nzppi
NEW ZEALAND PLANT PRODUCERS INCORPORATED

SCIENCE & TECHNOLOGY

FOR OUR PLANT PRODUCTION FUTURE

NZPPI SCIENCE & INNOVATION STRATEGY
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Chairman's Foreword

The plant production sector is "the genesis of all things green" – it underpins our plant-based export industries and delivers solutions to some of New Zealand's complex social and environmental challenges and aspirations (e.g., climate change, water quality, 1 billion trees, liveable cities).

Science and research is key to unlocking innovation in the plant production sector, which will fuel future export growth opportunities and develop smarter solutions to such complex issues.

The vision of NZPPI is to be a vibrant plant production industry widely respected for its professionalism, innovation and major contribution to New Zealand. One of our key goals is to lift innovation, create a step-change to timely and relevant science, research, development and technical advice. But to do this effectively requires a well thought out plan. In May 2017, NZPPI took a first step towards achieving this goal by holding a Science and Innovation Summit in Rotorua, which began to identify the basis of a science strategy.

After further input at NZPPI's 2017 conference, the NZPPI Board established a steering committee to direct the development of a Science and Innovation Strategy for NZPPI. This document is the product of that effort; the culmination of considered input by the steering committee members (comprising industry and science leaders) and others that provided feedback and had input, including scientists from Plant and Food Research and from Scion. Our thanks to Bill Dyck who led this process.

Science and Innovation is expensive, but the government already invests over $1.5 billion annually into science and does so primarily based on strategic need. Without a strategy it is difficult, if not impossible, for the Ministry of Business, Innovation, and Employment and the Crown Research Institutes and universities to know what industry wants and where to focus research effort. A strategy is also useful for identifying where NZPPI should invest resources for the best gain to members.

The plant production industry forms the basis for many other primary sectors and the science and technology strategic priorities identified in the NZPPI strategy are relevant to most downstream sectors: sustainability; improved diagnostics; enhanced soil health and plant quality; knowledge transfer; and biosecurity.

As a first step to implementing the Science and Innovation Strategy, NZPPI will establish an R&D Committee to advise on research priorities, work with the CEO to influence government funding, and provide direction for NZPPI research investments.

A step change is needed – there are some immediate opportunities and "low hanging fruit" identified in this strategy, but the big opportunity is to create a research platform for science that will catalyse innovation in the plant production sector. And put the latest scientific information, knowledge and tools in the hands of those that can fuel innovation and deliver solutions - our plant producers.

Andrew Harrison
NZPPI Chair

Executive Summary

This Science & Innovation Strategy recognises the value of the plant producer sector to the economy and wellbeing of New Zealand and the importance of science and innovation to underpin NZPPI's vision to be a professional and vibrant industry. It also recognises the opportunity for joined-up thinking; not only with plant producers and the wider primary sectors that depend on plant producers, but also with the science community to determine what is really important in science and innovation to benefit New Zealand. The Strategy identifies current strategic priorities for the plant producer industry and sets out a plan to address these. The strategic priorities are:

1 Sustainable plant production systems

Sustainable production is a common challenge facing NZPPI members, as well as all primary sectors, and it is a challenge that can be addressed through science and innovation. There are many issues around sourcing and discharging water, integrated crop management, chemical options and environmental impacts, soil and plant media quality and certification, plastic use and more sustainable alternatives, to name a few. Maintaining "social licence", or the ability to operate in the future with the support of the wider community, depends on keeping up to date on the issues as they arise and ensuring research and/or knowledge transfer is directed to address these issues before they impact on the industry.

Key question: How can science and innovation improve sustainable nursery production and help to retain social licence to operate in the face of growing consumer awareness of sustainability issues?

2 Improved diagnostics for assessing plant health and detecting pathogens

The advent of molecular science means that new technologies for assessing plant health and detecting pathogens in plants and the environment are being advanced on an extremely rapid basis. New tools are becoming inexpensive to apply and highly reliable for making accurate assessments in the lab and nursery. Enhanced capability will lead to improvements in nursery plant production as plant health problems can be detected and addressed before they become serious issues, and the risk of spreading pathogens can be greatly reduced as asymptomatic plants carrying pathogens can be identified and steps taken to prevent the spread of potentially serious plant diseases.

Key question: How can science and innovation help improve plant health assessment and pathogen detection to enhance plant production and reduce risk from pathogens?

3 Enhanced soil health, plant quality and vigour

New Zealand requires greater science effort in soil quality and soil health if it is to meet economic growth objectives of increasing productivity by 40%. Nursery plant production depends on soil and media quality, whether for in-ground production or container stock. Optimum management of soil and media properties will lead to improved sustainable nursery production and improved plant quality and vigour.

In addition to optimising soil micro-organisms, substantial opportunities exist to modify the microbiome of commercial plant species that contribute to New Zealand's primary production sectors. The best opportunities for success are to focus research efforts in plant production systems, including tissue culture and nursery production. Microbiomes are complex and involve both the plant and the soil microbial properties. There is an opportunity for New Zealand to establish a technology platform to optimise the microbiome for plant production but also conservation purposes, but to do this properly would require considerable research investment and multi-sector collaboration.

Key question: How can soil health, plant quality and vigour be enhanced by better understanding and managing components of soil quality, and by manipulating the complex microbiome that exists for plant species of interest?

4 Knowledge transfer to NZPPI members

The answers to many of the questions facing New Zealand plant producers are known but this information is not readily available to NZPPI members. There is also an ongoing problem in New Zealand and international science that research results, and knowledge built on these results, are often not easily accessed. This strategic priority addresses these issues and aims to make results from current and also previous plant production research available to members in a manner which provides knowledge, rather than just information.

Key question: What is the most cost-effective way to make relevant information and knowledge available and transferrable to NZPPI members?

5 Biosecurity

Biosecurity is also a strategic priority that cuts across many sectors, including plant producers. Without excellent biosecurity and the science to underpin it, all primary sectors, the environment, and New Zealand's economy and social wellbeing are at risk.

Plant production is a key component of the biosecurity system and considerable efforts need to be made to ensure that germplasm imports are pathogen free, and that nurseries are not a ready pathway for pest and pathogen spread, even of organisms already present in New Zealand. NZPPI needs to do its part to encourage relevant biosecurity research to reduce risk on germplasm import pathways and on plant movement pathways.

Key question: What additional science and innovation is needed to reduce biosecurity risk to benefit NZPPI members and, by default, the greater NZ economy?

The S&I Strategy also identifies some immediate opportunities that could be pursued at very low cost, including:

Strategic Priority	Immediate Opportunity
Sustainable production	- Investigations into sustainable chemicals – e.g., neonics - Investigations into sustainable plant containers – a biodegradable pot workshop is planned with Scion
Enhanced diagnostics	- Work with MPI and others to initiate research to reduce germplasm import time – has been communicated to GERMAC
Soil quality and plant health	- Work with other plant sectors to encourage coordinated research into manipulating the microbiome to enhance plant health and quality – has been raised with plant sector biosecurity managers
Knowledge transfer	- Develop an internet search engine function for the NZPPI website to enhance members opportunities to find critical information – low cost
Biosecurity	- Contribute biosecurity science priorities from this Strategy to the Plant Production Biosecurity Scheme and - Contribute to the Biosecurity 2025 Statement of Biosecurity Science Priorities – both very low cost

The S&I Strategy has conducted a preliminary analysis as to the strategic priorities for NZPPI members, but it has not specifically analysed the risk of not conducting specific research projects or the benefit in conducting the research. Therefore, a priority should be for the new NZPPI R&D Committee to assess the risk of not taking immediate action on each priority identified.

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$500 mil
to NZ's economy annually
NZ Horticulture industry contributes
$3.9 bil
in export value

Introduction

New Zealand Plant Producers Incorporated (NZPPI) was established in 2016 to address key priorities vital to the future wellbeing of New Zealand plant producers. Plant producers contribute in the order of $500 million to New Zealand's economy annually and the industry underpins much of the country's primary sectors.

