2021 **Field Walks Handbook**

Handbook contents – field walk topics

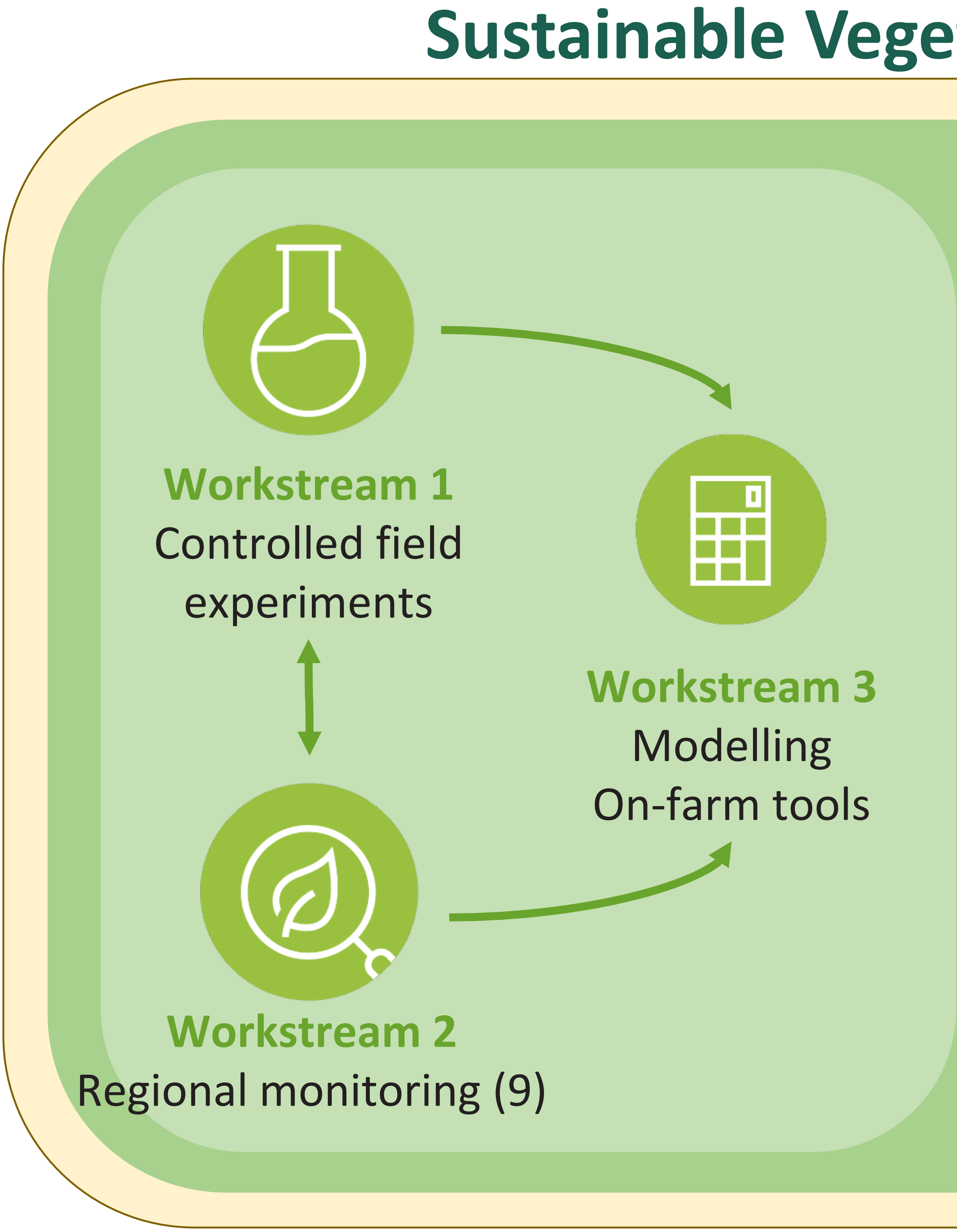
R&D

Biosecurity

Industry Sustainability

Research & Development

Sustainable Vegetables Systems (SVS): PNZ-79



Ministry for Primary Industries
Manatū Ahu Matua

Potatoes NEW ZEALAND
Growing together

table Systems

Workstream 4

Knowledge transfer

Changing the landscape

- Regional on-farm monitoring
- Direct grower engagement, monitoring sites
- Pukekohe, Waikato, Hawke's Bay, Manawatu and Canterbury locations
- Monitoring current practices
- Controlled field experiments to quantify nitrate leaching
- Hawke's Bay and Canterbury sites
- Support model development

Outcomes

Good management practice:

implemented,
quantified,
acknowledged

Environmental compliance

Joining the Dots framework

- Problem recognition
- Research
- Guidelines
- Implementation
- Reporting and assurance

- The Sustainable Vegetable Systems project is a component of this Joining the Dots framework.
- Research findings will be used to develop case studies and grower facing management tools.
- Links to Farm Environment Plans under the NZGAP Environmental Management System (EMS).

SVS is a 4-year project which will provide growers with the tools to manage and meet regulatory requirements.

Our overall aims are:

- To maintain the potato industry's social license to operate
- To protect the ability to grow, process & export potatoes, whilst meeting environmental standards and maintaining international competitiveness
- To ensure grower access to land, water and nutrients through national, regional and farm programs in order to achieve industry growth targets.

In essence the SVS project protects land, food, and people

Sustainable Vegetable Systems

EVIDENCE: Milestone 1

Prepared by Andrew Barber and Miriam Hall

30th September 2020

Reporting period: 1/07/20 – 31/8/20

Activities

Workstream 1 – Controlled experimentation to quantify nitrate leaching

Objective 1: Literature review

The New Zealand Institute for Plant & Food Research (PFR) is currently undertaking a literature review, this report is expected to be delayed until 30 October 2020, this delay from 30 September 2020 is due to significant PFR resource being allocated to the development of Objective 2 and setting up trial sites.

Objective 2: Controlled experiments

This objective is on track, PFR has focused resources and activity on setting up the trials for the coming year. This has involved significant scoping of the activity required and has included consulting with the Technical Working Group (TWG) on crop rotations and practices. Essential monitoring equipment has been ordered, however as this is being imported internationally has been delayed due to COVID-19. This delay was expected and discussed with the Programme Management team and MPI prior to contracting. It is expected that planting will be delayed and differ from that planned in the Business Case.

At PFR Lincoln wheat is currently being grown and monitored, this was planted as part of the pre-existing project PNZ-79, which will be superseded contractually by SVS. This rotation is expected to be followed by broccoli or cover crop (rye grass/oats). The final rotations are still being finalised however, Lincoln's 2nd rotation begins in October 2020 with pak choi, followed by silver beet and fresh potatoes. The Hawke's Bay trial sites will be set up by 30 November 2020 with trials due to begin in March 2021, this is a delay from the planned activity, due to the previously mentioned delay in trial equipment and finalisation of rotation plans.

The TWG suggested rotations are currently being reviewed by PFR against the science requirements and budgets.

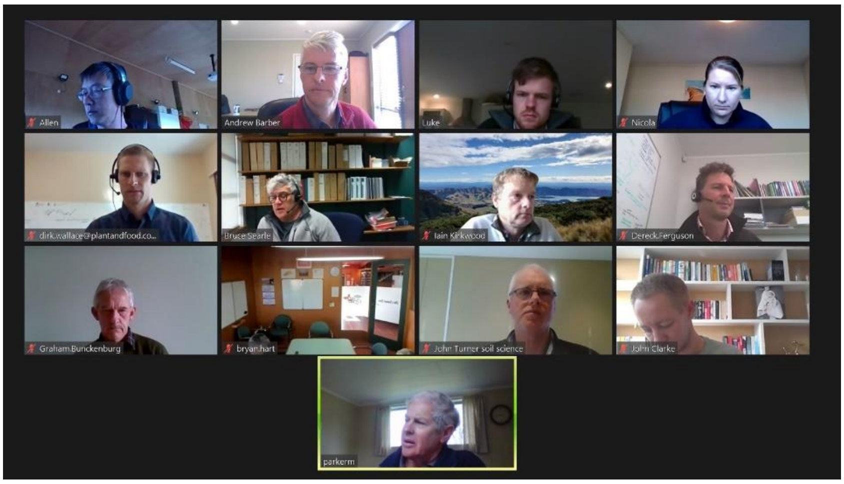
PFR and other project team members met on the 11th August in Lincoln. Pictured here looking at the trial site sown in wheat.

