Potatoes™ NEW ZEALAND

Dow Agrosciences Agronomists Forum 2017

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Potatoes New Zealand Conference 2017
PIA, 57 Ward Street, Pukekohe, Auckland

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Dow Agrosciences Agronomists Forum - Groups

First Name	Last Name	Company	Group	# in Group
Daniel	Sutton	Fruitfed Supplies	1 Facilitator	
Justine	Croft	Potatoes NZ Inc.	1 Scribe	
Steven	Dass	Horticentre	1	
Jessica	Dohmen-Vereijssen	Plant & Food Research	1	
Gary	Graham	Pukekohe Growers Supplies Ltd	1	
Rob	King	Talleys Group Ltd	1	
Andre	Lubbe	Leicester's NZ Ltd	1	
Vesna	Mijalkovic	Southern Star Seeds Ltd	1	
Peter	Reynolds	T A Reynolds Ltd	1	
Maryann	Robson	Plant & Food Research	1	
Phil	Schunk	SGS New Zealand ltd	1	
Glen	Surgenor	Dow AgroSciences	1	
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Iain	Kirkwood	Eurogrow Potatoes Ltd	2 Facilitator	
Steve	Sheppard	Potatoes NZ Inc	2 Scribe	
Jerome	Benefield	Pukekohe Growers Supplies Ltd	2	
Steve	Bitter	Syngenta Crop Protection	2	
Rebekah	Frampton	Plant & Food Research	2	
Michal	Haines	Farro Fresh	2	
Moe	Jeram	Plant & Food Research	2	
Brian	Leicester	Leicester's NZ Ltd	2	
Philip	Meares	Dow AgroSciences	2	
Paul	Olsen	Olsen Agri	2	
Jai	Prakash	SGS New Zealand Ltd	2	
Grant	Smith	Plant & Food Research	2	
				10
Shane	Smith	Pukekohe Growers Supplies Ltd	3 Facilitator	
Nick	Pyke	Foundation for Arable Research	3 Scribe	
Sally	Anderson	Market Access Solutionz Ltd	3	
Glenys	Christian	The Grower	3	
Arjune	Dahya	Dayaveg	3	
Carolyn	Edwards	Plant & Food Research	3	
Bryan	Hart	A S Wilcox & Sons Ltd	3	
Marian	McKenzie	Plant & Food Research	3	
Dean	McMiken	Pukekohe Growers Supplies Ltd	3	
Alexandre	Michel	Plant & Food Research Ltd	3	
Sarah	Ross	Massey University	3	
Zack	Taylor	Zelam	3	
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Dow Agrosciences Agronomists Forum - Groups

First Name	Last Name	Company	Group	# in Group
Graham	Bunckenburg	Balle Bros Ltd	4 Facilitator	
Chris	Claridge	Potatoes NZ Inc	4 Scribe	
Bharat	Jivan	Jivan Produce Ltd	4	
Warren	Lockett	Dobmac	4	
Charles	Merfield	The BHU Future Farming Centre	4	
Nick	Reed	McCain	4	
John	Sarup	Spud Agronomy & Consultancy Ltd	4	
Bryce	Simpson	Adama New Zealand Ltd	4	
Sarah	Sinton	Plant & Food Research Ltd	4	
Gail	Timmerman-Vaughan	Plant and Food Research	4	
Herman	Van der Gulik	Enza Zaden	4	
				9
Tim	Pike	Mid Canterbury Growers LTD	5 Facilitator	
Jen	Linton	FAR	5 Scribe	
John	Anderson	Plant & Food Research	5	
Vonny	Fasi	Fruitfed Supplies PGG Wrightson	5	
Michael	Haupt	Fruitfed Supplies	5	
Tony	Hendrikse	Potatoes NZ Inc	5	
Debbie	Johnston	Bluebird Foods	5	
Grant	Morrow	Dobmac Machinery	5	
Nick	Proudfoot	Fruitfed Supplies	5	
Farhat	Shah	Plant and Food Research	5	
Stephen	Sullivan	SGS New Zealand Ltd	5	
				9
Ross	McCallum	Talley's Group Ltd	6 Facilitator	
Kate	Underwood	Potatoes NZ / The Chip Group	6 Scribe	
Steven	Dellow	Plant and Food Research	6	
Bill	Griffin	Plant & Food Research	6	
Bernard	Harris	Dow AgroSciences	6	
Cyril	Hickman	SGS New Zealand Ltd	6	
Mark	Juett	COEL	6	
Tjeerd	Kikstra	Harnett & Kikstra	6	
Ian	Kirkland	Dow AgroSciences ltd	6	
Andrew	Luxmoore	Fruitfed Supplies	6	
Annalise	Williams	Seed & Field Services (SI) Ltd	6	
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Roger	Blyth	Seed and Field	7 Facilitator	
Grant	Morris	Plant & Food Research Ltd	7 Scribe	
Hamish	Gates	Horticentre	7	
Mike	Gordon	Pukekohe Growers Supplies Ltd	7	
Sara	Harnett	Harnett & Kikstra	7	
Steve	Lewthwaite	Plant & Food Research	7	
Elliott	Lovegrove	Eurogrow	7	
Andrew	Pitman	Plant & Food Research	7	
Derek	Schofield	Horticentre	7	
Craig	Watson	Talley's Group Ltd	7	
Andy	Bailey		7	
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Tomato potato psyllid myths research update

