission was to share information, build on research and development, learn all we could to survive the incursion and go on to thrive. This included pastoral care and a lot of kindness, which has been evident to see time and again.

Over 100 guests from across the wider kiwifruit industry marked 10 years since that day at a function hosted by KVH and held in the Zespri building the night of 5 November 2020.

The event was an opportunity to acknowledge and reflect on the anniversary of the discovery. Guests heard from speakers including David Tanner (current KVH Board Chairman), Lain Jager (former Zespri Chief Executive), Barry O'Neil (former Director General of the Ministry of Agriculture and Forestry), Peter Ombler (former NZKGI President), Shane Max (Zespri), and John Burke (inaugural General Manager of KVH).

Thank you to all those who were able to attend and enjoy the opportunity to recollect and reconnect with those that were at the core of the response and have shaped the recovery over the past 10 years. A special thanks to the sponsors of the event - it wouldn't have been possible without you.



A Special Award was won by the New Zealand kiwifruit industry for its outstanding commitment to biosecurity.

THE IMPACT OF PSA SEARED INTO THE MIND

The funds from sponsors also contributed towards the production of a commemorative booklet of reflections that create a historical record of what happened from many unique perspectives.

In honour of the 10-year anniversary the keepsake brings together some of the stories from the early days of Psa. While many growers would prefer to forget this harrowing time, capturing these stories and the lessons from our past experiences is important to improve our preparedness for future incursions and share these lessons with others.



'Psa the New Zealand story' is a series of reflections from the kiwifruit industry's biggest biosecurity response and recovery.

The book was released in April 2021 and is available to read on the KVH website at www.kvh.org.nz.

BUILDING BIOSECURITY CHAMPIONS

KVH has run regular KiwiNet workshops over the last 12 months, where people from across the industry came together to share their expertise and enjoy presentations from guest speakers.

KiwiNet is a team of people from across the kiwifruit industry who are selected to champion biosecurity education and readiness and coordinate the deployment of kiwifruit industry resources into biosecurity responses.



A decade after first being discovered, a function was held to acknowledge the journey of the industry during the Psa response.



Guest speakers regularly attend KiwiNet workshops to present to industry champions.

The August 2020 workshop included a special session with Craig Thompson (recent Zespri Global Supply Manager and current KVH Board member) about high-profile biosecurity threats in Italy. Craig has been on the frontline with Italian growers, post-harvest, and scientists trying to combat Psa and other pests and diseases we're keen to keep out of New Zealand.

The most recent 2021 workshop focused on what we know, what we're learning, and how we're building our understanding of risk from vine decline. There were presentations on Kiwifruit Vine Decline Syndrome (KVDS) and kiwifruit trunk diseases, detailing current management advice for growers based on what has been learnt so far from ongoing research and overseas experience.

There was an exclusive insight into the changes and challenges being faced head-on at our borders by Mike Inglis, Northern Regional Commissioner at the Ministry for Primary Industries (MPI). His biosecurity teams are responsible for our passenger, mail, freight, and cruise pathways in the upper North Island, and he talked about the work they do – in partnership with industry groups like KVH – to ensure we have the world's safest and smartest border.

KiwiNet workshops take place around every six months and copies of presentations from the day are then made available at www.kvh.org.nz.

INDUSTRY BIOSECURITY DAY A SUCCESS

Several biosecurity events were held during the region's Tauranga Moana Biosecurity Capital Biosecurity Week in late 2020, including a Kiwifruit Biosecurity Industry Day jointly hosted by KVH and Zespri.

Key research findings and practical examples of research that the industry has been taking part in were discussed, particularly around one of our highest risk threats, BMSB. Dr. Sonia Whiteman from Zespri gave an interesting presentation about what has been learnt about BMSB biology and impacts from trials in Italy, and Gonzalo Avila from Plant & Food Research explained trials underway in China and the USA to learn more about the promising biocontrol, the Samurai Wasp. The information from these trials is fundamental to developing and putting in place an effective release plan for the parasitoid wasp, should we ever need it in response to BMSB in New Zealand.

National biosecurity responses were discussed by special guest John Walsh from Biosecurity New Zealand, who spoke about the different parts of the New Zealand biosecurity system and discussed the importance of surveillance for early detection of pests and diseases – vital for any successful response. As well as the specialised, targeted surveillance and trapping programmes in place across New Zealand, the general surveillance undertaken by growers greatly increases our chances of detecting harmful threats early enough to do something about them.

KVH's Erin Lane and Linda Peacock delved into this area in more detail, with a presentation on the importance of reporting unusual symptoms seen on orchards. Unusual symptoms reported to KVH were summarised, including case studies of how investigations take place and exactly what happens after a report is made.

The days presentations were filmed and are available to watch on the KVH YouTube channel.

Our multi-layered biosecurity system

INTRODUCTION TO THE BIOSECURITY SYSTEM AND HOW WE CONTRIBUTE TO PRE-BORDER



Often when people think of biosecurity in New Zealand, our borders come to mind - things like airports and detector dogs, ports, and sites where goods are held until they are inspected and cleared.

However, there's much more to our biosecurity system than this single line of defence at the border. We are fortunate to have a world class biosecurity system made up of multiple layers, led by government and strengthened by many participants including kiwifruit growers and other primary producers.

While Biosecurity New Zealand is the lead agency for the biosecurity system, having everyone involved is critical. It's especially important for the kiwifruit industry as pests and diseases are one of our biggest threats and our success depends heavily on maintaining one of the best levels of pest and disease freedom internationally.

The first time the kiwifruit industry faced the far-reaching impacts of a big biosecurity incursion was after Psa was found in late 2010. Although there were some dark times when the outlook was bleak, we were fortunate that our research, resilience, and unity as an industry resulted in a strong recovery. This may not always be the case and we could face significant challenges in another big incursion. However, we can reduce the risk of these challenges and protect our industry by continuing to be active participants of the biosecurity system.

HOW THE SYSTEM PROTECTS US

Our biosecurity system is based on activities split across three different areas - internationally, at the border, and within New Zealand. Each of these reduces risk at various points on many different pathways into the country, such as passengers, machinery, ships, cargo, and mail.

We call the three areas 'layers' because they interlock with, and support each other, and together they ensure we have a thorough and robust system that can find and manage any threats that may come our way.

Pre-border (things that happen outside of New Zealand, before cargo arrives)

There are regulations and offshore inspections that help minimise the risk of unwanted arrivals. Some items are banned from coming to New Zealand, others must be treated before coming here. Biosecurity New Zealand inspects some overseas loading facilities and cargo before it's shipped.

Examples of pre-border measures KVH advocates: risk assessment, incoming pathway risk management, regulatory obligations, reducing risk on importation pathways, importer and passenger awareness and education projects, detection practices, and design of diagnostics tools.

At New Zealand's border

New Zealand's airports, seaports and transitional facilities (TFs) where goods are held and inspected before being moved offsite, are closely monitored by Biosecurity New Zealand.

Passengers who travel to New Zealand complete biosecurity declarations and detector dogs are used to identify risk goods on people and in luggage. High-risk or suspicious items are x-rayed and inspected.

Cargo is checked by Biosecurity New Zealand officers or accredited people (trained specifically to manage biosecurity risk) at TFs before it is cleared for release. This means every sea container entering New Zealand has some sort of biosecurity interaction before release, making our approach to biosecurity unique globally. Suspect containers or packages are treated for pests.

Examples of border measures KVH advocates: ensuring inspections of imported goods to verify compliance with import requirements, post-entry quarantine, systems for auditing of TFs, management of risk including treatment, destruction, or re-export of risk items.

Post-border (within New Zealand)

Industry groups, central and local government, and communities all work together to make sure we're always watching for new pests and diseases and preparing to handle an outbreak.