Workstream 2 – Regional on farm monitoring

Objective 1: Monitor on farm nitrogen balance

Objective 1 is on track with the TWG established for both Workstreams 1 and 2.

Growers at the 9 regional monitoring sites have all been engaged with and are currently working through site selection. The idea is to monitor form the same part of the paddock throughout the 4-year project. Therefore, getting the site selection right is important from the outset.



The TWG has been meeting weekly for an hour to refine the soil and plant sampling protocols. PFR scientist's Dr Bruce Searle and Dr Hamish Brown have been involved to ensure data collection is suitable for utilisation in Workstream 3.

Objective 2: Modelling design and development

Activity will begin once data collection is underway.

Workstreams 3 Farmer facing tool(s)

Objective 1: Modelling communities of practice

The modelling community of practice idea is in development. This will be one of the key project outputs as it looks to increase the industries nutrient modelling capabilities. A group of professionals with modelling qualifications will workshop vegetable growing simulations. Knowledge will be built off this hands-on process that can be used directly in Overseer or other nutrient budgeting tools. In conjunction with PFR a subject matter expert is being approached to support this community of modellers and to do some initial modelling to help identify modelling gaps.

Objective 2: Modelling design and development

Activity will begin following the PFR literature review (WS1 – Obj. 1), social scientist input (WS4 – Obj. 1) and the gaps review in WS 3 – Obj. 1.

There have been initial discussions with Overseer and other nutrient projects to ensure awareness and alignment of work programmes. A scan of tools has included the German tool N Expert, and preliminary discussions on what tools need to deliver. This will also form part of PFR's review in WS1 and 4.

Objective 3: Model delivery and implementation

Activity will begin once model design and development is underway/complete.

Workstream 4 – Developing a change landscape

Objective 1: Understanding a change landscape

PFR social scientist Toni White has been engaged by the Workstream 4 management team. She will begin scoping the project following the workshop on 4th November 2020.

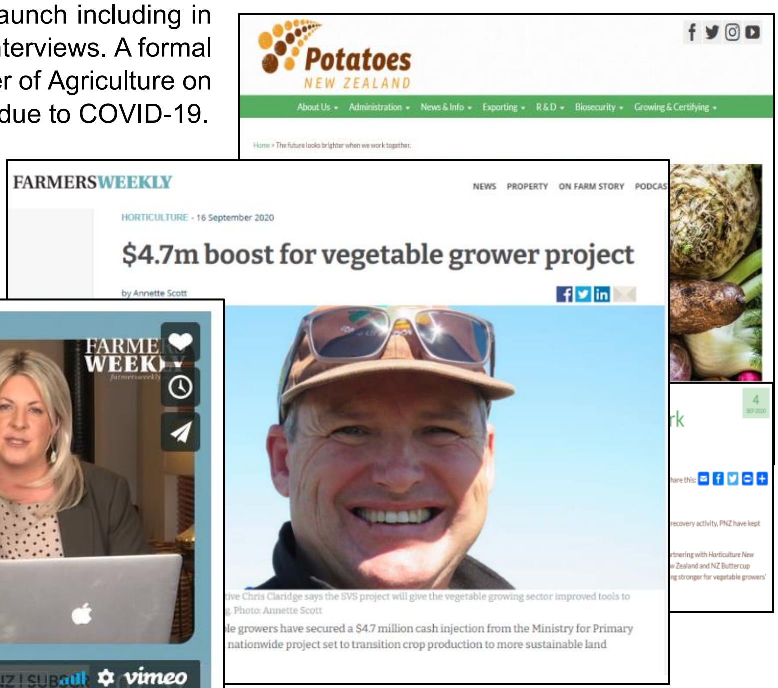
Objective 2: Extension activities

A dissemination leadership team has been established. Several video conference meetings have been held. The next meeting is face to face on the 4th November with the wider Workstream 3 & 4 team.

This first workshop will be held amongst the project delivery participants in Wellington. Participants include PFR, PNZ, HortNZ, and external parties such as NZGAP and LandWISE who have concurrently running work with nutrient elements. Workstream 3 modelling is the main delivery element that growers will see, hence the importance of insuring these two workstreams are well connected. Presentations at this workshop include workstream 3 & 4 overviews, PFR's social science element, concurrent projects, Workstream 3 modelling, and beginning the discussion on what SVS's dissemination programme looks like and its alignment with Product Group activities.

Activities have focused on a soft project launch including in rural papers, industry websites and radio interviews. A formal launch with Hon Damien O'Connor Minister of Agriculture on the 20th August in Lincoln was postponed due to COVID-19.

PNZ and HortNZ have a process for capturing media activity. A log has been started of both SVS specific and nutrient related media coverage.



Programme management

The project is currently on track with delays expected due to COVID-19 are not envisioned to affect the overall delivery and impact pathway.

Upcoming milestones/activity

Workstream 1: PFR sites established in Lincoln and Hawke's Bay and trials will begin in Lincoln. Literature review to be completed.

Workstream 2: Regional monitoring will continue in Canterbury and begin in the other regions. This will include visits by PFR staff to each of the 9 sites to engage with those doing the regional monitoring and the respective growers.

Workstream 3: Review of current representation of crops in Overseer. Establishment workshop for the modelling community of practice to be completed.

Workstream 4: Workshop and stakeholder analysis underway.

Programme Management: Governance and reporting requirements will be established. PFR contract to be finalised and invoiced.

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Potato Tuber Moth Targeted

By Glenys Christian

STANDFIRST: Two Pukekawa trials are showing some early promise for potato growers when it comes to greater control of the potato tuber moth, *Phthorimaea operculella* (PTM).

The pest, which comes from South America and has now been found in over 90 countries, particularly presents a problem around Pukekohe. This is due to the area's dry, hot summers and mild winters which allow potato growers to leave their crops in the ground from mid-January through to April. But cracks in the volcanic clay soils provide plenty of opportunity for tuber infection by PTM larvae.

Organophosphate pesticides have been relied on at the later stages of potato growth for PTM control but due to overuse, environmental impact and resistance developing many are now being phased out, said Pukekohe company, Inta-Ag's chief executive officer, Shane Smith.

Integrated pest management (IPM) strategies have been looked to for the future, but biological controls can be affected by ultraviolet light or rain. While irrigation is one of a number of cultural methods used, growers face a trade off with late crop potatoes left in the ground, as they would prefer to use this water on their still growing crops to increase yields, he said.

IPM programmes are being focused on but being slower to work and often working at very specific growth stages of the pest, growers and agronomists will need to build up an understanding of how this can be integrated into a future programme, he believes. So Inta-Ag has been running a trial on a potato grower's land at Pukekawa using straw mulch to see what effect it can have on PTM. The one hectare trial site had 10 tonne of straw mulch applied in October last year with several traps set up to catch PTM as well as TPP.

Shane said he was aware of the mulching technique being used by organic potato growers in the United Kingdom which kept the soil moisture levels higher as well as preventing the PTM larva getting to potato tubers so easily. Mulching also brought about several other benefits which weren't forseen, with growers there noticing fewer weeds in their crops and better disease control, particularly when it came to sclerotinia.

It was too early to yet tell how effective mulching was with full results from the Pukekawa trial expected in April or May when PTM damage can be fully assessed after the potato crop has been in the ground for some time. But he said from his weekly visits to the trial site it already appeared that nightshade, potato growers' worst weed threat, was being kept at bay.

When it came to potential costs for growers looking at straw mulching for their crops, Shane said this needed to be balanced against the expense of using pesticides. And a lot would depend on the price of the straw mulch they used. The potato grower involved in the trial also grew barley, so rather than selling the baled straw was able to use this as mulch, considerably reducing his costs.