By Jessica Dohmen-Vereijssen, PFR Lincoln

By this time of the year tomato potato psyllid (*TPP, Bactericera cockerelli*) populations are peaking in potato crops.

A bacterium, *Candidatus* Liberibacter solanacearum (CLso), is carried and passed on by TPP, and by now its symptoms can be visible in foliage and tubers. In tubers those symptoms are called zebra chip (ZC) disease, which results in darkening of the potato chip when fried.

TPP and CLso

TPP is a small insect, approximately the size of an adult winged aphid. Adults and nymphs feed on the phloem in a plant and do so by puncturing the leaf, similar to the way a mosquito bites people, so feeding damage is basically invisible. Both adults and nymphs can carry CLso. However, not every TPP carries and therefore transmits CLso; only a small percentage of the population tests positive for the bacterium. There is no indication on the outside of the adult and nymph of whether it is infected with CLso or not. Not even the white stripe on the adult's abdomen is an indicator; this will become more apparent or visible as the adult psyllid darkens with age. Adults have to be screened with molecular techniques (polymerase chain reaction or PCR), to ascertain whether they carry the bacteria. A current government-funded project is looking into regional genetic differences between TPP populations in New Zealand and whether the percentage of CLso-infected TPP varies throughout the growing season. Non-infected TPP can acquire CLso when they feed on an infected potato plant.

Once TPP has infected the plant with the bacterium there is no way back; the plant is infected and some degree of damage will be done. CLso cannot be prevented from reaching the tubers even if a spray is applied within 4 weeks after seeing the foliar symptoms. Once a plant is infected with CLso, it takes about 4 weeks for the foliar symptoms to become visible and to find visible tuber symptoms. The symptoms are a response of the plant to being infected with CLso, they are not the bacteria themselves.

Host plants

Host plants of TPP and CLso are found in the nightshade (Solanaceae) and bindweed (Convolvulaceae) families. Research was conducted on the role of non-crop host plants to increase knowledge about the role of these plants in the life cycle and ecology of TPP and CLso. We now know that non-crop host plants are important in the ecology of TPP, as the insect's life stages are present year-round on these host plants. These plants provide suitable feeding and breeding substrates throughout the year (***Figure** 1*), and increased numbers of TPP are observed when African boxthorn (*Lycium ferocissimum*) is growing adjacent to potato crops.

Additionally, we detected CLso in wild-collected thorn-apple (*Datura stramonium*) and Jerusalem cherry (*Solanum pseudocapsicum*) outside the cropping season in Hawke's Bay. Although the incidence of weeds infected with CLso in the environment may be low, these weeds may be a potential reservoir for the pathogen and the vector in the absence of a suitable crop host, providing an inoculum source for infection of subsequent crops.