New Zealanders report more than 10,000 suspected pests and diseases every year to the Biosecurity New Zealand pest and disease hotline on 0800 80 99 66. About 750 of these lead to a formal investigation.

There are 13 surveillance programmes across the country that watch for specific risks, including one for Brown Marmorated Stink Bug (BMSB) which has traps in high-risk areas including the Bay of Plenty. A network of labs provides world-class diagnostic testing for any new or unusual finds.

Examples of post-border measures KVH advocates: surveillance activities and trapping, readiness and response planning, and long-term pest management programmes.

If harmful pests and diseases get into New Zealand, they can cause economic, environmental, social or cultural impacts.

Biosecurity is about reducing the chance of this happening, and the damage should it occur.



Machinery wrapped and ready for treatment in Georgia, USA. Credit: Ken Glassey, Ministry for Primary Industries.

HOW DO WE KEEP RISK OFFSHORE?

To reduce the risk of new pests and diseases arriving and establishing in New Zealand, we require all incoming goods, ships, and aircraft to meet strict import requirements.

Biosecurity New Zealand works to keep risks offshore by imposing standards that countries wanting to export goods to us need to meet. This allows us to keep New Zealand safe from biosecurity risk while maintaining our international trade.

A key component of pre-border management is understanding what is happening offshore to ensure that we are aware of and have the appropriate measures in place to manage a risk before it arrives in New Zealand. For example, there are very strict management actions for risk goods that could carry fruit flies, because the consequences of an incursion are so serious. These include requiring approved treatments known to mitigate the risk to occur on commercial goods before they can be exported to New Zealand.

BMSB is another good example of a pest that would also cause significant harm, but we know that a different approach is needed because it can enter on a different type of pathway. The BMSB is a hitchhiker that can get a ride on many types of containers, luggage, and equipment. As such, pre-border risk management for this pest requires high-risk goods to undergo treatment or be managed through approved offshore systems set up to manage the risk, like the used vehicle offshore system in Japan which has now been running successfully for over 20 years. As BMSB has spread around the world, Biosecurity New Zealand has kept pace by requiring mandatory treatments on high-risk goods from an ever-increasing list of countries. Currently there are 37 countries on this list.

HOW KVH HELPS MANAGE PRE-BORDER RISK

While pre-border risk management is outside of our Government Industry Agreement for Biosecurity Readiness and Response (GIA), KVH does undertake several activities to increase the chances of threats to our growers being kept offshore.

Global scanning

The Biosecurity New Zealand Emerging Risks System (ERS) proactively identifies and manages information relating to potential or emerging biosecurity risks. KVH adds to this intel by continually undertaking global scanning using our own international connections with research providers and industry, literature searches, and informal conversations to ensure we are aware of any possible specific risk to the New Zealand kiwifruit industry from offshore threats. We feed this directly in to the ERS so that when we learn of possible threats, Biosecurity New Zealand also becomes aware and can begin understanding whether national current measures are suitable and if not, changes to import standards will be implemented.

Submissions on IHS consultations

Import requirements, commonly known as Import Health Standards (IHS), are created by Biosecurity New Zealand. When they are initiated or majorly amended, they need to go through a consultation process. The purpose of this process is to ensure people and organisations, such as KVH, can provide some input into the risk management measures proposed to ensure they are sufficient to manage risk to our industry. KVH actively engages in these consultations with kiwifruit growers and our industry at the forefront of our mind. A good example is the aforementioned Vehicle, Machinery and Parts IHS that manages the risk of BMSB hitchhiking on these types of goods into New Zealand from 37 listed countries. KVH has submitted on every iteration of this standard to ensure it continues to appropriately manage risk.

Offshore connections

Considering that most of the pests and pathogens that threaten our industry are found offshore, maintaining a close connection with the international kiwifruit and research community is integral to our biosecurity readiness. Although recent travel has been affected by COVID-19 we have in the past had several international researchers give presentations to growers and industry representatives, including guests representing projects funded by the United States Department of Agriculture and those affected by the impacts of some of our most unwanted pests in Europe.

White Peach Scale: Influencing offshore risk management

A PRE-BORDER CASE STUDY

While New Zealand is one of the world's largest kiwifruit exporters, we do also import kiwifruit during the summer months when locally produced fruit is in short supply.

Imported kiwifruit is a potential pathway into the country for the unwanted White Peach Scale (WPS), a pest that could easily adapt to New Zealand conditions and threaten production.

WPS has had a significant impact on the kiwifruit industry in Latina, Italy with fruit losses of 10-20% being recorded in some years. As well as production issues, there are possible market access issues as we see with many other scale species, and the pest is therefore considered a serious threat to not only the kiwifruit industry but also other horticultural industries.

As well as infecting bark, WPS also attacks fruit and leaves of plants. In severe cases it appears as white, cottony masses encrusting the bark of the tree. Scale insect feeding can result in early leaf and fruit drop. Trees which are heavily infested can become stunted and young plants can die very quickly after infestation.

Over recent years WPS has been a topic of contention between KVH and Biosecurity New Zealand, because of steadily increasing interceptions (border and post-border) year on year, to the point where in one particular season 39% of import consignments were infested.

KVH has advocated for tighter controls on this pathway and undertaken research to better understand risk, however our efforts have been unsuccessful in presenting a case to justify the application of specific treatments. But, by engaging across the supply chain we have been successful in reducing risk on this pathway to the current level of just two border detections this past season. This makes WPS an excellent case study to illustrate that the border is not a zero-risk system, and while KVH will continue to advocate for greater measures to reduce risk, we all have a role in the post-border space to reduce risk further and provide greater protection for our industry.

INCREASING RISK TO THE INDUSTRY

In 2013, KVH received reports of scale on imported fruit in supermarkets across the Bay of Plenty, which subsequent investigation confirmed as WPS. With no specific treatments for WPS on this import pathway, other than inspection by New Zealand and Italian officials and treatment upon detection, KVH advocated Biosecurity New Zealand to urgently:

- increase awareness and vigilance of New Zealand border staff inspecting kiwifruit at our borders;
- notify Italian authorities of the increase in risk so they could heighten their inspection vigilance;
- review the risk assessment for this import pathway and re-assess whether further treatments or controls should be required.

All three actions were agreed on and undertaken, however two years later in the 2015/16 season WPS detections at the border and post-border reached an all-time high and posed a potential threat to the New Zealand kiwifruit industry. KVH elevated the matter with Biosecurity New Zealand and achieved agreement to fumigate all remaining imports until Italy could achieve assurance and certification responsibilities. By the season end, investigations revealed that 18 of the 46 (39%) consignments that season had WPS.

Biosecurity New Zealand agreed that this level of infestation was unacceptable and worked with KVH to agree actions to prevent such infestation occurring in the future, such as an agreement to review import requirements if WPS interceptions exceeded 5% of importations in the future.

A science-based Pest Risk Assessment was completed which acknowledged that while this pest may sometimes have a high likelihood of entering our borders, the likelihood of it establishing here is very low because of the pest being immobile and unlikely to make its way from a supermarket shelf to a host plant. However, the risk assessment also acknowledged that:

“any practices which involve concentrating imported ingested fresh produce within close proximity of suitable hosts (e.g. repacking of imported produce in pack-houses, followed by disposal of rejects in orchards) may result in increased likelihood of exposure”.



White Peach Scale

WORKING WITH IMPORTERS

KVH has continued to engage with Biosecurity New Zealand, and commission independent research in partnership with Zespri, to better understand the cold tolerance of scale (which confirmed the pest can survive typical cold duration associated with the importation of fruit).

However, as highlighted in the risk assessment, it is possible that some scale may enter our borders on imported fruit, in the same manner that it is possible that scale may enter markets on our exported fruit despite the controls to reduce the likelihood of such events occurring.

It is our ability to influence risk management practices post-border that is going to have the greatest influence on residual risk. In this instance, that is making sure that imported fruit doesn't end up on orchards, either through importers, or by people taking imported fruit on-orchard.