The Value of Plant Production

Commonly referred to as the nursery industry, producers of plants contribute some $500 million to New Zealand's economy annually. Yet this figure is only a small indication of the vital importance of the industry to New Zealand's financial and social wellbeing. (NZPPI Prospectus 2017)

New Zealand's horticulture industry contributes approximately $3.9 billion in export value and an additional $1.1 billion in domestic value. Yet the vines that support the abundant premium quality grapes start their lives in a nursery. Avocados too begin their journey as young trees at the nursery. Apples, and many important exported and domestically consumed fruit come from a small number of expert nursery growers working in collaboration with New Zealand and international breeders to source new 'protectable' varieties to secure the future of our export pip fruit market. Nurseries and associated breeders are the starting point of New Zealand's key horticultural innovations in terms of plant varieties we can rely on to take us into the future. Forestry nurseries supply the millions of juvenile seedlings of radiata pine and other species required to eventually generate the forestry industry's $4.7 billion in exports.

The new darling, the manuka honey industry depends on bees, but also on the science of developing the best possible cultivars of our native manuka and understanding the science behind the production of highly active UMF honey via the qualities of the nectar producing manuka plants. This and the ability to propagate the large numbers of plants to help meet an almost insatiable world demand for this extraordinary product of New Zealand.

Tourism is also a key revenue earner for the New Zealand economy and we strongly promote our "clean green" image to the world. Plant producers supply the stock to establish buffer zones along waterways to protect treasured aquatic values and produce native plants to revitalise degraded natural ecosystems and to absorb carbon dioxide to reduce the country's greenhouse gas emissions deficit.

Greening of New Zealand's urban environment provides not only a tangible value but many social and societal benefits to New Zealanders. Trees and plants have a vital role to play in human wellbeing on many levels. Plant life improves air quality in urban and industrial spaces, near motorways, and there is evidence too of the psychological benefits of 'green life' exposure in having a role to play in mental health and wellbeing.

The role of science and innovation

The Vision of NZPPI is to be a vibrant plant production industry widely respected for its professionalism, innovation and major contribution to New Zealand. Understanding and embracing the opportunities that science and innovation offers is key to achieving this vision.

The NZPPI Science Summit, held in Rotorua in May 2017, identified a number of issues driving the need for science and innovation in the plant production industry.

The development of this Science & Innovation Strategy follows on from this workshop and the enthusiastic endorsement to proceed with the strategy following the NZPPI Conference in July 2017.

Labour
issues around availability and also health and safety; and the need for technological solutions to replace labour and reduce costs in some areas

Plant quality
health and nutrition issues and opportunities to improve product quality

Biosecurity and germplasm imports
issues around getting new germplasm into NZ as well as around increased biosecurity risk

Sustainability
issues around maintaining soil quality, eco-friendly containers, water use and discharge, and reducing waste

Regulations
to facilitate operations and new developments

Knowledge access / communications
to access and disseminate useful information to members

"We must reach out to the science community, the team leaders, communicators and the universities and let them get to know us the people involved in Plant Production, our industry. All we need to do is to be a willing participant with an open mind and a smile on our dial!" (Nicola Rochester - feedback from NZPPI Science Summit May 2017)

Purpose of the strategy

The Science & Innovation Strategy will be used to help deliver on NZPPI's vision and to guide science investment by both government and industry, influence research providers in relevant research areas over the next five years, and to provide direction to improve technology/ knowledge transfer to NZPPI members.

Scope

The scope of the S&I Strategy is strategic and applied science and technology that can benefit the wider plant producer industry. It covers all aspects of plant production, from biosecurity, through genetics, growing – plants/media, mechanisation, sustainability to the nursery gate. It is intended to be general to the industry rather than specific to a particular sub-sector or company.[1] The scope includes improving technology/ knowledge transfer across the full spectrum of nursery operations to the nursery gate, and beyond in the case of biosecurity.

Industry best practice production programmes and their supporting protocols and standards are outside the scope of this strategy.

Vision for the Science & Innovation Strategy

NZPPI wants to be recognised in the identification, development and implementation of research that will underpin the organisation's vision to be a vibrant plant production industry widely respected for its professionalism, innovation, and contribution to New Zealand.

Current State

NZPPI is a new organisation and currently does not fund any R&D projects, although, as of September 2017, it has been involved in discussions to influence Ministry of Business, Innovation and Employment (MBIE) competitive funding and it has submitted a proposal to the Sustainable Farming Fund (SFF). Based on draft versions of this S&I Strategy, NZPPI has been in discussion with Scion and Plant and Food Research as well as technology companies regarding opportunities for collaboration.

[1] Individual members of NZPPI may have research projects underway, both within New Zealand and overseas, but these largely sit outside the scope of the S&I plan as they are for the benefit of individual companies.

Government science and research funding

The New Zealand government invests considerable funds into Crown Research Institutes (CRIS), universities, and also private companies and industry organisations. There is an opportunity for NZPPI to tap into these funds by developing and implementing an S&I Strategy. The relevant funding opportunities are described below and more detail can be found on the website links provided below.

The Ministry of Business, Innovation and Employment (MBIE) and the Ministry of Primary Industries (MPI) are the key government departments managing funding schemes relevant to NZPPI. MBIE funds relevant to NZPPI include:

ENDEAVOUR FUND:

"The Fund invests in excellent research that has high potential to positively transform New Zealand's future economic performance, sustainability and integrity of our environment, help strengthen our society, and give effect to Mātauranga Māori."

(http://www.mbie.govt.nz/info-services/science-innovation/investment-funding/how-we-invest/endeavour-fund/?searchterm=endeavour%20fund%2A)

RESEARCH PARTNERSHIPS:

This scheme is industry or sector driven and partnership members determine the research that will be undertaken by the research providers.

(http://www.mbie.govt.nz/info-services/science-innovation/research-partnerships)

CALLAGHAN INNOVATION:

The scheme is mainly relevant to individual companies but NZPPI members should be made aware of its existence.

(http://www.callaghaninnovation.govt.nz)

STRATEGIC SCIENCE INVESTMENT FUND:

SSIF supports underpinning research programmes and infrastructure of importance to New Zealand. While NZPPI cannot access this funding directly, it can influence how it is applied, and what areas of new research CRIs invest in.

(http://www.mbie.govt.nz/info-services/science-innovation/investment-funding/how-we-invest/strategic-science-investment-fund/?searchterm=ssif%2A)

PRESEED ACCELERATOR FUND:

The PreSeed Accelerator Fund (PSAF) is designed to support early stage technology commercialisation activities.

(http://www.mbie.govt.nz/info-services/science-innovation/investment-funding/current-funding/pre-seed-accelerator-fund/)

NATIONAL SCIENCE CHALLENGES:

New Zealand's Biological Heritage (NZBH) aims to reverse the decline of NZ's biological heritage by protecting and managing native biodiversity, improving biosecurity, and enhancing resilience to harmful organisms. The biosecurity aspects of this challenge are very relevant to NZPPI, particularly current projects that are investigating plant nursery biosecurity networks.

(http://www.biologicalheritage.nz)

REGIONAL RESEARCH INSTITUTES:

In 2015, a new "Regional Research Institute" initiative was launched. In the second funding round "Plantech" was selected to become a new Regional Research Institute and is relevant to NZPPI.

(http://www.priorityone.co.nz/planttech-regional-research-institute)

Other funding sources

MINISTRY FOR PRIMARY INDUSTRIES (MPI):
There are a range of funds available with the Sustainable Farming Fund (SFF) and Primary Growth Partnership (PGP) being the most suitable options for NZZPI purposes.