"A lot of Pukekohe growers are growing barley now as a break crop before onions," he said.

"It depends what will work for each grower."

Some might decide to try the mulching just on their late planted potato crops as well as further finetuning crop rotations in line with IPM principles.

"There may be a mix of two of three different techniques," he said.

Already there are plans for the trial to be repeated next season over a larger area. Shane hopes that straw mulch can be used on around 20ha spread over two or three different potato growers' properties, and that it will take in a variety of local areas such as Waiuku where PTM damage can be particularly prevalent.

Another PTM trial which is in its first year at Pukekawa is also being run by Inta-Ag. It's looking into the effect of different cover crop mixes sown on potato headlands. Buckwheat, linseed, clover, Phacelia and Smart radish were sown to attract PTM to those areas rather than the potato crop, with the mix possibly being adjusted. There are plans to involve Plant & Food researchers to assess exactly what insects are found in traps later this year.

"Already we've seen an abundance of insects," Shane said.

"You notice straight away there are birds swooping down on the headlands and more white butterflies."

• A Potatoes New Zealand literature review of PTM control methods was carried out last year and can be found on its website https://potatoesnz.co.nz/research-and-development/technical-bulletins/

Mulching trials at Pukekawa potato farms

Biosecurity

September 2020

No. 5

Technical Bulletin

Control of Potato Tuber Moth, *Phthorimaea operculella* (Zeller) (Lepidoptera: Gelechiidae)

Prepared by Dr Paul Horne,
IPM Technologies Pty Ltd.
July 2020

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Aim

This report is in response to a request from Potatoes New Zealand for a review of scientific publications from the last 10 years on potato tuber moth research, focusing on management options – including alternate hosts – particularly over winter, chemical resistance, IPM strategies – cultural practices etc. The report covers this but includes references from before 2010 as some important older studies are still highly relevant.

Introduction

The Pest

Potato tuber moth (*Phthorimaea operculella* (Zeller)) (referred to from here in this document as PTM) is a cosmopolitan pest that originated in South America (Kroschel and Lacey 2008; Rondon and Gao 2018). It has now been recorded in over 90 countries worldwide (Kroschel and Schaub 2013). It is in the family Gelechiidae as is the related pest tomato leafminer or tomato pinworm (*Tuta absoluta*). *T. absoluta* is a serious pest of tomatoes in many parts of the world and is resistant to many insecticides but it is not found in either Australia or New Zealand (CABI 2019a). There is possible confusion with the common names as PTM is known as tomato leafminer in northern Queensland (Abbott and Abbott 1999). In the USA PTM is also known as potato tuberworm (Rondon and Gao 2018).

Larvae of PTM feed either on tubers of potato or within the leaves of potato plants. The leaf-mining aspect makes them difficult to control with many insecticides and control failures have been reported many times. This is in part because of where they feed but also because of insecticide resistance. Also, spraying the foliage may kill caterpillars but damage can still be serious (Foot 1974; Rondon 2010).

In Australia and New Zealand PTM is primarily a field pest of potatoes as harvested tubers are kept in cool stores (Foot 1979, Horne 1990). However, in countries where cool storage is not available it is a more serious pest after harvest as populations of PTM continue to develop. Research has been conducted for both in-field control and reducing damage in warm-stores.

PTM is believed to not develop when temperatures are constantly below 10°C (Beukema and Zaag 1990) but other authors have found the lower threshold for development to range between 4.25°C and 13.5°C (Rondon 2010; Rondon and Gao 2018).

Host Range

PTM feeds on a range of food plants, mainly those in the family Solanaceae. Das and Raman (1994) reported PTM feeding on 60 species of plants worldwide. The main crops attacked are potato (*Solanum tuberosum*), tomato (*Solanum lycopersicum or Lycopersicon esculentum*), and tobacco (*Nicoitana tabacum*) but the pest also attacks eggplant (*Solanum melongena*), bell pepper (*Capsicum annuum*) and Cape gooseberry (*Physalis peruviana*). Also attacked are wild species of Solanaceae, including weeds (eg, black nightshade (*Solanum nigrum*), apple of Peru (*Nicandra physalodes*) and thornapple (*Datura spp*). However, they have also been reported as feeding on non-solanaceous plants such as sugar beet (*Beta vulgaris* L.) in the family Chenopodiaceae while other host plants belong to the families Scrophulariaceae, Boraginaceae, Rosaceae, Typhaceae, Compositae and Amaranthaceae (Das and Raman 1994).

Although there is a wide host range, potato, followed by eggplants are the preferred hosts on which the female moths oviposit (Meisner et al 1974). Also, although there are records of PTM on this wide range of hosts, field studies have demonstrated that it can only reproduce if caterpillars feed on potato, tomato and eggplant (Rondon 2010; Rondon and Gao 2018).

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Control options

Control measures for any agricultural pest can be broadly categorised as either 1. Biological (invertebrate natural enemies and pathogens), 2. Cultural or management techniques or 3. Pesticides. The use of a compatible set of measures from these three categories is described as Integrated Pest Management or IPM. These categories are used to arrange the results of the review.

Biological controls (invertebrates)

PTM is not native to either Australia or New Zealand and although it is attacked by generalist predators such as damsel bugs (*Nabis kinbergii*) (Horne et al 2002), parasitoid wasps were introduced into both countries as classical biological control agents. In Australia, three species of wasps – *Orgilus lepidus, Apanteles subandinus* and *Copidosoma koehleri* are well established and provide significant levels of control (Horne 1990 and 1993; Horne and Page 2008). CABI (2019b) lists these species as being present in New Zealand but Herman (2008a) records that of 17 species introduced as biological control agents for PTM, only *A. subandinus* became established. *A. subandinus* has been recorded as reaching parasitism rates of over 80% in New Zealand potato crops where broad-spectrum insecticides are not applied (Herman 2008a).

Biological controls (pathogens)

Microbial control of PTM was summarised by Lacey and Arthurs (2008) and the use of biopesticides including microbial pesticides for control of potato pests was reviewed by Sporleder and Lacey (2013). The main pathogens studied have been the bacteria *Bacillus thuringiensis* (Bt) and granulosis virus. Bt is sold commercially for control of a range of caterpillars under several different trade names including "Dipel"," Delfin" and "XenTari" and with two subspecies (*Bt kurstaki* and *Bt aizawai*).

Bacteria and Viruses

Bt

Although some publications report that Bt has been successfully used against potato moth (Lacey and Arthurs 2008; Sporleder and Lacey 2013) others such as Rondon (2010) concludes that it is not particularly effective under field conditions because of degradation by UV and wash-off by irrigation or rainfall. It is a stomach poison and must be ingested. So, an additional problem with it in the field is that PTM caterpillars feed for almost all of their life protected within the leaf and would not be exposed to a surface application except briefly in the first instar stage. Given the rapid degradation of Bt and PTM populations producing almost continuous batches of eggs (and first instars), it would require multiple applications of Bt to target newly hatched caterpillars before they enter the leaf.

Another use of Bt has been to isolate the gene for the Bt toxin and genetically modify potato plants to produce varieties containing this toxin. When it was discovered that there were genes responsible for the production of crystal proteins (the toxins) these were given the abbreviation "cry proteins" for (crystal proteins). As more types of proteins were discovered, those active on lepidopterans were given the numbers 1 and 2, with major variations allocated uppercase letters and minor variations designated by lowercase letters. Eg Cry1Aa, Cry1Ab. In 1995 the EPA in the USA approved the commercial production of four Bt crops; corn, cotton, tobacco and potato. However, the bulk of production is corn and cotton (Abbas 2018).

There have been varieties of potatoes producing Bt that are effective on PTM (Douches et al 2002) and another strain of Bt (*Bt tenebrionis*) for control of Colorado potato beetle. GM potato varieties such as Spunta G2 have been developed and although they are approved in some countries including the USA, many other countries have progressively banned the use of such varieties (Abbas

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2018). Although they may be effective on PTM the varieties have not been used widely because of issues with differing perceptions about the safety of GM crops on humans (Abbas 2018).