As well as direct discussion with Biosecurity New Zealand to ensure offshore measures remain appropriate, KVH also continually seeks to raise awareness with importers of kiwifruit here in New Zealand.

In the subsequent years following the increased finds, KVH visited these importers to discuss how we can work together to protect the kiwifruit industry from WPS and other possible pests.

Topics covered during these visits were around:

- raising awareness of the threat, including distributing copies of an information poster developed by KVH for display at all importer premises;
- working together to understand the pathway better and develop ways we can reduce the risk further. Waste fruit has been highlighted as key to this as WPS cannot move far on its own and needs to be transported on host material. Disposal of reject imported fruit is key to minimising overall risk as if the fruit is disposed of near vines (or other hosts) the risk would increase exponentially;
- inspecting all incoming goods when unloading/distributing and reporting all finds to Biosecurity New Zealand.

WPS TODAY

KVH remains actively engaged with Biosecurity New Zealand on WPS and at the end of every season we review data about the number of interceptions so that we can be assured they remain low and that offshore interventions remain appropriate.

Since the 2015/16 season (when there were 18 interceptions), there has been a significant decrease in numbers. This is likely a direct result of all the hard work that has gone into ensuring engagement with our offshore partners about risk being appropriately managed.



White Peach Scale



Biosecurity at the border

Thanks to TV shows and our own experiences with travel, the border has a high profile as the line of defence against pests and pathogens entering our country.

However, the border is more than just the teams of people and detector dogs at the airport, it's a complex system that is employing smarter technologies to manage the tensions between increasing volumes and demands for faster throughput.

The border is managed by Biosecurity New Zealand and is outside of KVH's role and responsibilities, although as explained in this article we do have initiatives to help influence the system and deliver better biosecurity outcomes for New Zealand kiwifruit growers.

BORDER MANAGEMENT

Biosecurity New Zealand manages risk at the border by verifying compliance with import requirements on four main pathways to prevent the entry of pests.

The four pathways are passenger, mail, cargo, and craft (airplane and ships). Cargo, which can come in via the sea or air is either inspected on arrival or moves to one of thousands of approved and audited transitional facilities (TFs) around the country, for inspection and clearance.

The border also includes quarantine facilities to test newly imported plant material for pests and diseases in a controlled situation before it is released into the New Zealand environment.

Biosecurity New Zealand has three main areas of focus for intervention tools to mitigate biosecurity risks at the border:

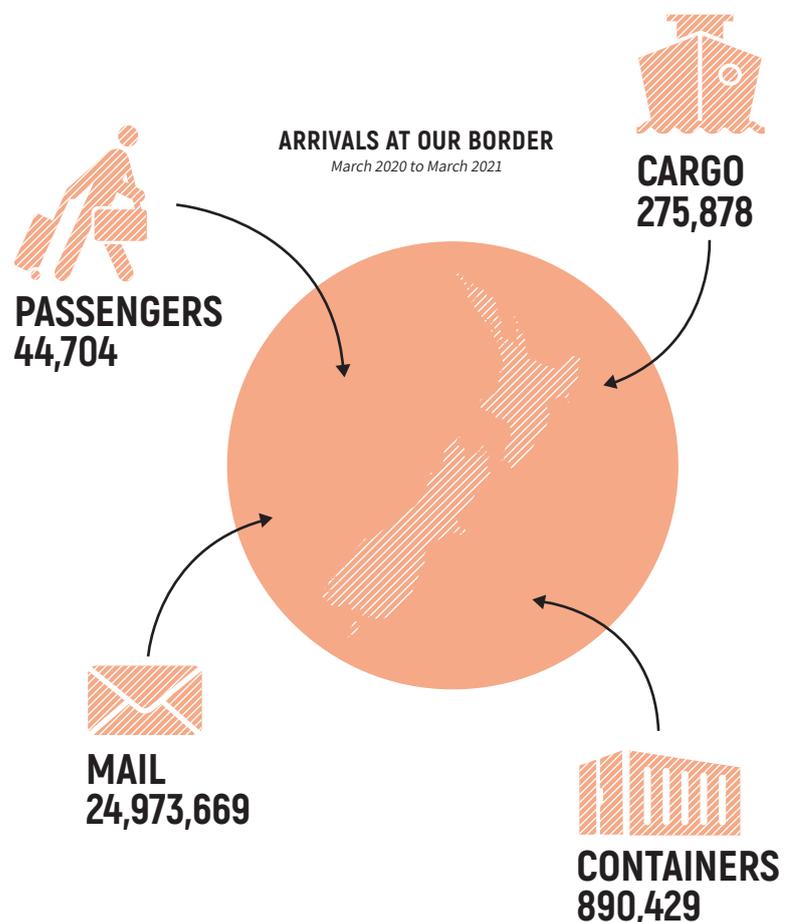
- voluntary compliance achieved through increasing awareness of requirements, and incentivised through avoidance of delays or fines for compliant behaviour;
- anticipating or detecting risk goods and verifying compliance with import requirements (commonly called Import Health Standards) with tools including profiling, x-ray screening, inspection and detector dogs;
- managing risk goods or non-compliant behaviour with tools including fines, treatments, and post-entry quarantine.

Border inspections by officials operate on a targeted system based on risk profiles, which are generated based on many criteria including the risk item pathway; the nature of the item; it's country of origin; and the history of the person or company sending the item.

Items flagged as high-risk may be subject to 100% inspection, while low risk items will receive much lower levels of inspection.

There are various technologies used by Biosecurity New Zealand to create these risk profiles and better utilise resources, such as the Integrated Targeting and Operations Centre (ITOC) in Auckland which establishes better coordinated operations and increases risk management capability, and the x-ray image transfer system which screens airline baggage before it arrives in New Zealand.

The expectation of border activities is that all significant pathways including any hitchhiker pathways are covered, and monitoring is performed to provide slippage information about how much is getting past the border and how effective current protection measures are.



Border officials inspect close to 50,000 import consignments a year. Border clearance is vital to protecting New Zealand’s environment and primary industries from unwanted pests and diseases.

THE CHALLENGE

New Zealand is becoming increasingly connected in a global world and these connections bring both opportunities and risks. Forecasted growth in passenger arrivals, new trade markets and changing demographics increases pressure on the New Zealand biosecurity system, particularly at our borders, where leakage is inevitable.

KVH AT THE BORDER: A PEST FREE PORT

One of the ways KVH interacts with the border is by creating strong relationships and trust between industry, regulators, and commercial port operators. We all want the same outcomes of avoiding biosecurity incursions that could impact our operations. By working together, we can explore opportunities to innovate and strengthen screening and inspection programmes and raise awareness about biosecurity.

There is a partnership between industry and government at the Port of Tauranga that encourages everyone who works around the port to play their role in keeping pests out of New Zealand.

The initiative is driven by KVH, the Port of Tauranga, the Tauranga Biosecurity New Zealand office, and local government and industry organisations. The aim is for everyone involved in port activities to have a better understanding of biosecurity risks.

The Port of Tauranga is New Zealand’s largest and fastest growing port, processing a large volume of goods, from a wide range of diverse origins. This presents a key risk to the kiwifruit industry and local businesses as these goods may contain biosecurity threats. With more than 1,000 workers on the port and several different companies operating, there is dispersed social and geographic responsibility for managing these threats.

Frontline staff are the focus of the partnership and activities to raise awareness of biosecurity responsibility at the border include a focused induction for all port workers; awareness campaigns and pest alerts for key pests such as Brown Marmorated Stink Bug (BMSB) and Spotted Lanternfly; a widely distributed calendar showing the range of potential threats and their impacts; and regular communication with the port community through signage, staff presentations, and special Biosecurity Week activities and functions.

The partnership, including social science researchers from AgResearch, has measured what motivates different groups of people around the port with biosecurity responsibility, and how biosecurity awareness and behaviours can be improved.