MINISTRY FOR THE ENVIRONMENT (MFE):
MfE manages environmental funds such as the Waste minimisation fund, the Freshwater Improvement Fund and Community Environment Fund.
(http://www.mfe.govt.nz/more/funding/community-environment-fund)

AGMARDT:
AGMARDT is an independent not-for-profit organisation that provides funding to support businesses and industry groups to gain a deeper understanding of their customers and their markets to identify and exploit potential opportunities.
(http://agmardt.org.nz)

PRIMARY GROWTH PARTNERSHIP (PGP):
PGP is a joint venture between government and industry, that invests in long-term innovation programmes to increase the market success and deliver long-term economic growth and sustainability across primary industries, from producer to consumer.
(http://www.mpi.govt.nz/funding-and-programmes/farming/primary-growth-partnership/)

SUSTAINABLE FARMING FUND (SFF):
SFF funds 'communities of interest' to conduct applied research and extension projects that tackle a shared problem or develop a new opportunity. NZPPI submitted a proposal to SFF in September 2017 to develop a knowledge management system.
(http://www.mpi.govt.nz/funding-and-programmes/farming/sustainable-farming-fund/)

Science Providers

There are a range of science providers that have skills and capabilities suitable to deliver to NZPPI's Science & Innovation strategy. Skills and capabilities relevant to NZPPI are spread across all New Zealand Universities. Crown Research Institutes (CRIs) are, collectively, the largest dedicated providers of science research in New Zealand. CRIs undertake basic and applied science, and technology research and development, in many instances from the idea through to the commercial outcome. Of most relevance to NZPPI are Landcare Research (LCR), Plant and Food Research (PFR), Scion, and AgResearch. In addition, there are a number of private research organisations, both in New Zealand and overseas, that can make significant contributions to NZPPI science and innovation.

Key drivers for S&I in the plant producers' industry

Key drivers for Science & Innovation can be found in the vision statement for NZPPI i.e., "to be a vibrant plant production industry widely respected for its professionalism, innovation and major contribution to New Zealand." The Innovation pillar in the NZPPI Strategy highlights the need to lift innovation and to create step change in access to timely and relevant research. The Influence pillar in the NZPPI Strategy is also relevant as it highlights the need to achieve advocacy outcomes that improve our business environment and to develop stronger connections and influence.

There are also a number of national-level drivers, as well as sector initiatives that will have an influence on, or be influenced by, NZPPI S&I priorities.

NATIONAL DRIVERS

New Zealand's Labour-led coalition is more focused on issues of environmental sustainability and social responsibility than the previous government and some of their policies will have a significant and likely positive impact on NZPPI. The "Planting One Billion Trees Programme" seeks to plant 500 million additional trees above current planting rates primarily to provide regional development and environmental benefits, including helping to meet the government's climate change objectives[2]. The government has also signalled additional investment earmarked for R&D and for biosecurity, specifically to support National Science Challenges, including countering myrtle rust and kauri dieback. The government also proposes to increase R&D spending to 2% of GDP over ten years.

[2] https://www.mpi.govt.nz/funding-and-programmes/forestry/planting-one-billion-trees/

PRIMARY SECTOR SCIENCE ROADMAP

The Primary Sector Science Roadmap (2017)[3] is particularly relevant to NZPPI. It looks to maintain and increase the value derived from the primary sector by achieving sustainable growth in productivity and profitability. It recognises the need for diversification of products and to respond to challenges such as biosecurity, food safety, and climate change. The roadmap also specifically acknowledges that the health of soils, freshwater, and marine environments are paramount in New Zealand's future planning.

MPI developed the Primary Sector Science Roadmap to provide direction to strategy and investment decision-making by science funders and research providers, and also to industry and government departments. The Roadmap recognises that science is critical to primary sectors to provide knowledge to enhance production and innovation, while protecting soils and other environmental values. It also realises that there are new drivers pushing for change in the primary sectors, including new technologies that can enhance productivity, as well as the need for greenhouse gas mitigation and improvements in water quality and other environmental aspects.

The Roadmap recognises several key uncertainties such as society's acceptance of new technologies, biosecurity threats, environmental limits, regional impacts of climate change, and consumer perceptions and the need to be alert to disruptive change. It also recognises the relevance of science to provide evidence for decision making and the importance to driving transformational change in the primary sector. In the same way that good science is important to farming, horticulture, and plantation forestry to underpin regulations as well as technology implementation, it is also important to plant producers that in many cases support downstream enterprises. This applies to potentially revolutionary technologies such as gene editing, but also to the continued application of chemicals for the protection of the environment.

There are increasing demands for science to better understand the environment and the potential impacts of the primary sector, but also science and technology that will provide for sustainable productivity growth. There is an increased focus on higher value products, moving away from the traditional commodity markets, and much greater emphasis in science that integrates economics, social and cultural values with science to enhance productivity.

The Primary Sector Science Roadmap identifies several new outcomes that science needs to support. Many of these are of direct or indirect relevance to NZPPI and include many "soft science" issues, as opposed to the more traditional biological sciences. For example, the roadmap recognises the need to recognise changes in people's preferences and values and how these inform and motivate the development of new or improved products through the supply chain. Informed public engagement and understanding of risk and consequences enabling co-development and implementation of new and innovative primary sector science and technologies.

All eight science themes identified as being important for primary sector production are relevant to NZPPI, but some more so, such as in the Adding Value Theme and the strong interest in low chemical use in pest and disease control and concerns about degrading water quality, being recognising consumer demand for increased transparency and traceability.

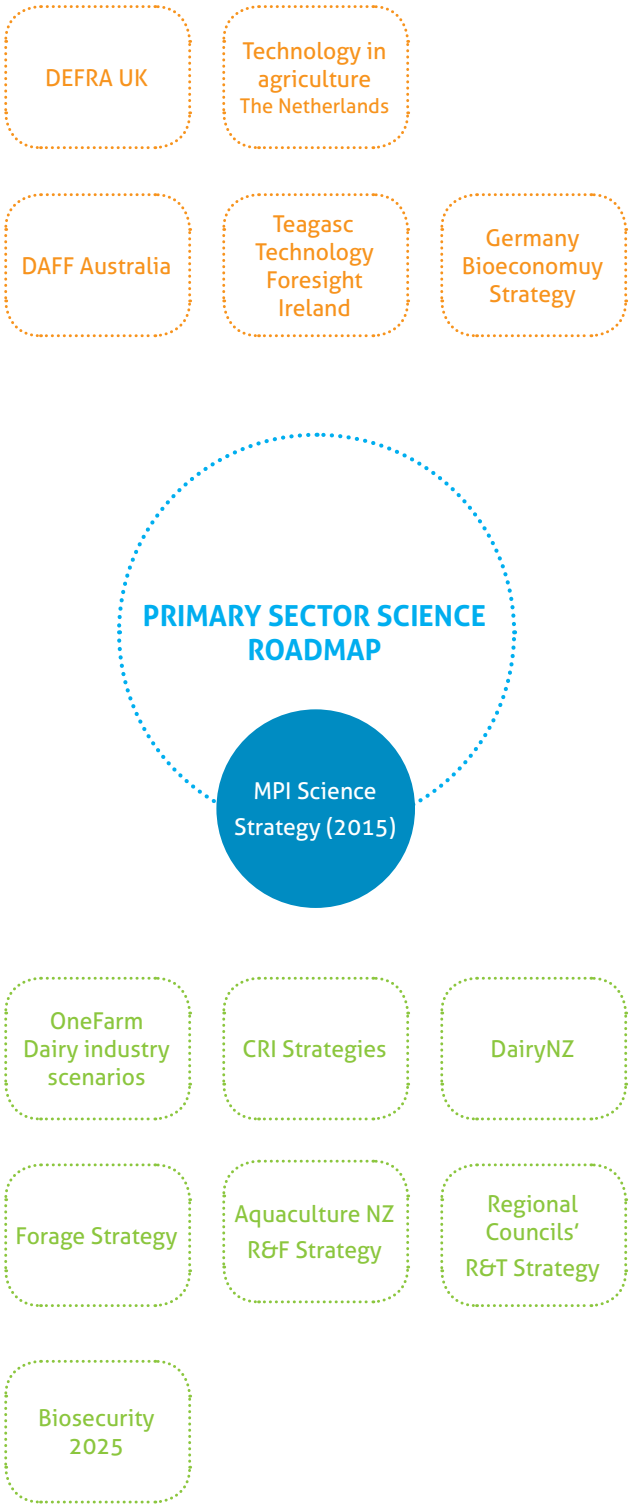
The Roadmap was influenced by a number of earlier strategic documents, which are shown in the diagram below. This is also a role that then NZPPI S&I Plan can play in the future; influencing what goes into central government strategies and thereby influencing government science funding.