Granulosis virus

Viruses have been developed as commercially available products for some caterpillar pests such as "Madex" and "Cydex" for codling moth, "Gemstar" and "Vivus" for *Helicoverpa* and "Spod-X" for *Spodoptera exigua*. Sporleder and Lacey (2013) have reviewed the potential of different biopesticides and there are granulosis viruses that have been used against potato moth but there has been no large-scale production. It is commonly referred to as *PhopGV or Po*GV and some trials report over 90% mortality in laboratory trials (Lacey et al 2011). In some cases (eg in Peru), government agencies have produced this as a pesticide for use by potato farmers. Granulosis viruses have spread around the world with potato moth and has been found in Australia and New Zealand (Teakle 1998). Trials have largely been focused on potato storage in developing countries (Lacey and Arthurs 2008; Sporleder and Kroschel 2008) but also in the field in Australia (Reed and Springett 1971).

Granulosis viruses used as insecticides have similar problems to Bt, with degradation by UV and wash-off by water. However, it has also been shown that there is the potential for PTM to rapidly develop resistance to granulosis virus (Briese and Mende 1981).

Fungi and Nematodes

Several species of fungi and nematodes have been shown to be effective in killing PTM (Rondon and Gao 2018). Sporleder and Lacey (2013) summarise the available products against PTM and list *Beauveria bassiana* as being commercially available in Europe and the USA. Other fungi tested against PTM are *Isaria fumosorosea* and *Metarhizium flavoviride* (Sabbour 2015).

Nematodes *Steinernema carpocapsae, S. feltiae* and *Heterorhabditis bacteriophera* have been shown to kill PTM larvae in laboratory trials (Hassani-Kakhki 2012; Sporleder and Lacey 2013; Kepenecki et al 2013) but these have not been commercially produced.

Cultural controls

In a review of PTM control it is stated that although current methods of control rely heavily on the use of pesticides, early control of this pest should focus on cultural methods (Rondon 2010). Such methods have been known for many years and include variety selection, deeper planting of seed, producing a large hill, irrigation to prevent soil cracking and early harvest. Rowe (1993) states in a manual on potato production (in the USA) that "the moths cannot reach tubers covered with more than 2 inches of soil, unless it is deeply cracked". Goldson and Emberson (1985) recommended that in New Zealand deeper planting should be done to help control PTM. Some of the best-known work on cultural control of PTM was conducted in New Zealand by Marion Foot (1974, 1976). Other cultural controls include elimination of cull piles, controlling volunteer potatoes, and rolling (Rondon 2010).

Pesticides

Pesticides are often applied to control pests of potatoes including PTM and this has long been the case. Herman (2008a) reported that in the North Island of New Zealand where PTM is a major pest, control was "dominated by applications of broad-spectrum insecticides at 10 – 14 day intervals".

Insecticides targeting PTM in the foliar stage can be effective but many studies (summarised by Rondon 2010) have shown that this does not ensure that there will be no damage to the tubers. Kuhar et al (2013) describe the efficacy of insecticides on PTM as "unpredictable". This is because caterpillars can access the tubers through cracks in the soil and so soil conditions are critical in determining the level of control (see section on cultural controls). In New Zealand it has been found that crops with bad tuber infestations sometimes had relatively

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little foliar infestation (Herman 2008b) and it is the same in Australia (Horne – unpublished data). As noted by New Zealand researchers, (Foot 1974, 1976 and Herman 2008a,b), even if there is control of a PTM population in the foliar stage, there can still be significant damage to tubers if appropriate cultural controls are not utilised.

Insecticide resistance

Resistance by PTM to insecticides is known to occur in various parts of the world. This includes the USA (Kuhar et al 2013) where resistance to insecticides including fipronil and synthetic pyrethroids has been reported. PTM was one of the first pests that became resistant to DDT in the 1950's including in Australia (Champ and Shepherd 1965). In Queensland, Australia, while not saying PTM was resistant, Abbot and Abbot (1999) stated that the currently registered insecticides (at that time) were unable to provide an acceptable level of control. In Egypt, PTM was recorded as resistant to several organophosphates, carbamates, synthetic pyrethroids and imidacloprid (El-Kady, H. 2011).

A recent review of resistance to diamide insecticides (eg "Belt" and "Coragen") recorded resistance by several lepidopteran species, but this does not include PTM (Richardson et al 2020). However, the related species *Tuta absoluta* has developed resistance to this group.

In a recent review of Bt genetically modified crops (Abbas 2018) it was suggested that their use was probably nearing the end, partly because of concerns about human safety but also because of the development of resistance to GM crops by some species of caterpillars.

Attract and kill

The use of pheromones to attract PTM to a container with insecticide ("attract and kill") has been developed (Kroschel and Zegarra 2010) and commercialised by CIP in Peru (Sporleder and Lacey 2013). The insecticide used is usually a synthetic pyrethroid with rapid knock-down, but it is not disruptive to biological control as it is not sprayed over the crop. This approach catches only male moths and so would need to be done on a district-wide basis to be effective in suppressing a population. This is because female moths that have already mated could fly into paddocks where the males have been trapped.

IPM

Integrated Pest Management (IPM) is simply using biological, cultural and chemical control options in a compatible manner, rather than relying on insecticides as the mainstay of pest control. IPM involves trying to use these options in a compatible way and using biological and cultural options as the mainstay of control with chemical options used only as support tools when necessary (Horne and Page 2008; Page and Horne 2012). Selecting the pesticide that will cause least disruption to biological control agents is important rather than selecting a product that might be most effective against the target pest but is disruptive to biological control agents.

However, to develop an IPM strategy to suit a farmer in any crop the first thing to be done is to look at the range of pests present. This will be different in different locations and can also differ between farms in the same locality due to different perceptions of "what is a pest of importance". IPM needs to deal with all pests that the farmer is worried about, not just one pest (FAO 2000; Trumble 1998). Therefore, there is IPM for potatoes but not, for example, IPM for aphids.

An IPM strategy for potatoes was described by Horne and Page (2008) and such an approach can be built for any potato grower in any region in the world. Once the list of pests is established then all of the available control options can be listed. It is often important to emphasise that all options, despite the possible costs, be listed, as the expenditure changes markedly (reduced) when there is little requirement for insecticides. This means a single expensive insecticide may be far more cost-effective if it is the only intervention required and it supports biological controls.

In a recent (2019) article in Potatoes Australia magazine, a grower described his experience of using IPM, starting in 1995. (https://ausveg.com.au/app/uploads/publications/PA%20Feb%20Mar%202019%20Web.pdf).

His conclusion to the article is the most telling, where he states, "In the last 20 years I have used fewer insecticide applications on all paddocks than I might have used in a single season per crop before IPM". His experience is typical of growers in Australia who have changed to using IPM from regular applications of insecticides (he previously sprayed insecticides every 10-14 days). Another grower with the same experience estimated that he had saved $55,000 in five years (from 1995 to 2000) by adopting IPM and using much less insecticide without compromising quality (O'Sullivan and Horne, 2000).

The point is that insecticide applications similar to those currently being applied in North Island potato crops were the standard practice in Australia 20 years ago. This has been turned around by adoption of IPM in Australia.

Summary

Scientific studies around the world have documented that there are options for controlling PTM in all three available methods – biological, cultural and pesticides. In developing countries without access to cool stores, losses to PTM are more serious after harvest while in developed countries with access to cool stores damage is more likely to be in-field.

Biological control options include parasitoid wasps, and these have been shown to be present and able to contribute significantly to control of PTM in New Zealand. However, they are highly disrupted by non-selective insecticides. Other species such as *Orgilus lepidus* could be introduced, but this would not improve control unless changes in pesticide applications were widely adopted.

Other biological control options have been shown to have some potential (pathogens and nematodes) but have not been made commercially available in most countries, including New Zealand.

Researchers have repeatedly stressed that if cultural controls (in particular soil management and irrigation) are ignored then pesticide applications in the foliar stages of the crop cannot be expected to provide acceptable levels of control. This research has been conducted and confirmed in New Zealand as well as in other countries.