All in all, the research indicates that people appreciate the importance of biosecurity, report being generally familiar with the concept, appear open to receiving more information or training about biosecurity, and are willing to support biosecurity outcomes.

Port staff were surveyed because they are a first line of defence for biosecurity, for a large amount of incoming goods. They are a group who report that they understand what biosecurity is, and rate that they know how important it is, for themselves, and the wider environment. When asked however, most staff provide a relatively simple definition, and do not tend to consider the more serious ramifications of a potential incursion.

Education will continue with this group regarding the scope of biosecurity, current biosecurity threats, and reporting protocols. It is important for this group that reporting processes are increasingly streamlined to ensure consistency and ease of reporting across the port.

Transitional Facility (TF) staff were surveyed because they are also a key line of defence for incoming goods, which are not being unpacked at the port. TF staff tend to be informed, engaged and cognisant of biosecurity.

There is a need to ensure all TF staff (not just operations managers and accredited people) have some biosecurity training and the partnership is working closely with Biosecurity New Zealand on this. Resources, such as pest alerts, are now produced and shared in different ways to improve reach to all staff in all TFs.

Overall, the findings from this research suggest these groups are relatively aware of biosecurity, concerned about it, and enthusiastic to learn more. Critical next steps are continuing to provide educational resources and encouraging biosecurity behaviours. The plan for this research is to conduct follow-up surveys in the coming years, to see if biosecurity awareness, perceptions and behaviours have improved.

Other ports – particularly those near or associated with kiwifruit growers and growing regions – are encouraged to pick up the partnership model that has been developed in Tauranga and adapt it to suit their needs so that biosecurity becomes ingrained in the day-to-day behaviour of all those at the border in the port environment. KVH would like to acknowledge the Port of Tauranga for working with us on this initiative, for taking biosecurity seriously, and for taking a proactive approach to managing risk.



Port Staff rated:

their understanding of biosecurity	8.1/10
biosecurity as a threat to the Port of Tauranga	9.4/10
their ability to make a difference for biosecurity	8.1/10



Transitional Facility Staff rated:

their understanding of biosecurity	9.6/10
biosecurity as a threat to the Port of Tauranga	9.7/10
their ability to make a difference for biosecurity	9.6/10

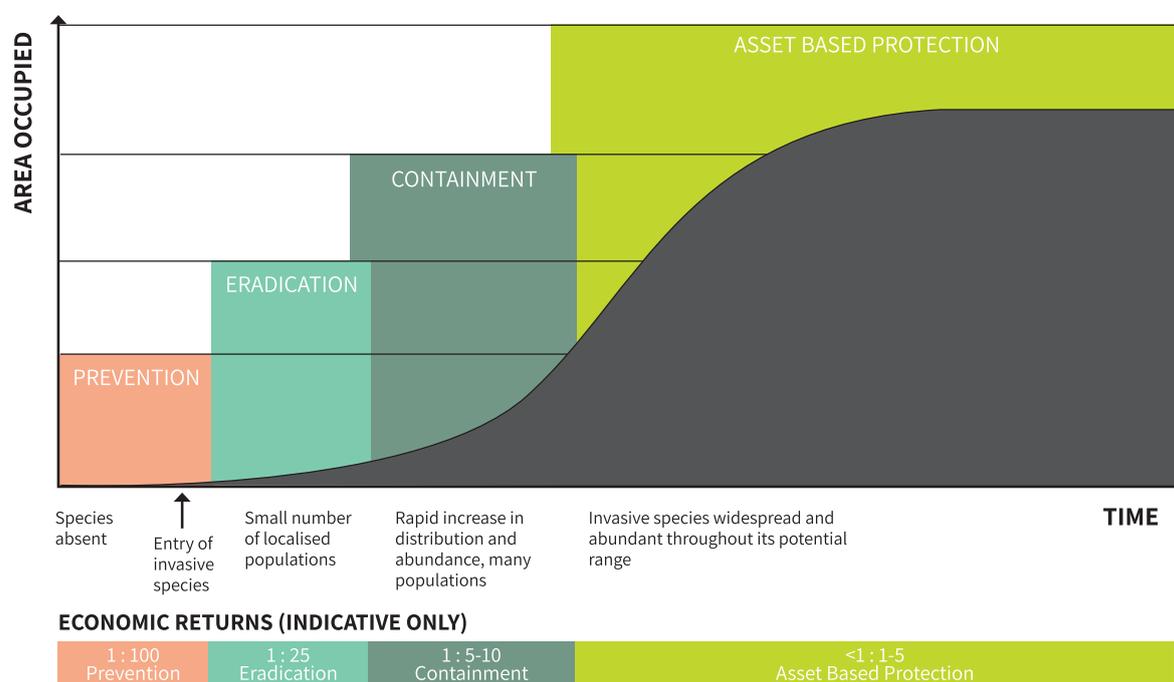
Biosecurity in New Zealand

HIT IT HARD, HIT IT EARLY

Early detection, followed by strong action up front, provides the best chance of biosecurity response success. If not controlled early on, problems rapidly escalate to the point where control options become very limited and expensive, with wide reaching collateral damage.

The below invasion curve shows that the closer to the point of introduction that detection occurs, the more likely eradication will be. Failure to eradicate results in a challenge for growers that must be dealt with year upon year, with associated economic impacts and management costs.

GENERALISED INVASION CURVE SHOWING ACTIONS APPROPRIATE TO EACH STAGE



THE THIRD LAYER: POST-BORDER

The post-border layer of the biosecurity system can often be forgotten, but for primary industries it is where our activities can have a direct influence in protecting our investments. This is our safety net, to give us the best chance of eradicating anything which may have slipped into our country, despite the pre-border and border measures mentioned earlier.

This layer includes surveillance to detect pests and diseases early; industry preparedness activities such as traceability and tool hygiene to prevent new organisms from spreading; and joint programmes across government, industry, and community organisations to reduce potential damage of those organisms which have become well established here, such as Psa.

SURVEILLANCE

Surveillance involves looking for unwanted exotic pests and diseases for early detection of new incursions, looking for established pests and diseases to determine distribution and population density to support pest management actions, or to determine pest or disease presence or absence to provide trading partners with area of freedom assurances.

There are 13 targeted surveillance programmes across New Zealand. Two of these are for kiwifruit's most unwanted threats, the Brown Marmorated Stink Bug (BMSB), and fruit flies.

The current national BMSB programme includes traps that have been installed at 80 high-risk sites to maximise the likelihood of finding these pests if they are here.

In the Bay of Plenty, traps are monitored fortnightly for the duration of the high-risk season each year (which is September through to the end of April) at 10 locations running from the Port of Tauranga in Mount Maunganui to Whakatane.

A comprehensive fruit fly surveillance programme involves almost 8,000 pheromone traps checked fortnightly during the high-risk season (starting October and continuing through until July). The trapping network is designed for early detection of breeding populations and uses three different lures which can detect several economically significant fruit fly species. The traps are placed in potential host trees and arranged in a specific pattern to cover areas identified as likely points of entry and detection because of their vicinity to international air and sea ports, presence of host material, and habitat suitability such as temperature.

While these targeted surveillance and trapping programmes won't guarantee early detection of pests entering New Zealand, combined with public surveillance they will greatly increase our chances of detecting them early enough to be able to do something about them.

READINESS AND RESPONSE

The kiwifruit industry wasn't well prepared for the Psa incursion in 2010, and we have been working hard to ensure we have learned lessons from the past and will be better prepared if we face another major incursion in the future. Much of this work is done in partnership with Biosecurity New Zealand and other industry parties under the Government Industry Agreement for Biosecurity Readiness and Response (GIA); an initiative to which KVH was the first to sign up to and now has 24 members.