[3] https://www.mpi.govt.nz/news-and-resources/science-and-research/primary-sector-science-roadmap-te-ao-turoa/

SOCIAL LICENCE TO OPERATE

Maintaining social licence to operate has become common terminology to describe a relatively new concept that most industries are now facing and that developed out of the mining industry. Social licence to operate generally refers to a measure of confidence and trust that society has in businesses to behave in a socially acceptable way. While plant producers can claim to be the genesis of green plants, we will likely become more and more accountable to consumers. Social media has become a powerful tool in holding companies and organisations accountable and NGOs can now rapidly rank and publicise business performance and influence consumers' preferences. An analysis of what is important for the nursery industry to maintain social licence to operate has not been conducted, it can be assumed that it will be primarily around issues of environmental and social performance and general ethical behaviour. AGMARDT potentially provides a funding mechanism to research this issue and opportunities to capitalise on "green thinking".

> "New Zealanders' think that the environmental issues we most need to address to live up to our overseas marketing messages (i.e. where they see potential licence to operate issues arising internationally) are associated with water quality of lakes, rivers and coastal areas and farm run off. There are also concerns about waste disposal."[4]
> (Sustainable Business Council – NZ)



[4] https://www.sbc.org.nz/__data/assets/pdf_file/0005/99437/Social-Licence-to-Operate-Paper.pdf

BIOSECURITY 2025

In particular of considerable relevance to the NZPPI S&I Strategy is the development of a "Statement of Biosecurity Science Priorities", announced in May 2018. The intention is for the Statement to influence biosecurity science funding. The immediate opportunity is for NZPPI to submit priorities from S&I Strategy to the development of the Statement.

PLANT PRODUCTION BIOSECURITY SCHEME

The myrtle rust response in 2017 highlighted the crucial role that plant producers play in early detection of new incursions and slowing their spread. This led MPI to initiate the Plant Production Biosecurity Scheme (PPBS) and contract its development to NZPPI. The output will be a plant production biosecurity standard and manual, which to be credible and useful needs to be underpin by sound science particularly to ensure inspection and diagnostic technologies are appropriate and working.

RELEVANT INDUSTRY SECTOR DRIVERS

HortNZ's current strategy recognises that the NZ horticulture industry cannot keep doing what it has done and expect to continue to grow. The strategy emphasises that horticulture sectors with a solid foundation in science (e.g. existing cultivar development programme, health attribute identification/extraction programmes or an on-farm technology development programme) need to increase their investment into science and research and need to collaborate to invest in establishing a science and technology platform to improve quality and production efficiencies. As well as focusing on increasing productivity, HortNZ strategic actions also include a focus on sustainability. Points all relevant to NZPPI and that offer collaborative opportunities.

NZ Forest Owners Association (NZFOA) has a Science & Innovation Strategy, and also a Biosecurity Science Strategy, both of which are currently under review. Strategic priorities for the industry include mechanisation, as men on the ground are replaced by machines for health and safety reasons. Phytophthora needle diseases are the major focus of forestry biosecurity science. Again, opportunities for cooperation and collaboration for NZPPI.

A New Zealand "Pastoral Industry Forage Strategy" and "Discussion Document" was released in November 2017[5]. Of relevance to NZPPI and this S&I Strategy is the intention to better coordinate R&D across the various sectors, which includes research into the application of biotechnologies, endophytes, agrichemicals, biosecurity and environmental outcomes etc. It also identifies the need to form a "Forage Biosecurity Council" and to consider representation from relevant nursery growers as they, amongst others, are seen as having a vital role in managing biosecurity risks already in New Zealand (ref p32).

In Australia, which has many similarities to New Zealand, the Australian Horticulture Innovation Nursery Strategic Investment Plan[6] identifies a potential financial impact of the plan of $140M based on an investment of $16M over the next five years. It identifies a number of opportunities that are drivers for change, including opportunities to increase the size of the industry, make better use of science and technology to improve productivity, and a stronger focus on best management practices; and a number of threats, such as increased biosecurity risk, rising costs of labour, and reduced access to existing and new chemicals. These are similar issues of focus for European plant nurseries (https://www.enaplants.com). There are opportunities for collaboration in science and technology with Australia as well as with several other countries.

[5] https://beeflambnz.com/your-levies-at-work/national-forage-strategy
[6] http://horticulture.com.au/wp-content/uploads/2017/06/HortInnovation-SIP-Nursery.pdf

Strategic goals and objectives

The strategic goals of the NZPPI Science & Innovation Strategy are to:

1. **Provide coordinated and representative direction to government science and technology development funding**
2. **Provide strategic direction to NZPPI efforts in science and technology investment**
3. **Facilitate knowledge transfer and uptake by NZPPI members**
4. **Influence science and technology capability development to meet future needs**

GOAL 1

To provide coordinated and representative direction to government science and technology development funding

Without a strategy it is very difficult, if not impossible, for government and research providers to comprehend sector requirements for new science and technology. A well thought out strategy, that is owned by NZPPI members, can send a powerful message to funding organisations, including research providers, as to what is required to both benefit the plant producer industry, and also the New Zealand economy and environment. This goal is about providing strategic influence to MBIE, MPI and other science funding sources to help direct funding to areas of importance to NZPPI that will also provide wide benefit. In some cases, NZPPI funding may be required to leverage external funding, but less so for areas where there is also considerable national good, such as in biosecurity and environment.

Objectives within this goal include:

- 1.1 Ensure that government departments, CRIs, and universities are aware of NZPPI and the S&I Strategy.
- 1.2 Provide timely input towards the development of research bids by research providers to MBIE and other funding sources.
- 1.3 Work closely with relevant CRIs to understand, and potentially influence their priorities for investing Strategic Science Investment Fund (previously known as core funding) to areas relevant to NZPPI and potentially other sectors.
- 1.4 Communicate science and innovation priorities to relevant sector bodies, such as HortNZ and NZFOA, and seek partnership opportunities.
- 1.5 Influence science direction of Biosecurity 2025 where opportunities allow.
- 1.6 Provide input to strategic thinking for relevant National Science Challenges, particularly Biological Heritage and Our Land and Water.
- 1.7 Provide strategic influence to GERMAC, particularly with regard to Import Health Standards and germplasm imports.

GOAL 2

To provide strategic direction to NZPPI efforts in science and technology investment

As for external funding, a comprehensive strategy is required to ensure that efforts made through NZPPI science investment are for the optimum benefit of members, based on strategic thinking and prioritisation.

Objectives within this goal include:

2.1 Communicate to members through the NZPPI newsletter and other fora the strategic priorities identified in this document.

2.2 Seek regular input from NZPPI members on new issues and opportunities that may require a science and technology solution.

2.3 Seek out and follow through on funding opportunities in the various grant schemes, such as SFF, PGP, AGMARDT etc.

2.4 Provide resources to ensure the S&I Strategy is implemented in a timely manner and that the strategy is regularly refreshed.

2.5 Keep NZPPI members up to date with strategic science investment signals from government departments and from CRIs.

2.6 Provide opportunities for NZPPI members to be directly involved in research projects as appropriate.

GOAL 3

To facilitate knowledge transfer and uptake by NZPPI members

This goal focuses on ensuring existing knowledge, as well as new relevant knowledge, is readily made available to members. There is considerable plant production knowledge that has been documented over the last several decades that is not readily available to members. There is also a large amount of new knowledge generated each year both in New Zealand and internationally that may be relevant to NZPPI.