PTM is capable of developing resistance to insecticides but so far there is no evidence to suggest that PTM is resistant to the newer insecticides of the Group 28. Control of PTM in the foliar stage of the crop is likely to be good. Instead, crop protection failures are more likely to be attributable to failures in cultural controls. This conclusion is the same as what New Zealand entomologists Marion Foot and Tim Hermann have previously described. The need to adopt an IPM strategy that involves using all three control options and not just a reliance on pesticides during crop growth is once again emphasised.

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ON FARM BIOSECURIT

If any pest of concern is found "Snap it, Catch it, Report it" – Ca

Visit our website for a list of Sector Risk Organisms https://potatoesnz.co.nz/biosecurity/secto

1. Entering a Property

e.g. growers, workers, sales representatives, consultants, crop monitors, inspectors, field surveyors, other visitors

- Limit entry points into a property.
- Park in designated parking areas (using signage will help).
- Wash down vehicles if necessary.
- For anyone coming from another property, wash hands and clean footwear (or provide booties and overalls to visitors). If footwear needs cleaning, ensure soil is removed before using disinfectant. (Disinfectant won't work if dirt present).

- For anyone who has recently been overseas in rural areas, ensure footwear and clothing worn overseas is clean.
- Ask visitors to stay on tracks.
- If transporting visitors, use own vehicles where possible.
- If you will not be present when visitors are going to your property – discuss with them prior to their visit, the hygiene/biosecurity practices you would like them to adhere to.

Photo by Jacson3 Ltd, www.cleanboots.co.nz

2. Bringing organic material onto your property (including seed)

e.g. seeds, organic fertiliser, compost

- Source certified seed.
- Talk with suppliers about biosecurity, hygiene, testing and record keeping.
- Ask for copies of tests/certificates/ declarations if available.
- Inspect on arrival for visible pests and diseases.
- Store away from production areas if possible.
- Traceability – record where from and where used. Have the ability to trace backwards and forwards.

New plantings

- Regularly check new plantings for anything out of the ordinary.

3. Equipmen

e.g. new, second han equipment

- Clean storage/harves debris, waste and dir
- When moving betwe down vehicles and ot
- Consider establishing hard stand or sump.
- Do not let water "run areas.
- Regularly check areas facility, for new pests
- Keep an up to date cl
- Clean vehicles from t
- For maximum protect broad-spectrum disin

TY ADVICE

all MPI on 0800 80 99 66

or-risk-organisms/

Potatoes NEW ZEALAND

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fectant after washing.

4. Contractors

What do you want your contractor to do?

- What hygiene/biosecurity practices do you want them to implement?
- How can you check contractors are doing it?
- Contractors following good biosecurity practices may be slower – but what level of risk are you prepared to accept?
- Can you include biosecurity in contractual arrangements with contractors?

Photos by Jacson3 Ltd, www.cleanboots.co.nz

5. Know your normal

- Monitor your crop.
- Know your normal – what pests and diseases might you expect to see.
- Know your exotic pests – know what might be of concern.
- Keep the PNZ Pests and Diseases Handbook as reference.
- Train staff to look out for unusual pests and signs/symptoms.

Photo by Wilcox

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Growing together

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Bt toxins (including GM crops, Bt potatoes):

Walker GP, Cameron PJ, MacDonald FM, Madhusudhan VV, Wallace AR. 2007. Impacts of Bacillus thuringiensis toxins on parasitoids of Spodoptera litura and *Helicoverpa armigera*. Biological Control. 40: 142-151.

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Potato Mop Top Virus: surveying your farm

	Tuber			Soil				
Scenario	**Infected Seed (PMTV inside tuber)**	**Non Infected Tuber with Infected Powdery Scab on surface**	**Non Infected Seed**	**Infected Soil (PMTV inside Spongospera)**	**Non Infected Soil**	**Risk of Infection**	**Effects**	**Action**
1			x		x	Zero	No effect	No risk of infection.
2	x			x		High	Foliar and Tuber symptoms	Worst case scenario. Planting is not recommended.
3	x				x	Medium	Foliar and Tuber symptoms	Infected seed risks contaminating disease-free soil and should be avoided. In the absence of the vector, transmission from mother to daughter tubers is, depending on variety and conditions, incomplete and so is self eliminating. Together with roguing of symptomatic plants the infection can be eliminated from stocks in a few generations.
4			x	x		High	Tuber symptoms only	Variety resistance can be used to reduce both incidence and severity of powdery scab. Infection of roots and tubers by the virus is favoured by conditions favourable to the fungus, particularly wet soil.
5		x		x		High	Tuber symptoms only	Use clean seed.
6		x			x	Medium	Tuber symptoms only	Use clean seed.

Note: If you suspect you have found PMTV on your property, please contact Iain Kirkwood from Potatoes New Zealand on 027 240 1092.

Tomato Red Spider Mite (TRSM): latest advice on 2020 incursion in Auckland

The tomato red spider mite's main hosts are plants in the Solanaceae family, including tomatoes, potatoes, eggplants, as well as beans, kumara and some ornamentals – roses and orchids.

It is commonly found on weeds including nightshades, shepherd's purse, cleavers, and fat hen.

While more information is collected on this pest and its presence in New Zealand, growers are advised to follow good biosecurity practices – treat nightshade weeds around your property and glasshouses.

More information is here: https://www.biosecurity.govt.nz/protection-and-response/responding/alerts/tomato-red-spider-mite/

And here: https://www.tomatoesnz.co.nz/biosecurity/tomato-red-spider-mite/

Background on the tomato red spider mite

- Tomato red spider mites are the size of a full stop. They are not insects, but a type of arachnid, relatives of spiders, ticks and scorpions. There are a few red mite species in New Zealand already.
- The tomato red spider mite got its name because it eats tomato plants, is red, and makes silk webbing to protect itself and its eggs, like some spiders do.
- The mite is exceedingly difficult to identify because it is so small and because it looks very similar to other mite species present in New Zealand. Identification requires an expert. It is easier to find the webs it creates on host plants.
- We do not know how long the mite has been in New Zealand or how it arrived. It could have been carried by the wind, arrived on a visitor's clothing or bags, or hitchhiked on imported products.
- The discovery of this mite in New Zealand is considered by the Ministry for Primary Industries' trade and market access experts as unlikely to have any significant impact on trade in horticultural products.
- Tomato red spider mite is a quarantine pest for Korea, Thailand and Ecuador, and we do not export many of the host plant products to these markets.
- However, there are some host commodities exported to Thailand including tomatoes.

TOMATO RED SPIDER MITE *(Tetranychus evansi)*

Photo: Alain Migeon, CBGP - INRA, Monferrier-sur-Lez (FR)

What is it?

Spider mites are not insects, but a type of arachnid, relatives of spiders, ticks and scorpions. Tomato red spider mite *(Tetranychus evansi)* is a small, red coloured arachnid that feeds on the sap of plants. Identification in the field is difficult and usually requires an expert. *T. evansi* looks similar to other spider mite species, closely resembling the two-spotted mite *(T. urticae)* and bean spider mite *(T. ludeni).*

Where did it come from?

Tomato red spider mite is thought to originate in South America and has been introduced to many countries in Africa, Europe, Asia and North America including Hawaii. It was first reported in Australia in 2013. While tomato red spider mite is a significant pest, it is not technically feasible or cost beneficial to eradicate from Australia as it has a very broad host range; it is difficult to diagnose in the field; there are multiple pathways for spread. It is also difficult to detect the pest when levels of infestation are low.

What does it look like?

Mites are difficult to see without magnification. Adult tomato red spider mites are small with eight legs and may change colour during their lifecycle. They can vary in colour from light orange to deep orange red or brown. Female tomato red spider mites are approximately 0.5 mm in size and a broad oval shape. Males are much smaller (0.3 mm), orange to straw coloured and are a more elongated, triangular shape.