Readiness and response plans have been prepared for major threats both at a national and industry level. For example, at a national level we have preparedness guides for fruit fly and BMSB which have been developed in collaboration with a wide range of industries. At an industry level, KVH has led development of readiness plans for some of our key threats, *Ceratocystis fimbriata* and Invasive *Phytophthora*.

One of the primary purposes of developing a readiness plan is to identify gaps in the system, where we may lack knowledge or specific tools and then address these through research projects. Where these gaps are kiwifruit specific, we work closely with Zespri's Biosecurity Innovation portfolio.

As well as preparing and planning, GIA is about shared decision making between government and industry and KVH has been actively involved, representing the kiwifruit industry, in some of New Zealand's most recent biosecurity responses. Great examples are the 2015 and 2019 fruit fly responses in Auckland.

To ensure that as an industry we are ready, willing, and trained to lend a hand to Biosecurity New Zealand in these situations we have our own network of people selected from across the kiwifruit industry to coordinate deployment of industry resources into a biosecurity response. In the 2019 fruit fly response the kiwifruit industry contributed over 680 people days into the response, the most of any industry.

PEST MANAGEMENT

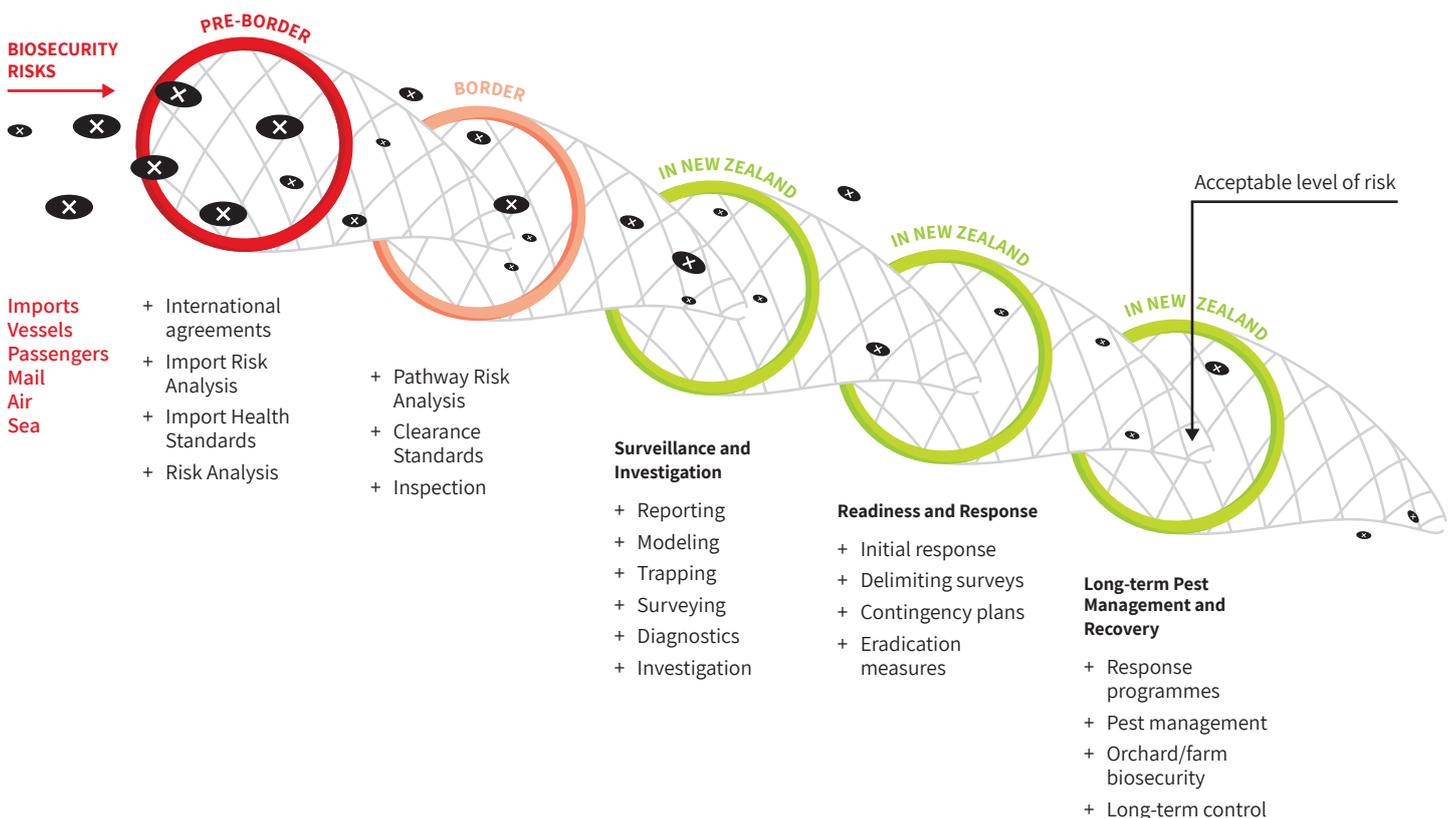
If an organism becomes established in New Zealand (moves beyond a stage where we can eradicate it) there is a system for developing long-term pest management plans at a regional and national level.

Industry organisations have used national pest management plans to manage organisms that damage their sectors, and councils regularly use regional pest management plans in their biosecurity work. The Psa-V National Pest Management Plan (NPMP) which KVH operates for the industry is a great example of how these plans can be utilised to help mitigate the impact of recently established pests.

The NPMP, which has been in place since 2013, provides a consistent and coordinated approach to Psa management at a national, regional and grower level. Without this, the effects of Psa would prove extremely difficult, if not impossible, to manage and control. However, it is important when it comes to post-border pest management that legislation and frameworks be adapted or refreshed over time so that they remain fit for purpose and offer the very best biosecurity protection.

With this in mind, KVH has been working with growers and others across the kiwifruit industry to develop and finalise a proposed new National Pathway Management Plan for the kiwifruit industry, which would replace the NPMP when it expires in 2023.

INDUSTRY AND GOVERNMENT WORKING TOGETHER TO REDUCE BIOSECURITY RISK



Proposed new pathway plan for better protection

A POST-BORDER CASE STUDY

While KVH contributes to national post-border initiatives such as surveillance for Brown Marmorated Stink Bug (BMSB) and fruit flies, we also have initiatives specific to our industry to reduce the impact of any future biosecurity incursions, should a new biosecurity threat be detected in a kiwifruit orchard. The most significant activity in this space is the development of a Pathway Plan for the kiwifruit industry.

PATHWAY PLAN 101

For two years, KVH has been working with growers and others across the kiwifruit industry to develop and finalise a proposed new National Pathway Management Plan for the kiwifruit industry.

In April 2021, the Plan was submitted on schedule to the Minister for Biosecurity so that it can go through the required parliamentary process before approval. This is expected to take around 12 months – during which the KVH team will continue to work with growers and industry, but with more of a focus on how we would implement the proposed Plan and what it will mean for everyone who works on or visits a kiwifruit orchard.

The Pathway Plan is a big deal, and a big piece of work, which will provide much better biosecurity protection for the kiwifruit industry but the great thing about it is that most people across the industry (especially growers) are already doing what the Plan asks of them and there won't be any great change to what happens day-to-day for most people already following the best biosecurity practices.

However, this project has been underway for some time now and there has been a lot of information shared at numerous events (in fact, during the formal consultation phase there were about 117 consultation activities) so now that the proposal has been finalised it seems like a fitting time to remind everyone of the purpose of the Plan and the benefits it will bring to us all, while covering some of the most common questions we've had.

Why do we need a new Pathway Plan?

We need to be as prepared as possible for the next biosecurity event, and the proposed Pathway Plan will help us ensure that we are. Biosecurity is one of our industry's biggest threats and by being prepared we can reduce the potential spread and impact of any future incursions.

Don't we already have good biosecurity activities in place because of what we learnt from Psa?