Objectives within this goal include:

3.1 As funding permits, develop a knowledge management system that will enable members to access existing information, and also new knowledge available from New Zealand and internationally.

3.2 Provide resource to enable knowledge scanning that focuses on priority areas for NZPPI members.

3.3 Regularly update members with links to relevant websites where new information and knowledge can be found.

3.4 Survey members to determine if they are aware of new knowledge being communicated by NZPPI and are getting access to the knowledge they require.

GOAL 4

To influence science and technology capability development to meet future needs

This goal focuses on influencing the maintenance and growth of capability in key science and technology areas that could benefit NZPPI now and in the future. Science and technology is rapidly changing and New Zealand's capability needs to respond. In many cases the needs of the nursery production industry will be similar to requirements for other primary production sectors.

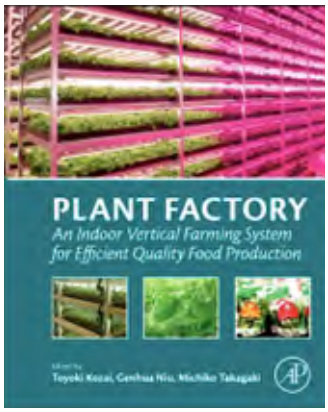
Objectives within this goal include:

4.1 Work with other sectors to identify gaps in current science and technology capability and also to identify future needs.

4.2 Together with other sectors, as possible, lobby appropriate organisations, including MBIE, Tertiary Education Commission (TEC), CRIs, and universities, to advise on key skill needs. Where appropriate provide a business case.

4.3 Every two years conduct a strategic stocktake to ensure needs are identified and updated.

The New Zealand horticulture industry been at the forefront of a step change in the management of plant pests and diseases, progressively removing traditional agrichemicals, such as carabamates and organophosphates. There are strong drivers to take this even further with research initiatives that will identify and develop the next generation of safe and sustainable plant protection systems.



Vertical farming, or "plant factories with artificial lighting" (PFAL) are developing in urban environments throughout the world but are currently constrained by a number of factors, including energy costs, and are currently only suited to a number of plant species. PFAL will continue to develop and will provide new technologies that will of interest to NZPPI members. It is definitely an area that needs to be followed quite closely in order to identify technologies than can improve efficiency in plant production in New Zealand.

Fruits and vegetables with naturally high nutrients and flavour compounds are now available in retail stores.

Research is continuing to explore how plant husbandry techniques can influence and increase the development of these important compounds.

"Collectively NZPPI's S&I strategy, and the priorities it identifies, will enhance industry practice, efficiency and productivity. While industry best practice production programmes, if any, and their supporting protocols and standards are outside the scope of this strategy, such programmes will importantly be underpinned by the science that this strategy generates."
Andrew Harrison – Chair, NZPPI

Research prioritisation

Research prioritisation is important, not only to guide NZPPI investment, but also to help influence central government and other sector investment in research, science and technology investment. There are several factors that need to be considered when identifying research priorities, including financial benefit to NZPPI members, but the most important criteria to consider is "risk". What is the risk if the research is not done, and how soon does it need to be done? Losing "social licence to operate" for aspects of nursery operations is probably the biggest risk to consider. Science, including social research, can help address questions around sustainability issues.

There is also considerable risk around biosecurity issues, as has been highlighted by the myrtle rust incursion. Nursery plant movement pathways pose risk for pest and pathogen movement, particularly in the case of undetected pathogens that don't produce disease symptoms on host plants.[7] This has recently been highlighted for Phytophthora infestations in European nurseries where a multi-country study found many Phytophthora species not previously discovered. Their spread throughout Europe, and also worldwide, has been attributed to international trade in live plants and transmission via nurseries to planting sites.[8]

The S&I Strategy has conducted a preliminary analysis as to the strategic priorities for NZPPI members, but it has not specifically analysed the risk of not conducting specific research projects or the benefit in conducting the research. There is also a need to assess the likelihood that the research can be successfully completed, and if so, can the results be implemented or will there be regulatory, investment, and perhaps social barriers that prevent successful uptake of any new technologies. This level of analysis needs to be done when projects are being developed for specific funding opportunities, and risk needs to be assessed against economic factors and likelihood of success. CRIs, universities, and private research companies are generally well-positioned to research NZPPI strategic priorities but require a science strategy to respond to in order to attract government science funding.

[7] Parke, J. L.; Gruenwald, N. J., 2012: A systems approach for management of pests and pathogens of nursery crops. Plant Dis. 96, 1236–1244.
[8] Widespread Phytophthora infestations in European nurseries put forest, semi natural and horticultural ecosystems at high risk of Phytophthora diseases. Forest Pathology 46 (2) 2016.

Strategic priorities

The S&I Steering Committee was involved in the identification and scoping of strategic priorities. The priorities below are those issues that need to be addressed in the short to longer-term, by not only NZPPI, but by other agencies that are primarily responsible for specific issues. In some cases, such as biosecurity, NZPPI can influence MPI to strengthen the biosecurity system to reduce risk, but there are also opportunities for NZPPI to partner with MPI to address critical biosecurity issues that impact directly on NZPPI and downstream sectors, such as horticulture and conservation planting.

The priority research areas that follow are in priority order reflecting NZPPI interests. Priority research areas are of relevance to much more than just NZPPI, but those of greatest relevance as identified by the S&I Steering Committee are categorised as short (ST), medium (MT) and long-term (LT) and grouped into four categories:

1. **Sustainable plant production systems**
2. **Improved diagnostics for assessing plant health and detecting pathogens**
3. **Enhanced soil health, plant quality and vigour**
4. **Knowledge transfer to NZPPI members**

Biosecurity is added as a fifth category to highlight the importance of this at a national level, and not something that NZPPI should be funding other than where there are well-defined and specific benefits to members.

1

Sustainable plant production systems

ABOUT THIS STRATEGIC PRIORITY

Sustainable production is a common challenge facing NZPPI members, and one that can be addressed through science and innovation. Issues are wide ranging and including sourcing and discharging water, integrated crop management, chemical options and environmental impacts, soil and plant media quality and certification, plastic use and more sustainable alternatives etc.

NZPPI is very focused on sustainable production systems and has identified a number of key objectives:

- Ensure chemicals used are "safe" and acceptable to NZPPI and to downstream users of plant products.
- Ensure chemical application technologies, container disposal methods etc are safe and acceptable.
- Develop more non-chemical solutions with improved effectiveness and reduced medium to long-term social issues.
- Reduce wastage in plant container use, either by recycling and/or by utilising sustainable materials in container production.
- Reduce nutrient and other pollutant runoff from nursery sites. Close the loop as much as possible.

Key question: How can science and innovation improve sustainable nursery production and help to retain social licence to operate in the face of growing consumer awareness of sustainability issues?

PRIORITY RESEARCH AREAS INCLUDE[9]:

- Chemical application and methodology and Integrated Crop Management (ICM) knowledge transfer (ST) along with scientific development of best practice (MT-LT)
- Investigations into sustainable media raw ingredients (ST)
- Investigations into sustainable chemicals – e.g., neonics (ST)
- Research into parameters on water runoff – leachate – (ST)
- Investigation into sustainable options for plant producers (at a high level) (ST) – overarching
- Investigation and/or development of "sustainable" plant containers (ST – LT)

[9] ST=short term; MT = medium term; LT = long term

2

Improved diagnostics for assessing plant health and detecting pathogens

ABOUT THIS STRATEGIC PRIORITY

Plant health is affected by a number of factors including pests, pathogens, nutrition and water stress. New technologies are rapidly being developed that enhance the ability to detect plant health problems early, including improved chlorophyll fluorescence technology for monitoring water deficit and nitrogen status, UAVs equipped with sensors such as thermal infrared to pick up moisture status, sensors to count plants and also detect weeds, and spray technology to eliminate weeds. Some of this technology is available now for outdoor nursery use and will soon be available for use in greenhouses.[10]

New molecular and non-molecular technologies have been developed and are in the process of being further refined that will enable more cost-effective monitoring of plant health and disease issues and for early detection of pathogens in asymptomatic plants. Enhanced capability in this area will lead to both improvements in nursery plant production as plant health problems can be detected before they become serious issues, and the risk of spreading pathogens can be greatly reduced as even asymptomatic plants carrying pathogens can be identified and steps taken to prevent the spread of potentially serious plant diseases. Some primary industries, such as kiwifruit, already require plant certification to guarantee plants from nurseries are free from specific pathogens, and other plant sectors, e.g., forestry, are wanting to follow this model as diagnostic technology becomes available and systems developed that enable reasonable outcomes.