During the year, there is a low background population of TPP flying around in the environment even in areas where there are no crop hosts present. However, when African boxthorn was present adjacent to a crop, there was increased activity nearby and an 'edge effect' (insects more abundant at the edges of the crop than in the centre) could be observed in the host crop.

TPP/CLso field research this year

Research on TPP, CLso and ZC in Canterbury this year is grower-initiated and focuses on end-of-season

▲ **Figure 1.** Counting tomato potato psyllid life stages on African boxthorn in winter in Canterbury.

management of TPP and desiccation. With organophosphates (OPs) being phased out and neonicotinoids being reassessed by the Environmental Protection Agency, chemical controls other than OPs and neonicotinoids for late-season management of TPP are being investigated for process crops. Tubers will be tested for ZC at several time points in the growing season and after desiccation. This will ascertain when ZC becomes prevalent in a potato crop, which may inform the timing of pest management. In seed crops, our focus this year is quite similar to that in process crops; when does ZC appear in the crop? In both projects the focus is on desiccation. In process crops, other desiccation techniques will be tested in addition to standard Reglone plus OP sprays. In seed crops, the focus is on whether ZC appears or increases after desiccation, as field observations have shown that re-growth can be heavily infested with TPP, which can lead to late infections with CLso. In this case, ZC symptoms may not show at harvest but can, depending on the cultivar, increase in storage. In the North Island, reduced spray programme adoption trials are being conducted and feedback is requested from grower groups after using the programme and the likelihood of future implementation.

In the United States, yield effects were observed because of TPP feeding, often referred to as psyllid yellows. We are in the second year of investigating the effect of feeding of non-infected TPP on tuber yield and quality in a cage trial in Lincoln (*Figure 2*). CLso-free TPP have been released onto potato plants at different times in the plant's physiological stage and yield parameters are being assessed at harvest. This trial is ongoing and results are available later this year. G

▲ **Figure 2**. The cage trial to study the effect of tomato potato psyllid feeding without the bacteria present on potato tuber yield and quality.

Reference material:

Video on results of the non-crop host plants project: *https://vimeo.com/192064496.*

Paper on CLso in non-crop host plants: *http://www.ndrs.org.uk/pdfs/032/NDR_032001.pdf.*

Non-crop host plants present in New Zealand: *https://www.nzpps.org/journal/68/nzpp_poster_684410.pdf.*

Acknowledgements: Research discussed is funded through the Plant Biosecurity Collaborative Research Centre, Potatoes NZ, Ministry of Business, Innovation & Employment (MBIE) and Plant & Food Research core funds.

Potatoes NEW ZEALAND Growing together

Tomato Potato Psyllid Control

Version 3. November 2013

Products with label claims for control of a range of insect pests including tomato potato psyllid in New Zealand