We do – as an industry our biosecurity activities are numerous and have increased significantly over the last 10 years. But they are largely focused on Psa only and could leave us vulnerable if we have any new incursions that spread differently. We can better manage risks with a new Pathway Plan that offers better protection, more value for money, and increased simplicity around management of risk.

How will the new Pathway Plan be better?

The proposed new Pathway Plan will make things simpler and help us manage risk more consistently. Instead of focusing on a single pest or disease (like Psa) it will focus on a wide range of threats and gives us a way to manage their pathways consistently and pragmatically - such as people and equipment, budwood, pollen and young plants for example.

What kinds of activities will the Pathway Plan help manage?

Some examples of everyday activities the Plan will help manage include:

- reporting and providing information;
- on-orchard biosecurity plans;
- hygiene practices when entering and leaving orchards;
- sourcing clean plant material;
- achieving best practice when contractors are working on-orchard and;
- additional controls for the movement between the north and south islands.

How will the Pathway Plan keep biosecurity risk low?

The intent of the proposed Pathway Plan is that all risk goods entering an orchard have a consistent and low risk of introducing a biosecurity threat to that property.

As you can see in the triangle image, the risk associated with each pathway varies, and it also varies depending on the organism of concern.

Certain mitigations (such as traceability and good biosecurity practices) will be required across all pathways and where additional risk remains, monitoring for specific or generic symptoms may also be required. Sometimes, these practices may still not be sufficient to reduce risk to an acceptable level and an additional layer of testing or treatment may be required.

This framework provides a scalable approach to ensure that risk mitigation measures are appropriate for the level of risk we face, and we can scale up if risk were to increase but also scale back measures to avoid compliance measures that aren't pragmatic for the industry or appropriate in low risk circumstances.

Is the Pathway Plan legislated? What happens to current legislation?

Since 2013, the National Psa-V Management Plan (NPMP) has been in place to reduce the impact and spread of Psa - it sets out rules and these have largely been effective, as evidenced by Psa still not being detected in the South Island, 10 years after it first arrived in New Zealand.

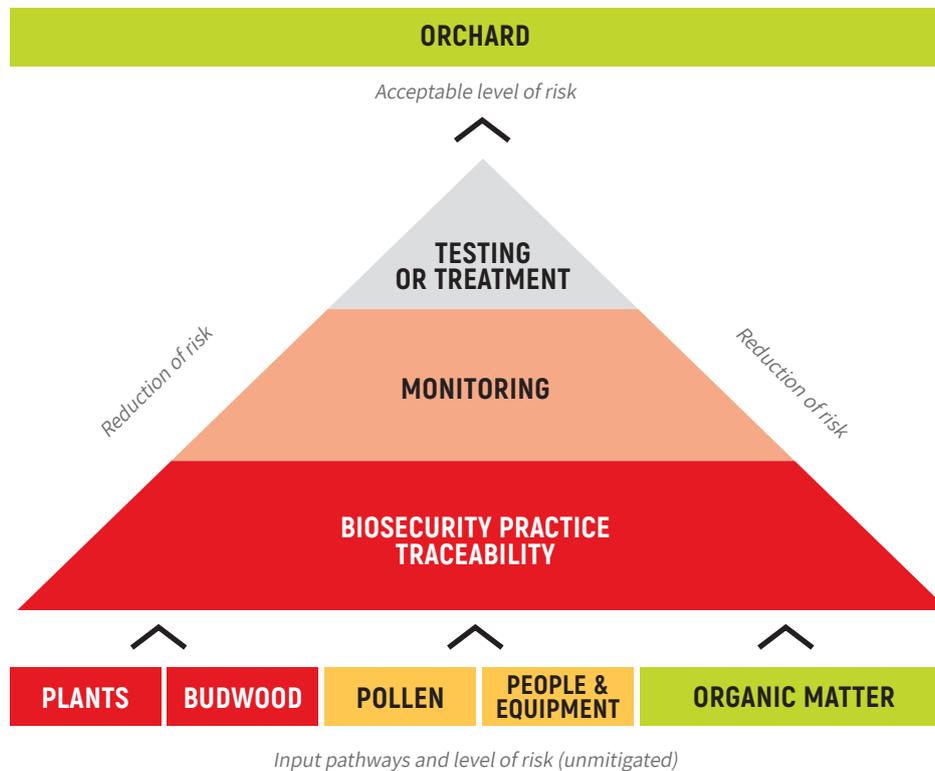
The NPMP (which is due to expire in 2023) and the proposed new Plan are similar in that they are both regulatory tools under the same part of the Biosecurity Act. The key difference is that the NPMP is specific to Psa only, while the proposed new Plan will enable the whole industry to manage a much broader range of biosecurity threats.

Growers currently pay an NPMP levy. This will be rescinded, and a new levy (for the new Pathway Plan) struck so that overall, the change in cost is proposed to be neutral.

How will KVH use the legislation to keep biosecurity risk low?

KVH uses a mostly educative approach to improve biosecurity practice and protect our industry investments and livelihoods, and this will continue. Rules are a necessary part of legislation though because they ensure that collective industry efforts aren't put at risk by the actions of a few.

From now through to the expected implementation date of the proposal (from April 2022), KVH will develop tools, standards, and resources - including biosecurity workshops - that will be put in place to ensure compliance with the 10 proposed rules is easy and practical.



I've heard KVH and others talk about how we'll need to complete orchard biosecurity plans. What are they?

We've been talking a lot about one of the key aspects of the proposed Pathway Plan, kiwifruit orchard biosecurity plans.

The Pathway Plan is very grower-centric and serves to protect your investments from biosecurity threats. While the Plan consists of 10 rules it is the requirement for growers to have and operate in accordance with an orchard biosecurity plan that consolidates these rules and is instrumental in creating an industry that is resilient to biosecurity threats.

By practicing better biosecurity on-orchard, growers can reduce or eliminate the impacts of pests on-orchard and prevent their arrival and spread. This reduces the risk of direct financial impacts on the individual grower, as well as reducing potential impacts of biosecurity events on the industry.

In practical terms, effective biosecurity on-orchard involves a grower:

- understanding orchard-specific biosecurity risks;
- agreeing what must happen on the orchard (including establishing and ensuring biosecurity requirements to be met by people visiting the orchard);
- sourcing and tracing clean plant material;
- checking and cleaning other risk items (e.g., tools, vehicles, machinery, bins, footwear and clothing);
- reporting.

Orchard biosecurity plans aren't new. There is currently a requirement under the NPMP for growers to have an orchard management plan for Psa-V. This requirement is proposed to be broadened to manage risk associated with a broader range of threats.

KVH already has a kiwifruit growers on-orchard biosecurity plan template which is aligned with the new requirements of the proposed Pathway Plan and is being refreshed so that it serves as a practical option to meet the requirements of this rule.

Support to complete an on-orchard biosecurity plan will be available from KVH throughout the next 12 months through the usual industry channels, including dedicated workshops.

More information about the Pathway Plan, including the proposal document and a summary of the proposed rules (and how these were changed to reflect feedback received during the consultation phase) is available on the KVH website at www.kvh.org.nz.

Research and innovation update

THE SCIENCE BEHIND OUR PROGRESS

Research and development priorities for both Psa and wider biosecurity are delivered to the kiwifruit industry by Zespri, under contract from KVH.

Projects are led by Dr Chandan Pal, with strong collaborative effort between the Zespri team and key KVH representatives including Matt Dyck, Erin Lane, Linda Peacock, Simon Cook and David Tanner.

Significant progress has been made over the last 12 months, even during COVID-19, with a highlight being popular industry events with growers and technical experts. Below is a summary of key programmes and outcomes from the work.