This priority area includes several aspects of biosecurity including managing existing pathogens, early detection of new pathogens to enable eradication, and also science to speed the process to import new germplasm. For the latter area, currently there are significant delays in the process to import new germplasm as plants are required to spend time in plant quarantine greenhouse facilities. Science has the potential to short circuit this process and obviating the need for quarantine greenhouse facilities, thus speeding the import process and reducing cost. See boxes explaining how this could work.

> "Linked at the hip with export is plant and germplasm import, in many cases the precursor to export, and the way we keep competitive and meet world demand - new and innovative varieties from the world's leading breeders and the opportunity to bring in plant material for own breeding programmes. Maintaining biosecurity in this inward transfer of new material is of national interest but in a balanced approach of do-able and financially acceptable mechanisms that allow practical entry of product." (Andy Warren, BLOOMZ NZ Ltd, NZPPI prospectus 2017)

[10] https://prezi.com/3gxk5c6tvbq_/unmanned-aerial-vehicles-for-landscape-nursery-and-greenhouse-operation-where-to-begin/

A proposal that Dr Jenny Aitken of The Tree Lab submitted to MPI is to conduct research on a species basis to potentially demonstrate, based on scientific evidence, the potential to eliminate the need for Level 3a and 3b quarantine greenhouses. The opportunity relies on using "photoautotrophic tissue culture technologies" and testing these against traditional quarantine procedures, potentially cutting quarantine time by at least 50% and avoiding the need for greenhouses.

THE OBJECTIVES IN THIS STRATEGIC PRIORITY INCLUDE:

- Cost-effective technologies to monitor plant stress and nutrient levels (ST)
- Cost-effective technologies to monitor and control weeds (ST-MT)
- More cost-effective diagnostic technology to monitor plant health and detect pathogens. (ST)
- Reduced time and cost for new germplasm import. (MT)
- Greater assurances to customers of plant nurseries that plants are pathogen free and healthy. (ST-MT)
- Improved plant traceability for plant health and quality assurances

Key question: How can science and innovation help improve plant health assessment and pathogen detection to enhance plant production and reduce risk from pathogens?

PRIORITY RESEARCH AREAS INCLUDE:

- Evaluation of technologies to cost-effectively assess plant health – including moisture and stress and nutritional status (ST)
- Evaluation of technologies to assess and control weed competition (ST)
- Investigation of plant health and pathogen diagnostics (ST to start; some LT)
- Research to reduce time to import new germplasm (MT)

3

Enhanced soil health, plant quality and vigour

ABOUT THIS STRATEGIC PRIORITY

It is recognised that New Zealand requires greater science effort in soil quality and soil health if it is to increase sustainable production and grow the land-based economy. Nursery plant production depends on soil and media quality, whether for in-ground production or container stock. Optimum management of soil and media properties will lead to improved sustainable nursery production and improved plant quality and vigour.

The community of micro-organisms that inhabits plant and soil ecosystems is referred to as the microbiome. MPI's Science Roadmap (2017) recognises the opportunities to better understand the microbiome:

> "Ecosystem and network approaches to our production systems can make them more resilient, particularly to pest and disease pressure and in response to environmental challenges. The microbiome is a good example of this. Microbiome components, such as soil microbiota, endophytes in forage plants, mycorrhizae in crop plants and the rumen microbiota, have profound impacts on productivity, properties of plant and animal products, biodiversity, and the general health of the ecosystem. There are opportunities to use our understanding of microbial population dynamics and properties across the supply chain, and our understanding of complex biological networks to modify plant and animal products, produce new ones and ensure favourable impacts on the environment." Primary Sector Science Roadmap (MPI 2017)

As a country, we have invested considerably in understanding and manipulating the ryegrass microbiome and are now world leaders in this field and have been very successful in transferring this science to highly productive pasture management. Similar opportunities exist to modify the microbiome of other plant species, with the best opportunity for success to focus research efforts in plant production systems, including tissue culture and nursery production. Microbiomes are complex and involve both the plant and the soil microbial properties. There is an opportunity to establish a technology platform to optimise the microbiome for production but also conservation purposes, but to do this properly would require considerable research investment.

The opportunities go well beyond the nursery stage with orchardists, vegetable growers, foresters, and others potentially benefiting. Indeed, the benefits will likely extend to the consumer, not only because of lower environmental impact in crop production, but potentially improvement of food quality. Traditional plant breeding has ignored the microbiome and may have weakened plant resistance to disease and other environmental stressors[11]. A plant technology platform would ideally combine plant breeding science with microbiome research to enhance the nutritional value of crops for human, and animal, consumption. Tissue culture and nurseries will be the delivery mechanism for greater value downstream.

[11] Growth-defense tradeoffs in plants: a balancing act to optimize fitness. Mol Plant 2014 Aug; 7(8) 1267-1287.

THE OBJECTIVES IN THIS STRATEGIC PRIORITY INCLUDE:

- Improved understanding of soil factors that are important to soil quality and soil health, particularly biological properties.
- Improved understanding of plant microbiomes at plant species level or even genotype level.
- Understanding what micro-organisms are currently present and also how to optimise the plant microbiome to enhance plant quality and disease resistance. This objective has direct application to many, if not all, sectors receiving plants from nurseries.
- Improved understanding of the microbiome to ensure conservation planting is not at odds with the conservation objective. We tend to think of matching plant genetics with the natural environment, but it is also important to avoid transferring foreign micro-organisms to natural areas, particularly pathogenic ones.
- Application of bio-stimulants to promote plant growth and increase stress tolerance.
- Applying eDNA technology to more rapidly identify organisms of interest.
- Encouraging fundamental research to apply genomic sequencing and advanced gene technologies to help discover new biological control agents.

PRIORITY RESEARCH AREAS INCLUDE:

- Investigation of existing biostimulants that could cost-effectively enhance plant quality (ST)
- Research into biopesticides to control nursery pests and pathogens (ST-MT)
- Understanding the soil microbiome (the rhizosphere microbiome) to enable manipulation of biological properties to benefit nursery production and downstream benefits. (MT-LT)
- Understanding plant microbiomes (the phytomicrobiome) by plant species and how these can be manipulated to benefit plant quality and disease resistance. (MT-LT)
- New tools to measure soil and media biological properties that are important to plant quality (ST-MT)
- Identifying key beneficial microorganisms that could be inserted (non-engineering) into crop species (ST-MT)
- Research to enhance delivery of selected microbiota in tissue culture and nursery systems to field crops (ST-LT)

Key question: How can soil health, plant quality and vigour be enhanced by better understanding and managing components of soil quality, by manipulating the complex microbiome that exists for plant species of interest, and applying advances in biostimulant technologies?

"Conventional farming that uses chemicals in the form of fertilizers and pesticides has substantially increased agriculture productivity and contributed immensely to food access and poverty alleviation goals. However, excessive and indiscriminate use of these chemicals has resulted in food contamination, negative environmental outcomes and disease resistance which together have a significant impact on human health and food security. The microbiome technology has the potential to minimize this environmental footprint and at the same time sustainably increase the quality and quantity of farm produce with less resource based inputs."[12]

[12] Microbiome and the future for food and nutrient security. Microbial Biotechnology Jan 2017 10(1): 50-53

4

Knowledge transfer to NZPPI members

ABOUT THIS STRATEGIC PRIORITY

Considerable nursery research has been conducted in New Zealand over the last 50 years but much of the results are not readily accessible, primarily because reports have never been digitised and made available on the internet. Additionally, in more recent years, there has been a great deal of relevant research conducted in New Zealand and overseas, and while publications are available on the internet, two problems prevail (1) identifying what is most relevant to NZPPI members and making them aware of the information, and (2) synthesizing research results into knowledge that can be readily interpreted and used by NZPPI members. A great deal of recent molecular science is highly complex and specialised skills are required to fully understand what is being reported and translating this into useful science. This is true across the board for NZPPI's strategic priorities and in many cases, highly relevant developments have occurred in research areas peripheral to plant production. For example, in the development of sensor technology for non-plant production purposes, automation, molecular diagnostics, engineering, etc.