Eggs of tomato red spider mites are rounded and deep to pale orange in colour. They are bright and clear when newly laid becoming rust red prior to hatching. Larvae are light green or pinkish in colour, slightly larger than eggs and have six legs. Nymphs look similar to adults with eight legs but are smaller and greenish to orange red in colour.

Where is it found?

The main hosts of the tomato red spider mite are plants in the Solanaceae family including weeds such as blackberry nightshade (*Solanum nigrum*) and silverleaf nightshade (*S. elaeagnifolium*), and the native kangaroo apple (*S. aviculare*). Commodities affected by tomato red spider mite include tomato, potato, eggplant, beans, citrus, cotton, tobacco and ornamentals such as roses. Tomato red spider mite can cause damage to plants grown both outdoors and in glasshouses.

What do I look for?

Feeding damage caused by the Tomato red spider mite sucking sap appears as many shiny pale yellow marks on the top of the leaf. Eventually the leaves turn brown and die or fall off. Severe attack leads to formation of webs on the plant.

Extensive webbing on a tomato plant in a greenhouse. Photo: RSM Project, ICIPE

Spider mite feeding under the leaf produces a typical loss of colour and gradual yellowing seen from above, particularly around the main veins. Photo: Eric Boa, CABI

T. evansi is spread over short distances by wind, irrigation water, and field workers (clothing, tools). The trade of host plants can also lead to long distance spread. Feeding from the mite can result in death of the host plant within 3-5 weeks after infestation. The mite is capable of inflicting significant economic impact through reduced yields and increased control costs. There are currently no interstate movement controls in place for the pest although Western Australia have Tomato red spider mite listed as a prohibited pest which would impact product if it arrived in Western Australia in an infested state.

What can I do?

Growers can put on-farm biosecurity measures in place to reduce the chance of *T. evansi* getting into their crops

These include:

- Controlling weeds and other potential host plants on your property. Nightshade weeds are a favoured non-crop host so thorough weed management may reduce the pest risk particularly as a source of survival between cropping rotations
- Using pest-free propagation material and seedlings, sourced from a reputable supplier
- Putting up farm biosecurity signs on gates and fences to manage visitors coming onto your property
- Avoiding the sharing of equipment
- Ensure visitors and employee footwear, clothing and equipment is free from soil and plant material before entering and leaving your property
- Teaching farm workers what to look for and how to report unusual pests and diseases.

An integrated pest management approach will be needed to control Tomato red spider mite. This should involve crop hygiene through culling of nightshade and other Solanaceae weed hosts from the crop area and surrounds, the use of natural enemies such as Stethorus lady beetles, and if required registered miticides. Biological control with predatory mites such as *Phytoseiulus persimilis* and *Neoseiulus californicus* is not likely to be as effective as for two spotted mite and bean red spider mite. *T. evansi* is also resistant to many acaracides and insecticides that are registered for use in Australian cropping systems. Unfortunately specific information on the effectiveness of control of Tomato red spider mite provided by the different miticides registered for use on affected crops is not available in Australia. Growers should select a miticide suitable for the intended situation and use.

More information

For more information or advice, contact the South Australian Research and Development Institute (SARDI) on 8429 0933 or 8429 0401.

Industry Sustainability

Plan Changes and Collective Consents

A catchment collective approach to managing contaminants: Overview for potato growers considering collective consent models

Background:

The PNZ approach to managing contaminant emissions contains elements supporting a catchment collective approach. This short paper and attached diagram explain how it may work. It has been prepared initially to engage with growers to establish support for the approach but is designed to be applicable to any business affected by; and responsible for outcomes sought under proposed regulations for compliance with the NPS (National Policy Statement Freshwater 2020) and NES (National Environmental Standards Freshwater 2020).

Basic outline of approach:

1. The NPS and NES require management by sub catchment or freshwater management unit (FMU). Loads of contaminant within an FMU will eventually be established as limits that are allocated to differing uses within the FMU. *These sub catchment loads provide an opportunity to manage the responsibility for contaminants at the sub catchment scale, as opposed to individual farms*. It allows for the community to manage effects collectively and take advantage of shared responsibility to increase the flexibility of land use activity.
2. It will be very hard to get all businesses in a sub catchment to agree to work collectively. But this should not prevent groups forming to undertake a collective approach for the area they have command or control over. See the footnote below for the proposed method to undertake the reallocation of responsibility.
3. This approach *requires the formation of a legal entity responsible* for managing things. The relationship between the legal entity and those represented by the entity would be supported by a contract under civil law outlining the rights and responsibilities of each party.
4. Funding will be required to establish a collective approach, because the legal entity will have to establish a tool and methods to track progress and support the development of an Integrated Catchment Management Plan (ICMP) by parties involved. *Funding responsibility will need to be managed by the civil contract between the legal entity and all growers / parties that agree to be part of it*.
5. *A decision support tool must be developed*. This tool is basically a catchment model that is capable of predicting the effectiveness of identified actions or mitigations to achieve the ten-year sub catchment load targets specified in the plan. In the case of Horizons, the catchment model developed recently by Horizons RC may be a useful proxy. At a minimum they must be able to assess the outcome and probable reductions across all four contaminants. The decision support tool must be:

   a. Able to be used by the Council as part of managing the overall water quality objectives for the region.

   b. Able to provide evidence to support a package of mitigation actions specified in an ICMP.

   c. Developed and approved by respectable scientists approved to do so.

   d. Able to continuously improve as better information becomes available from monitoring.
6. The legal entity will *use the ICMP and decision support tool to apply for an integrated consent covering the land specified in civil contracts agreed by participating parties*. The consent would cover enough time to allow for improvements to be measured and would reflect the investment in the decision support tool and the package of mitigations.

7. The legal entity would be required to monitor and report progress under the ICMP to the Council who would be able to take any *required enforcement action against either the legal entity or parties that have breached conditions of contract*. The consent could be reviewed and altered if the targets are not being achieved; or if the targets are being achieved quicker than expected.

Pros and Cons of the proposed approach

The legal entity could receive a proportion of the relevant sub catchment load limit, that would be calculated by a decision support tool. The limit allocated to the legal entity could be based on the area of land and the proportion of the relevant sub catchment load targets the group would be entitled to as individuals

Council		**Participating parties**	
Pros	**Cons**	**Pros**	**Cons**
The Council will have a greatly reduced group of consent holders and farm plans to manage.	The Council will need to develop a strong relationship with the sub catchment communities and support the development of catchment collectives.	The parties to a catchment collective will have support to manage mitigations and actions and report progress to Council.	The parties will have to agree to pay a fair share of the development and consenting costs incurred by the legal entity.
The Council will benefit from the development of decision support tools to monitor freshwater. These tools will allow far more sophisticated approaches to be taken in the longer term.	The Council will be required to invest in a framework that can manage all the sub catchment-based tools as an integrated tool to manage all freshwater. This will require investment in science, data and information handling.	Farm Plans will be far more tailored to individual properties and the contaminants of concern to achieve the best results for the best price.	The establishment of a legal entity[1] under contract among many parties will be complex and difficult to achieve. It will require the community to work together in a way they have not before. This will require some support from the Council.
The Council can obtain greater benefit in terms of positive water quality outcomes because a wider range of effective mitigations become available by working collectively at an enterprise level as opposed to a property level.	The Council will require the ability to manage a more sophisticated set of mitigation packages, alongside the community that chooses not to participate in a catchment collective. For this reason, the allocation regime should incentivise catchment collectives.	Commercially confidential information required to assess load reductions will not enter the public realm unless enforcement action is required by the Council. The rest of the information can be managed by the legal entity that is not subject to LGOIMA.	Any allocation of contaminants will be allocated to the entity not to any party within the collective. Procedures will have to be established for new parties entering or old parties leaving the collective.
Council and Iwi will have a range of resourced legal entities to work with on progressing achievement of freshwater objectives and limits		The flexibility to change land use will be increase between participants in the catchment collective, because the discharge outcomes a can be assessed and managed in a far more effective and sophisticated way.	No party will be able to abdicate their responsibility for undertaking improvements. They will have greater flexibility to manage how improvements are achieved though.