BIOSECURITY PORTFOLIO

Brown Marmorated Stink Bug (BMSB) – preparing for the most unwanted

One of kiwifruit's most unwanted, the high-risk BMSB remains a major focus of our research. We studied this pest's biology in terms of lifecycle and phenology, monitored surveillance traps across the Bay of Plenty region for early detection, and worked on sustainable BMSB management with pest traps and biocontrol agents in Italy and China. This research is of immediate benefit to growers in Europe and will inform management practices should BMSB become established in New Zealand.

The BMSB surveillance trapping network in the Bay of Plenty feeds into the national programme, with 20 traps at 10 sites across the region. No BMSB were found at any of the sites over the last 12 months.

Out trial work in Italy showed that Gold3 is likely to drop when BMSB feeding causes damage. Hayward is affected but less so. There were no impacts for Gold3 and Hayward on post-harvest storage or rots.

For management and control of BMSB, the industry is currently reliant on a combination of netting/trapping and agrichemical applications. Zespri is reviewing the Integrated Pest Management programme for BMSB in different countries, which will facilitate prioritising work in the coming year. We are also continuing to evaluate available traps (and developing new ones) for effective BMSB management.

Kiwifruit Trunk Disease – an emerging problem

We are building our understanding of the risk of Kiwifruit Trunk Disease (KTD). Investigations of a vine decline issue in Motueka were expanded to include surveys on orchards around New Zealand. No specific causal agent for the disease could be concluded and different principal fungal species/groups were identified in different orchards. There are likely to be roles played by cultivar, rootstock age, region, environment, and previous history of each orchard block. Pathogenicity testing work is underway to understand more about the disease.

Neonectria – a new fungal pathogen of concern

Our special focus was to explore one primary pathogen of KTD, *Neonectria microconidia*, based on our research and publicly available literature. This fungus was first identified in New Zealand in 2015 from stem cankers of kiwifruit; prior to this, it had only been recorded in China and Japan. However, *Neonectria microconidia* has now been shown to be present in the culture collections of Plant & Food Research from isolations made as early as 2001. We now know more about its host range, pathogenicity, life cycle, and distribution in New Zealand.

The fungus was found to be well distributed throughout the upper South Island kiwifruit growing region. It has been associated with on-vine symptoms and fruit rots of kiwifruit and may also be present in kiwifruit vines asymptotically. Our work indicates that the fungus is pathogenic to all four cultivars tested. Gold3 is more susceptible to the fungal infection than Red19 and Hayward. Its host range could be broad, and no control option is available, but more work is ongoing to understand control options and management.



Canker associated with *Neonectria microconidia* in Gold3.



Red *Neonectria microconidia* emerging through the bark of a kiwifruit vine.

***Ceratocystis fimbriata* – an industry culprit in Brazil**

The soil-borne fungus, *Ceratocystis fimbriata* is our most unwanted pathogen. This year we developed a sensitive molecular diagnostic test (PCR assay) that can be adopted for early detection. Readiness work is underway in Brazil. Initial findings via in-vitro trials indicated the potential of a set of fungicides and sanitisers to control the fungus. An in-vitro trial is underway.

Biosecurity risk pathways – pollen and compost

We have evaluated the biosecurity risk pathway for pollen and compost. A review of the risk posed by the pollen pathway (including other floral debris) was commissioned including literature from both kiwifruit and non-kiwifruit hosts. Pollen is a substrate that has been shown to transmit bacteria, fungi, viroids, phytoplasmas and viruses from diseased to healthy hosts. The current pollen milling processes are not likely to kill plant pathogens. The work confirms that the existing pollen protocols are adequate for managing current known risks. This work also will help inform KVH's proposed Pathway Management Plan to ensure appropriate measures are implemented to manage the level of risk associated with these pathways.

We also evaluated the biosecurity risk associated with compost and organic matter input. The risk is very low in conventional orchards but could be higher for the organic systems. There is no evidence that potentially pathogenic fungi or bacteria survive in compost, including the presence or survival of Psa and other kiwifruit pathogens. However, caution should be taken when the starting compost material is represented by branches, trunks, or bark in the compost. A correct procedure of composting should be sufficient to avoid any problem.

All biosecurity risks are considered – low risk is not no risk

We have over 100 pests and pathogens that are of risk to the kiwifruit industry and the risk level is different for each of them. This often changes based on their impact or damage around the world and their likelihood of establishment in New Zealand. Our focus over the last year has been:

- Chinese literature was translated to achieve a better understanding of offshore biosecurity risk and support market access.
- Potential threats of *Phytophthora* to kiwifruit were indicated by initial findings from Kiwifruit Vine Decline Syndrome (KVDS) in Italy. This has prompted a nationwide survey, which is underway to better understand baseline *Phytophthora* biodiversity in New Zealand kiwifruit orchards.
- Cherry Leaf Roll Virus (CLRV) is a risk organism that is currently managed under the Kiwifruit Plant Certification Scheme. Research to understand its impact on kiwifruit is underway to ensure risk management measures remain appropriate.

PSA PORTFOLIO

The Zespri/KVH Research and Development programme has produced a greater understanding of Psa, and how it can be detected and managed. That knowledge directly flows into KVH's practical Psa-management advice to growers however Psa continues to be our most problematic on-orchard disease and our goal is to ensure that the current risk level is maintained or lowered. Here are the key highlights from the last year:

Optimised and proactive Psa management programme – a key to success

Research work was conducted to identify and implement improved management practices in Psa-challenged blocks. The project compared Psa-managed versus Psa-challenged blocks over a four-year period. The work demonstrated that an optimised and proactive management programme can make a significant difference to OGR.

Monitoring strains and resistance control products

Protecting existing control products in our toolbox for Psa and monitoring resistance to optimise their use and product efficacy is our priority. Our nationwide annual resistance monitoring work confirmed that the prevalence of Psa virulent strains is stable, thus the overall Psa risk level is steady, and product efficacy of control products (copper, bactericides) are stable.

We are continuously monitoring how Psa strains are evolving to ensure we can detect unusual genetic changes that could make Gold3 susceptible to infection. We included samples from sites where Psa effects were strong through spring, and this work will continue bi-annually.

Less reliant on agrichemicals and bactericides - a sustainable future

We are continuously working towards developing new biocontrol products to manage Psa in a sustainable way to reduce reliance on the use of agrichemicals, copper, and antibiotics.

Urgent growers' needs – seasonal challenges

- Psa does not significantly increase disease incidence in areas where the pathogen is already present. However, contaminated pollen, or pollen suspected to be contaminated by Psa, should be used only locally to avoid the introduction and spread of potential new variants.
- Research confirmed that autumn applied Actigard elicits upregulates the defence genes in Hayward vines.
- Research found evidence that Gold3 grown on Bounty rootstock is more susceptible to bud rot than Gold3 grown on Bruno.
- Digital resources have been produced to inform growers about the industry's best practice for cut-out of Psa symptoms



Field images of Gold3 flower buds showing symptomless (black arrow), developing (white arrow) and advanced (red arrow) symptoms of bud rot.

Psa: the year that was

Winter 2020 was New Zealand's warmest winter on record. Normal rainfall meant Psa risk levels were similar to previous years through June and July, but a wetter August brought spikes in Psa risk for most regions.

In Northland, rain events in July and August delivered the region's highest maximum one-day rainfalls on record elevating Psa spread risk for this region.

La Nina conditions resulted in warm spring temperatures averaging 0.85 degrees above normal across the country and an unseasonably warm October meant Psa risk fell away. November reversed the trend though with spikes in Psa risk reflecting the wet month for much of the country, and resultant outbreaks of leaf spotting in Hayward blocks and some young plantings was noted into early December.

For the new Red19 variety, warm sheltered blocks with strong Psa protection programmes have reported few Psa symptoms. Marginal, cold, and inadequately sheltered trial blocks have seen increased symptoms that affected production.

Some young Hayward and Gold production blocks in Edgecumbe and Gisborne reported strong symptoms early season. These were more prevalent where water and/or inadequate wind protection had compromised plant health to some degree.