THE OBJECTIVES IN THIS STRATEGIC PRIORITY INCLUDE:

- Making previous plant production research results available to members in a manner which provides knowledge, rather than just information.
- Assessing the most relevant NZ and international research and turning this into knowledge to benefit NZPPI members.
- Providing an effective mechanism for communicating knowledge to members.

Key question: What is the most cost-effective way to improve access to relevant knowledge to NZPPI members?

PRIORITY RESEARCH AREAS INCLUDE:

- Developing a knowledge transfer mechanism that can look out for new knowledge, rather than just looking backwards for existing knowledge. (ST)
- Stocktake research/knowledge for key priority areas. (ST)
- Develop an effective knowledge communication system. (ST)
- Develop an internet search engine focused on member needs. (ST)

"The future is already here – it's just not evenly distributed."
William Gibson, The Economist, 4 December 2003

5

Biosecurity

ABOUT THIS STRATEGIC PRIORITY

Maintaining world class biosecurity has consistently been identified in KPMG's Agribusiness Agenda as being the number one priority for agri-business leaders (KPMG 2017). Ideally threats need to be prevented from ever reaching New Zealand, but this is an impossible goal given the large amount of trade and travel that occurs, and in some cases the ease at which pathogens and insects can be blown across the Tasman Sea from Australia. Plant production is a key component of the biosecurity system and considerable efforts need to be made to ensure that germplasm imports are pathogen free, and that nurseries are not a ready pathway for pest and pathogen spread. NZPPI needs to do its part to encourage relevant biosecurity research to reduce risk on germplasm import pathways and on plant movement pathways.

THE OBJECTIVES IN THIS STRATEGIC PRIORITY INCLUDE:

- Urgent and also strategic research projects to deal with key biosecurity risks are identified and communicated to relevant stakeholders.
- Primary plant production sectors are aligned with biosecurity science priorities to provide a united voice to central government, including MPI and MBIE.
- Minimised risk of accidental or intentional introduction of pests and pathogens to New Zealand.
- Solutions to key pest and pathogen risks developed in advance of incursions.
- Understanding the potential weediness of nursery plants and how to minimise these impacts.

Phytophthora are a big unknown for New Zealand primary sectors and the conservation estate as science has only recently been able to identify them at the species level and has reportedly discovered less than 20% of the species expected to exist. In the meantime, known highly pathogenic species such as P. ramorum move closer to New Zealand and pose a major threat to plant health and also to trade. The 2013 Australian Nursery Biosecurity Plan lists P ramorum as being "high to extreme" risk (see table PHA 2013[13]) and it is anticipated that it would receive a similar ranking in New Zealand.

[13] Industry Biosecurity Plan for the Nursery Industry

Common Name	Life Form	Scientific Name	Primary Host	Plant part affected	Entry Potential	Establishment Potential	Spread Potential	Ecnomic Impact	Overall Risk
Sudden oak death	Fun	*Phytophthora ramorum*	Broad host range across 70 genera from 33 families including oak trees, *Arbutus, Lithocarpus spp.*, fir, maple plants in Ericaceae family, *Eucalyptus gunnii*, beech, bay laurel, magnolia and yew. The known host range is broad and continues to expand with more research.	Stems, Branches, Leaves	MEDIUM	HIGH	HIGH	HIGH - EXTREME	**HIGH - EXTREME**
Bacterial canker	Bac	*Pseudomonas syringae pv. syringae* (exotic races)[24]	Broad host range including onion, leek, capsicum, chrysanthemum, citrus, cucumber, pumpkin, garden dahlia, hibiscus, walnut, lettuce, magnolia, mango, Lucerne, rice, passionfruit, avocado, bean, poplar, stonefruit, azalea, roses, tomato, willows, clover, blueberries, grapevine and maize	Leaves, inflorescence, stems, pods, seeds, flowers, fruit	HIGH	HIGH	HIGH	MEDIUM - HIGH	**MEDIUM - HIGH**
Guava/ Eucalyptus rust	Fun	*Puccinia psidii* sensu lato (exotic variants)[25]	Myrtaceae	Leaves, Shoots	HIGH	HIGH	HIGH	HIGH	**HIGH**

Other pathogens, including new strains of myrtle rust, new strains of Pseudomona syringae pv actinidiae (PSA), the bacterium Xylella fastidiosa, and species of Ceratocystis not present in New Zealand, are also a threat to many productive and conservation species. In most cases the potential impacts are not well understood, new hosts are regularly being discovered, introduction of new plants can result in new pathogen species emerging, and much more science is required to improve knowledge and to develop solutions preferably before these pathogens arrive. In most cases the funding for this research needs to come from other sources, but it is very much in NZPPI's interest to understand the threats to New Zealand's economy and environment, and to push, through this strategy, the need for greater research effort to reduce biosecurity risk. This effort in turn will reduce risk to NZPPI members.

In addition to the risk of spreading diseases, pathogens can also cause direct loss to nursery production as they impact health and survival of plants. Rhizoctonia, Pythium, Phytophthora cinnamomi, Verticillium wilt, and disease complexes such as the apple replant disease (whatever that is) continue to cause problems in New Zealand nurseries. In addition, Bermisia tabaci, which may or may not be in New Zealand, causes considerable expense to declare freedom status to European markets.[14]

NZPPI was actively engaged in the myrtle rust response from the time it was first discovered in a Kerikeri nursery in May 2017. For its part in the response, NZPPI was recognised at the NZ Biosecurity Awards in the Industry Category. In being nominated, NZPPI's influence and unified approach to the biosecurity system was highlighted, as was the organisation's pro-activeness in preparing for the arrival of unwanted pests and pathogens, like myrtle rust. Protocols for myrtle rust were developed at the outset to ensure the disease was managed in line with the best technical knowledge and advice available.

Key question: What additional science and innovation is needed to reduce biosecurity risk to benefit NZPPI members and, by default, the greater NZ economy?

[14] https://planthealthportal.defra.gov.uk/assets/factsheets/Bemisia-tabaci-Defra-Plant-Pest-Factsheet-Feb-2017-2.pdf

PRIORITY RESEARCH AREAS INCLUDE:

- The development of a nursery biosecurity certification system that will provide assurances to NZPPI customers and investors that plants and other products are low biosecurity risk. This system needs to be based on sound science and updated as necessary. (NZPPI is currently leading a major project to develop a plant biosecurity standard.)
- Investigations into new technologies to enable more cost-effective surveillance in nurseries for high-risk pests and pathogens and for previously unknown pests and pathogens arising with the release of new cultivars to industry.
- Other research to reduce risk of pest and pathogen movement on plant production pathways, from germplasm, through media, nurseries, and transport.
- Development of cost-effective diagnostic tools to rapidly detect pests and pathogens.
- Development of solutions to key biosecurity risk organisms, preferably before they arrive in New Zealand. E.g., efforts to combat Brown Marmorated Stink Bug is an excellent example of MPI being pro-active to prepare for a likely incursion of a high-risk organism.
- Identification of key high-risk organisms that could impact the nursery sector and corresponding growing sectors and science to improve understanding and control of these organisms.
- How to best empower growers to identify and act on potential new high risk organisms when (potentially) detected.