[1]The legal entity could receive a proportion of the relevant sub catchment load limit, that would be calculated by a decision support tool. The limit allocated to the legal entity could be based on the area of land and the proportion of the relevant sub catchment load targets the group would be entitled to as individuals

Diagram showing how the proposed collective sub catchment approach would work

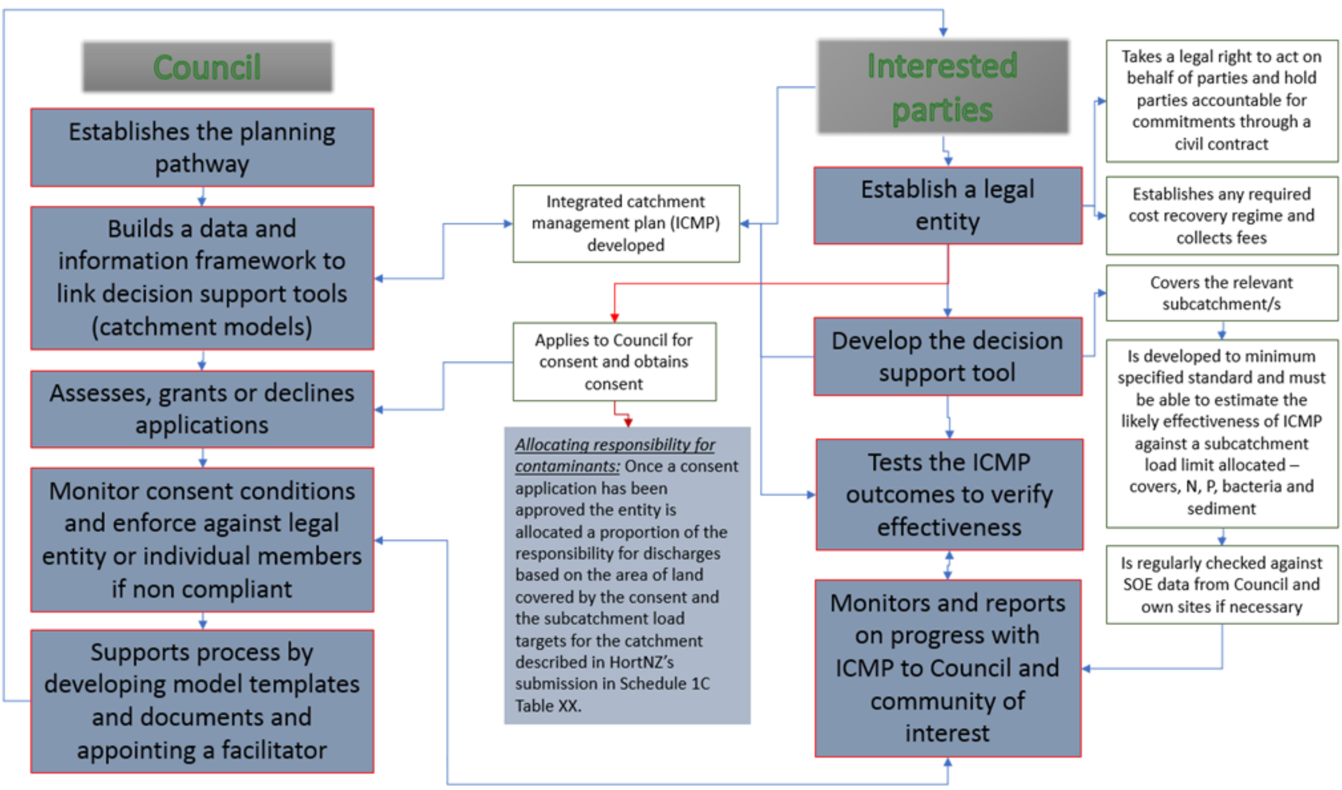
1 Enterprise
- Legal Entity establised to represent interested parties
- Financial Instruments
- Contracts for parties

2 Decision Support Tool
- Models calibrated to observed conditions
- Mitigations agreed
- Freshwater Objectives and Adaptive Management triggers
- Catchment Management Plan development

3 Resource consent(s)
- Adaptive management approach
- Catchment Management Plan
- Mapping of critical source areas
- Farm Plans and mitigation actions
- Assess future scenarios
- Monitoring sites in catchment
- Plan development

4 Monitoring and Reporting
- Freshwater objectives and targets
- Annual mitigation actions
- Water Quality
- Allocation
- Future Scenarios

Diagram showing the relationship with Regional Council for Catchment Collective approach



Dumping Update

Industry Key Points

1. $1.1 billion value
2. $ 610,223,000 processed frozen potatoes (all domestic plus export)
3. $217,561,000 potato crisps
4. $243,099,000 fresh
5. Potatoes New Zealand Incorporated (PNZ) represents:
6. 172 growers
7. 4 frozen processors; McCains, Talleys, Mr Chips and Makihihi Fries
8. 45% of our growers are in Canterbury and 30% in Waikato/Pukekohe
9. Potato industry is a significant contributor to local economies.

Global Pandemic Challenges

1. Covid-19 has caused global supply chain disruption, significantly changing supply and demand balance of numerous industries
2. Hospitality industries have been shut down through lockdowns
3. Traditional hospitality channel products remaining unsold, creating significant surplus inventories in major producing nations
4. Potatoes New Zealand estimates surpluses of frozen fries in Belgium and the Netherlands of 200,000 - 230,000 tonnes
5. New Zealand's Team of 5 Million has managed the pandemic better than most other nations, creating an open market where hospitality is thriving
6. NZ is open for business
7. NZ is an attractive market for surplus inventories.

PNZ Solution

- PNZ investigated options to defend the industry against significant surpluses arriving in NZ further disrupting NZ industry
- Options explored through available processes via MBIE Trade Remedies
- Anti-dumping application based on threat of material injury appeared to be best tool for defence
- Application submitted to MBIE 9 September 2020
- MBIE initiated anti-dumping investigation 2 November 2020
- Application and Initiation Report key take-outs:
    - Dumping margins 73 – 136%
    - Estimated excess inventories 205,000 – 230,000 tonnes
    - Forecast injury resulting in closure of New Zealand industry

Current status

- MBIE are receiving submissions from the EU and from NZ importers and distributors in response to our claims
- PNZ are responding to these submissions.

Potato Industry Strategic Targets 2021

PNZ New Draft Strategy

Potato Industry Strategic Targets 2021

1. Double the value of fresh & processed exports by 2025.

- Aligned with objectives of the government's business growth agenda.
- Implies volume and value growth.

2. Enhance the value of the domestic market by 50% by 2025.

- Implies value growth on stable volumes above CPI.

3. Zero net nutrient and GHG emissions by 2030.

- Aligned with the objectives of the government's emission targets.
- To be achieved in order of priority via reduction/mitigation, and offsetting.

2021 Potato Industry Strategic Themes and their initiatives

Research & Development

- Productivity
- Pests & Disease
- Environment

Markets

- Export
- Domestic
- Industry Metrics

Industry Good

- Structure
- Resilience
- Processes

Quality

- Biosecurity
- Standards
- Seed

Targets → Themes → Initiatives → Activities → Industry Transformation

PNZ Communications & Engagement

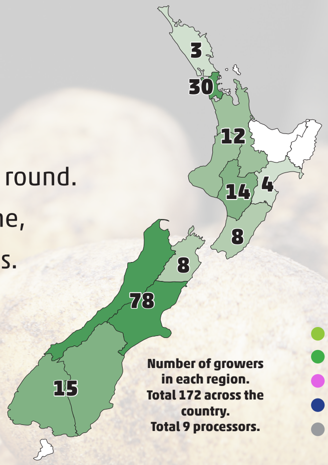
PNZ Communications Strategy 2021

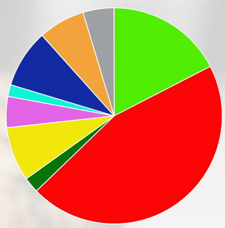
1. **Support Potatoes New Zealand Incorporated's Strategic Targets**
2. **Support all PNZ grower activities and education**
3. **Engage domestic and export consumers by promoting NZ fresh potatoes, NZ processed potatoes and NZ industry social good**
4. **Enhance PNZ Industry's Environmental Sustainability**

The PNZ industry value, gives a good platform for external communications and is a reminder of the value and importance of the industry to both NZ domestic and export markets.