Summer was again dry with above average temperatures keeping Psa at bay for the balance of the growing season. Thunderstorms and hail in the Tasman region on Boxing Day severely damaged many kiwifruit crops in the Motueka area and growers were recommended to apply copper to dampen any spread of the less virulent Pfm which can cause leaf spot infection on Hayward vines.



Autumn cankers activating.

MONITORING

KVH annual monitoring rounds to confirm presence or absence of disease across Exclusion and Containment regions were completed in October and November 2020.

In the Nelson/Tasman region, 18 blocks from Waimea to Takaka were monitored including Gold3 and Hayward. Four samples (from orchards with leaf spotting) were confirmed as Psa not-detected.

In the Whangarei region, 13 KPINs were monitored in October including Gold3 and Hayward. Focus was on areas with no Psa positive orchards, and an orchard where unusual leaf spotting had been reported was also included. Five leaf samples were taken, with testing confirming two new Psa positive sites.

KVH completed a further Psa monitoring round in late December, to provide additional information to assist decision-making regarding a potential change to the Whangarei regional status. Hayward and rootstock blocks on all 25 non-detected orchards were monitored. Fourteen samples (from orchards with leaf spotting) were taken, with three from young rootstock blocks returning a Psa positive result. With 48% of the growing hectares in the region confirmed as Psa positive, the status of Whangarei changed to Recovery from 2 February 2021.

The South Island and Far North retain their status as Exclusion regions, with no Psa detections.

In autumn 2021, KVH also assisted independent monitoring of blocks identified by Zespri as being potential suppliers of Red 19 budwood. Vines with Psa/secondary Psa were tagged as unsuitable for budwood supply and all monitored orchards were ranked to assist planning of budwood collection.

RESISTANCE RESULTS

The Zespri and KVH commissioned Psa resistance monitoring programme continues, with the aim of identifying any emergence of Psa strains with resistance to bactericide and copper control products.

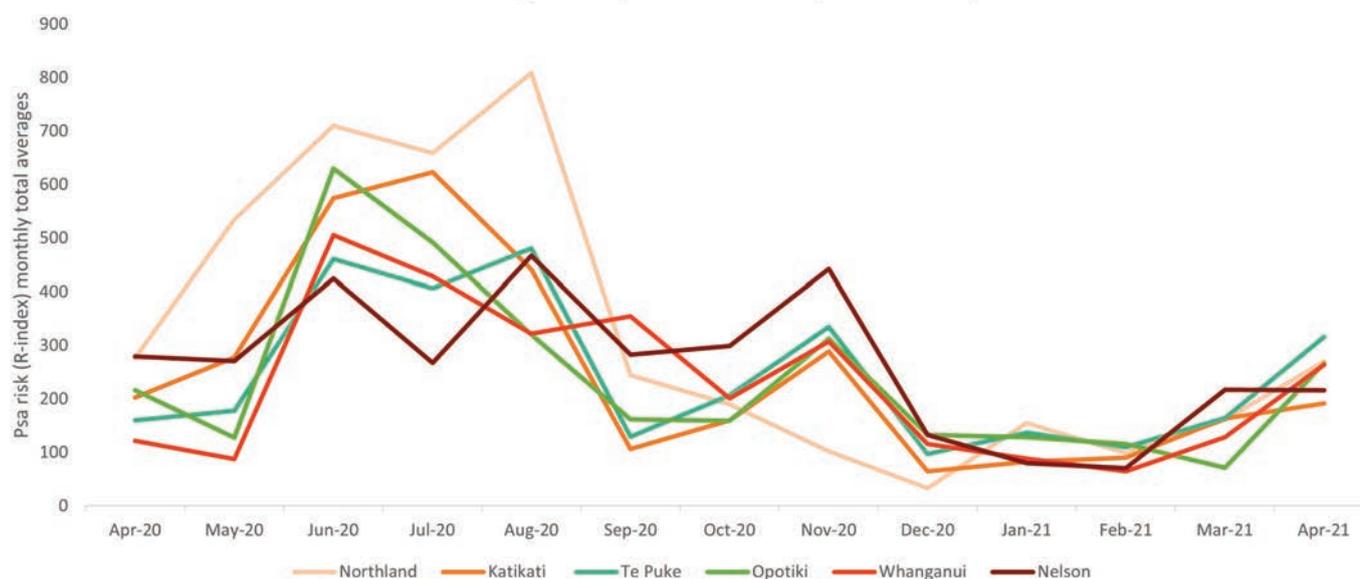
In the November 2020 sampling round 21 orchards were tested, with Psa detected in 19 orchards. Frequency of Psa detection in leaf samples was consistent with previous years. No Kasugamycin resistance was identified from any Psa-V isolates. Streptomycin resistance was observed in 3% of Psa-V isolates, fewer than the 8-10% recorded in 2019.

All 19 orchards with Psa-V identified had some copper tolerant Psa-V isolates. Overall results for testing copper resistance of Psa-V isolates showed a continued trend upward with 85% of isolates resistant to low (0.4mm) copper. As in previous rounds, isolates were resistant to low concentrations of copper only and would be expected to be easily controlled by copper products applied at label rates.

A selection of Psa isolates from the 2020 monitoring programme are currently being sequenced to look for any genetic evidence that Psa is adapting to our kiwifruit varieties. This two-year testing cycle looks for changes in genes identified with the potential ability to cause disease.

Using crop protection products with different modes of action, following label rates, and only applying products when needed, continues to be the recommendation to growers to prevent resistance occurring.

Psa risk total for given regions between April '20 and April '21



RESEARCH UPDATES

The Psa research day this year extended to online coverage to allow for COVID-19 restrictions and to cater for the high industry interest in this annual event.

Research on when Psa is infecting Hayward identified that early flower buds (two weeks after budbreak) are highly susceptible to Psa in favourable conditions, with these symptoms driven by external inoculum.

Symptoms of Gold3 bud rot were identified as different from Hayward but were clearly associated with Psa. Isolations showed Psa was found on flower buds four to five weeks after budbreak, as sepals begin to separate. Similar to Hayward, Psa was shown to move from external (sepals) to internal flower parts. Gold3 on Bounty 71 rootstock showed significantly more budrot when compared with Gold3 on Bruno.

Research clarified frost injury to both Hayward and Gold3 dormant canes occurs below -6 degrees Celsius, with cane death occurring at minus 10 degrees Celsius. Therefore frost damage to dormant canes leading to an increased Psa risk seldom occurs in North Island kiwifruit regions, except perhaps in some cold parts of orchards at high elevation.

Reflections from year four of the GoldFutures project highlighted the role of management practices in optimising OGR in the Psa environment. Through development of comprehensive spray programmes; good monitoring and cut out programmes; and orchard improvements to reduce vine stress; the OGR's of Psa challenged blocks lifted significantly, more closely matching returns for Psa managed sites.

A good practice workshop was held to further support those in high Psa risk areas. Growers created their own Psa programme, with the support of peers and using resources developed for the workshop to improve understanding of Psa management practices.

GROWER TOOLS

Resources added to the KVH website (www.kvh.org.nz) share practical advice on industry views on good practice Psa management. Video and print resources created through the Cut It Out research survey funded by KVH and Zespri identify what experienced growers do regarding Psa cut-out, and a set of activities to help teams develop and agree on strategies that suit their orchard are also available. These resources help new orchard managers and growers train those new to dealing with Psa.

WEATHER & DISEASE PORTAL

The dashboard layout for the online Weather & Disease Portal available to all growers has improved accessibility to forecasts, weather summaries and several different seasonal comparison tools. Evapotranspiration (ET) values are also now available to inform water management planning.

The platform now offers IBM Weather Company forecasts that update every hour and offer the possibility of increased forecast locations, enabling exciting future functionality.

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