Partnerships

The opportunities in science and innovation for the plant producers' industry can be more rapidly advanced in partnership with the wider plant sectors, horticulture, crops, forestry, ornamentals, and in collaboration with key science providers. This strategy provides a vehicle to communicate priorities to other organisations and to foster joined-up thinking that should lead to more rapid advances. This is a priority in the implementation plan.

Implementation

NZPPI will establish an R&D Committee (RDC) that will advise on research priorities, both to provide influence to government funding streams, but also to provide direction for NZPPI research investments. The chair of this committee will work closely with the CEO of NZPPI to communicate with key research providers (primarily CRIs and universities, but also private research companies), look for collaborative opportunities with research providers and also the plant industry and environmental sectors, and to influence government funding direction as appropriate. For example, in areas of plant biosecurity research, it is highly appropriate to liaise closely with MPI, MBIE, DOC, CRIs, and industry bodies.

The "Implementation Plan" (appended) describes how the strategy will be implemented and particularly how steps need to be taken to meet goals and objectives and to address key strategic priorities. A key role of the RDC will be to review this plan and modify as they consider appropriate. They will also want to consider which "immediate opportunities" to pursue.

There are several opportunities identified in this S&I Strategy that can be addressed immediately and these are listed below and also covered in the Implementation Plan (appended).

IMMEDIATE OPPORTUNITIES

Strategic Priority	Immediate Opportunity
Sustainable production	- Investigations into sustainable chemicals – e.g., neonics - Investigations into sustainable plant containers – a biodegradable pot workshop is planned with Scion
Enhanced diagnostics	- Work with MPI and others to initiate research to reduce germplasm import time – has been communicated to GERMAC
Soil quality and plant health	- Work with other plant sectors to encourage coordinated research into manipulating the microbiome to enhance plant health and quality – has been raised with plant sector biosecurity managers
Knowledge transfer	- Develop an internet search engine function for the NZPPI website to enhance members opportunities to find critical information – low cost
Biosecurity	- Contribute biosecurity science priorities from this Strategy to the Plant Production Biosecurity Scheme and - Contribute to the Biosecurity 2025 Statement of Biosecurity Science Priorities – both very low cost

IMMEDIATE PRIORITY

The S&I Strategy has conducted a preliminary analysis as to the strategic priorities for NZPPI members, but it has not specifically analysed the risk of not conducting specific research projects or the benefit in conducting the research. Therefore, a priority should be for the new NZPPI R&D Committee to assess the risk of not taking immediate action on each priority identified.

Acknowledgements

The Steering Committee members listed below were particularly involved in the development of the S&I Strategy and are acknowledged for their efforts. Anonymous reviews were received from several NZPPI members, that commented on a draft, and they too are thanked for their efforts. Dr Ed Morgan is thanked for technical input.

Steering Committee:

- Andrew Harrison
- Nicola Rochester
- John Liddle
- Geoff Thorpe
- Terry Wearmouth
- Mike Riordan
- Mark Brown
- Malcolm Woolmore
- Stephen Burton

Appendix: Implementation Plan

Goal 1.

To provide coordinated and representative direction to science and technology development funding

	Objective	Action (to be completed by 31 December 2018)
1.1	Ensure that government departments, CRIs, and universities are aware of NZPPI and the S&I Strategy.	Launch the strategy to key staff in government departments and CRIS.
1.2	Provide timely input towards the development of research bids by research providers to MBIE and other funding sources.	Work with CRIs and other research providers to help develop relevant bids to MBIE and other funding agencies in coordination with annual funding cycle.
1.3	Work closely with relevant CRIs to understand, and potentially influence their priorities for investing SSIF to areas relevant to NZPPI and potentially other sectors.	Work with Scion, Plant and Food, AgResearch, and potentially other research providers to identify opportunities to strategically invest SSIF funds for the benefit of all parties.
1.4	Communicate science and innovation priorities to relevant industry bodies, such as HortNZ, and NZFOA, and seek partnership opportunities.	Seek an audience with NZFOA, Hort NZ and subsector R&D managers to communicate NZPPI priorities and to seek partnership opportunities to influence science direction.
1.5	Influence science direction of Biosecurity 2025 where opportunities allow.	Provide input to Biosecurity 2025, and particularly to the "Biosecurity Science Priorities" document in June 2018.
1.6	Provide input to strategic thinking for relevant National Science Challenges, particularly Biological Heritage and Our Land and Water.	Communicate NZPPI biosecurity science priorities to the BioHeritage Challenge Senior Leadership Group as appropriate
1.7	Provide strategic influence to GERMAC, particularly with regard to Import Health Standards and germplasm imports.	Advise GERMAC of strategic priorities that could facilitate faster germplasm imports and also of any requirement to modify existing Import Health Standards or introduce new ones.

Goal 2.

To provide strategic direction to NZPPI efforts in science and technology investment

	Objective	Action (to be completed by 31 December 2018)
2.1	Communicate to members through the NZPPI newsletter and other fora the strategic priorities identified in this document.	Highlight the launch and implementation of the S&I strategy to members in June 2018 and throughout the rest of 2018.
2.2	Seek regular input from NZPPI members on new issues and opportunities that may require an S&T solution.	Develop a mechanism in mid 2018 to survey NZPPI members for advice on new issues and opportunities for S&T.
2.3	Seek out and follow through on funding opportunities in the various grant schemes, such as SFF, PGP, AGMARDT etc.	Obtain at least one SFF and one AGMARDT grant to address priorities identified in the S&I Strategy.
2.4	Provide resources to ensure the S&I Strategy is implemented in a timely manner and regularly refreshed.	NZPPI to pay for a part-time resource to implement the strategy.
2.5	Keep NZPPI members up to date with strategic science investment signals from government departments and from CRIs.	NZPPI R&D resource to stay abreast of government signals and changes on science policy and funding and relay these to NZPPI and members. Report twice a year to CEO.
2.6	Provide opportunities for NZPPI members to be directly involved in research projects as appropriate.	Work with CRIs to identify at least one appropriate opportunity for research to be conducted in an NZPPI members lab or nursery.

Goal 3.

To facilitate knowledge transfer and uptake by NZPPI members

	Objective	Action (to be completed by 31 December 2018)
3.1	As funding permits, develop a knowledge management system that will enable members to access existing information and also new knowledge from NZ and world.	Give high priority to developing a knowledge management system to access existing and also new knowledge relevant to plant production. Reapply to SFF.
3.2	Provide resource to enable knowledge scanning that focuses on priority areas for NZPPI members.	NZPPI R&D resource to regularly scan knowledge of high priority to NZPPI members and produce at least one report.
3.3	Provide technology to enable members to more readily scan knowledge bases themselves for relevant information.	Develop a search engine, limited to key URLs, to enable more efficient searching for members – before 31 December 2018.
3.4	Regularly update members with links to relevant website where new information and knowledge can be found.	Provide links to new knowledge in every NZPPI newsletter
3.5	Survey members to determine if they are aware of new knowledge being communicated by NZPPI and are getting access to the knowledge they require.	Conduct one survey towards the end of 2018 to determine the level of awareness of NZPPI members to new knowledge being generated by the R&D resource.
3.6	Hold at least one knowledge transfer workshop per year.	Work with Scion to hold a "biodegradable pot" workshop in 2018.

Goal 4.

To influence science and technology capability development to meet future needs

	Objective	Action (to be completed by 31 December 2018)
4.1	Work with other sectors to identify mutual gaps in current science and technology capability and identify future needs.	Provide at least one joint report with an industry body on mutual knowledge gaps and future science and technology needs.
4.2	Together with other sectors, as possible, lobby appropriate organisations, including MBIE, TEC, CRIs, and universities, to advise on key skill needs. If appropriate provide a business case.	Hold a meeting with at least one appropriate organisation to advise on key science and technology skills needed for the nursery industry and prepare one business case if appropriate.
4.3	Every two years conduct a strategic stocktake to ensure needs are identified and updated.	Plan to conduct a strategic stocktake of science and technology capability development needs in 2019.

Notes

Notes

nzppi
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