Industry Overview

Potatoes are grown across Aotearoa and harvested year round. The majority of production is in Canterbury and Pukekohe, with other growing regions scattered across both islands.



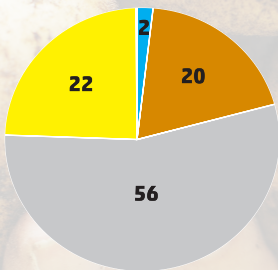


Values

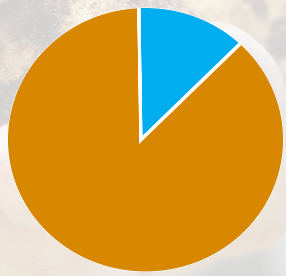
In 2019:

- **533,030 MT** produced from **10,417 hectares**
- Farmgate value **$190,000,000**
- **NZ consumed the equivalent of 66.5 kg of raw potato per person, in the form of fresh, chips or crisps**
- **Export** value **$12,307 per hectare**
- **Total Export** value **$128,211,000**
- **Domestic Retail** value **$99,124 per hectare**
- **Total Domestic Retail** value **$959,659,000**

% of total industry value



Industry value $1,087,871,000



Potatoes NEW ZEALAND

Theme	Strategic Initiative	Comms Activity & Support (Initiative no. & description)	Stakeholders & Audiences
R&D	Productivity	1.1 Identify key areas for optimising the value chain	• growers/processors/industry • consumers
	Pest & Disease	2.1 Publish up-to-date protocols & methods for pest & disease control	• growers/processors/industry • regional and central government/regulatory bodies
	Environment	3.3 PNZ-79 workstream 4 of Sustainable Vegetable Systems 3.5 Develop PNZ Sustainability Strategy document	• growers/processors/industry • consumers • regional and central government/regulatory bodies
Markets	Export	4.3 Develop information systems to underpin international marketing 4.5 Identify and report domestic barriers to international trade competitiveness and communicate with the govt. ie impact of regulatory compliance.	• consumers • r egional and central government/regulatory bodies
	Domestic	5.1 Develop & execute annual communications strategy 5.2 Drive industry engagement through effective delivery of key messages 5.3 Co-ordinate newsletters, media & social media activity & track outcomes 5.4 Work with strategic partners to develop appropriate resources & provide support 5.5 Annual PR campaign 5.7 Promote NZ grown fresh potatoes 5.8 Promote NZ grown & processed potato products	• growers/processors/industry • consumers • regional and central government/regulatory bodies
	Industry Metrics	6.1 Research & publish export values weekly 6.2 Research & publish processed values monthly 6.3 Research & publish annual market value & volume statistics via annual report and stand-alone industry charts for web & print	• growers/processors/industry • regional and central government/regulatory bodies
Industry Good	Structure	10.3 Develop Resilience Plan 10.5 Develop joint activities with other product groups to support vegetable industry	• growers/processors/industry

	Resilience	11.1 Support & promote horticulture training at a regional and national level 11.2 Support & promote good health & safety practices 11.3 Undertake on farm biosecurity training & development activities 11.4 Identify & support training of potential horticulture leaders 11.9 Protect domestic industry from unfair trade practices by investigation of antidumping safeguard measures (Comms supporting role) 11.10 Establish Transformational Plan for industry, embracing zero waste & zero emissions 11.11 Maintain grower's license to operate (Comms supporting role in Regional Plan submissions)	• growers/processors/industry • consumers • regional and central government/regulatory bodies • wider media and social media audience, local and global
	Processes	12.6 Establish carbon-zero operations for PNZ Inc. (Comms supporting roles) 12.7 Seek regular feedback from growers & industry, to identify issues, that membership wish to address.	• growers/processors/industry • consumers • regional and central government/regulatory bodies • wider media and social media audience, local and global.
Quality	Biosecurity	Implicit communication of incursions and management advice (not yet a written initiative in Biz Plan)	• growers/processors/industry • consumers • regional and central government/regulatory bodies
	Standards	8.7 Publish potato Grower Guides including MRL, Biosecurity Guide, Pest & Disease handbook, Seed Rules etc.	• growers/processors/industry
	Seed	9.6 Annual Seed Authority letter	• growers/processors/industry

TAKING PART IN A HORTICULTURE FIELD DAY?

THINK ABOUT BIOSECURITY! HERE ARE SOME EASY STEPS.

Field days are a great way to share information and knowledge in a hands-on way. However, movement of people, goods and vehicles between farms/orchards during a field day can present a biosecurity risk. Pests or pathogens can inadvertently be carried:

- onto the host's property
- back to the attendees' property.

Implementing simple everyday biosecurity practices can help to minimise the biosecurity risk for both hosts and attendees, which is a great outcome for all.

If you are an ORGANISER:

- Include biosecurity messaging on promotional material and in communications with host properties.
- Minimise the number of vehicles and use transport that is not usually used on the farm/orchard if possible.
- Keep a register of all attendees to ensure tracing is possible if required.
- Avoid visiting properties that are known to have high risk pest, pathogen or weed infestations.

If you are a HOST PROPERTY:

- Make sure good biosecurity practices are visible on your property.
- Provide a biosecurity briefing about the actions you'd like visitors to take so that attendees know what you expect of them.
- Ensure that you have a designated and clearly signposted parking area.
- Provide a footwear wash and disinfection station at the point of entry e.g. boot scrubbers and water for cleaning, sanitising spray or a footbath containing an appropriate sanitising product for disinfection.
- Provide hand sanitiser if people will be touching plants or soil.
- Avoid use of other people's tools and equipment for demonstrations, unless they have been thoroughly cleaned and disinfected first.
- Monitor the part of your property where the visit took place over time for unfamiliar pests, pathogens or weeds.

If you are an ATTENDEE:

- Make sure your clothing and footwear is clean. Avoid wearing clothes and shoes that you wear on your own farm/orchard.
- Clean and disinfect your footwear between each site during the field day and before returning to your own farm/orchard.
- Follow all biosecurity signage and requests at host properties.

BE A BIOSECURITY CHAMPION:

HELP TO PROTECT YOUR PROPERTY AND YOUR SECTOR FROM PESTS AND PATHOGENS.

Notes

Notes

Notes

Event Day Advice

Health and safety

These events are being held on working farms. Please take appropriate care and be aware of potential hazards.
For your safety, please:

- **Follow instructions from PNZ staff/event manager, at all times**
- **Stay within the areas specified by PNZ staff/event staff**
- **Stay out of trial plots unless invited by PNZ staff/event staff**
- **Report any hazards you see, directly to a member of PNZ staff/event staff**

Biosecurity: All visitors to farms will clean boots/footwear upon entry and departure, or boot covers will be provided by event manager. Biosecurity Advice is covered in Topic 8 & will soon be available in A3 poster form.

Specific hazards to be aware of:

- ***Vehicles:*** **Take care when moving across or through the car parking, entry and exit areas**
- ***Trips and falls:*** **Watch out for uneven ground**
- ***Weather:*** **Sun block is available on site**
- ***Electric fences***

First aid and emergencies Should you require any assistance, please ask a member of PNZ staff. In case of emergency call 111 and notify a PNZ staff member. Iain Kirkwood has current First Aid certificate and first aid kit.

Event Sites

- **Canterbury** - PLovett's Farm
- **Pukekohe** - Jay Masters' Farm, Sundale Farms
- **Opiki** - Mike Moleta's Farm

Vehicles - Vehicles will not be permitted outside of the designated car parking areas.

Smoking - No smoking permitted on these property.

2021 Upcoming Industry Events

- **PNZ Biennial Conference & AGM**
  19th & 20th August
  Vodafone Events Centre, Auckland

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