IRAC mode of action group number, insecticide group	Active ingredient and trade names	Pests controlled: Aphids	Pests controlled: Potato tuber moth	Pests controlled: Other caterpillars	Pests controlled: Potato tomato psyllid	Pests controlled: Psyllid life stage affected	Broad Spectrum	Contact	Trans laminar	Systemic	Timing	Withholding period
1A Carbamate	Carbaryl				Note 1							1 day
	Pirimicarb (Aphidex WG, Pirimor 50, Pirimisect, Piritek, Prohive)									Partial (Pirimor)		Nil
1B Organophosphate	Acephate (Lancer 750 DF, Orthene WSG)				Note 2	Orthene: Adults/ Nymphs						7 days
	Azinphos-methyl (Cotnion 200)											14 days
	Dimethoate (Danadim Progress, Dime, Dimezyl 40 EC, Rogor E)										14 day interval	14 days
	Methamidophos (Metafort 60 SL, Methafos 600)			T	Note 1						14-21 day interval	7 days
	Phorate (granule) (Crop Care Phorate 20 G, Disect, Thimet 20 G)				Note 1							13 weeks
3A Pyrethroids	Deltamethrin (Ballistic, Decis Forte, Deltaphar 25 EC, Deltamax)			T							10-14 day interval	14 days
	Lambda-cyhalothrin (Karate Zeon, Cyhella, Kaiso 50WG)					Adult					7-14 day interval	14 days
	Esfenvalerate (Sumi-Alfa)			T & CW	Note 1							Tomato: 3 days
3A + 6 Pyrethroids and Avermectin	Acrinathrin and Abamectin (Tripsol)					Adult, Nymph					7-14 day interval Max/season: Potato = 4 Tomato = 2	Potato: 7 days Tomato: 3 days
1A + 3A Carbamate and Pyrethroid	Pirimicarb and Lambda-cyhalothrin (Dovetail)									Partial	2 week interval or by pest activity	14 days
4A Neonicotinoids	Imidacloprid (seed treatments) (Gaucho)				Note 1						Seed treatment	42 days
	Thiamethoxam (in furrow application) (Actara)				Note 1							90 days
	Thiacloprid (Topstar)										Apply up to 2 applications at 7 day intervals	7 days
4A + 3A Neonicotinoid and Pyrethroid	Thiacloprid and Deltamethrin (Proteus)					Adult, Nymph					Apply up to 2 applications at 7 day intervals	14 days
5 Spinosyns	Spinosad (Success Naturalyte)			T	Note 1							7 days
	Spinetoram (Sparta)					Adult, Nymph					Apply 4 back-to-back at 7 day intervals	7 days
6 Avermectins	Abamectin (Avid, Vantal, Abba, Verdex 18EC)					Adult, Nymph					Maximum 4 applications per season at 7 day intervals	14 days
9B Pyridine azomethine	Pymetrozine (Chess WG, Bravium)				Note 1	Adult, Nymph						7 days
23 Lipid biosynthesis inhibitors	Spiromesifin (Oberon®)					Adult, Nymph, Eggs					Maximum of 2 applications in total per crop cycle	7 days
	Spirotetramat (Movento® OD)					Adult (reduces egg laying), Nymph				Phloem and xylem	Maximum of 2 applications in total per crop cycle	35 days
28 Ryanodine receptor modulators	Cyantraniliprole (Benevia®)				T	Adult, Nymph (more active on nymphs)		Minor (most active via ingestion)		Xylem	Maximum of 3 consecutive applications per season at 7 to 10 day intervals	14 days
Broad spectrum organic insecticide	Insecta-Kill (85% silicon dioxide)											Nil

CW label claim for control of cutworm. **T** label claim for control of these pests on tomatoes.
Note 1: Overseas label claim for control of tomato potato psyllid (TPP), there is no NZ label claim for TPP. **Note 2:** Overseas label claim for control of psyllid (i.e. other psyllid, but no specific claim for TPP). There is no NZ label claim for TPP.

Note: *The information about psyllid control is not a recommendation for use of the product. Growers must comply with label directions and withholding periods when using these compounds to ensure residues in the treated potatoes comply with the maximum residue limits.*

How to use this chart

This chart is designed to provide a quick reference guide to agrichemicals that have label claims for a range of potato insect pests, including tomato potato psyllid (TPP), in New Zealand.

Products are grouped by mode of action group number to assist with insecticide resistance management (far left column).

The chart highlights those products that are registered in NZ to control TPP. Other products included on this chart do not hold a specific label claim for psyllid but an overseas label claim for psyllid species may be noted.

For easy reference agrichemical modes of action are indicated by the colour coding:

Translaminar insecticides penetrate leaf tissues and form a reservoir of active ingredient within the leaf. Assists coverage to TPP feeding on underside of leaves.

Systemic insecticides move within the plant's vascular tissues, either through the xylem (up) or phloem (down) and can provide longer lasting protection. Useful where coverage may be difficult.

Contact insecticides can provide quick knockdown of insect pests and kill insects by direct contact during spray applications or by coming into contact with residues on the plant surfaces. Good spray coverage is essential.

Broad spectrum insecticides will kill a wide range of insects, including beneficial predators, it is recommended they are used later in the season.

Some important points to consider when applying insecticides

Resistance management

A resistance management strategy must be adhered to because the TPP can quickly develop resistance to insecticides.

- Rotate the actives with different modes of action as listed in the table.
- Even if a particular agrichemical is very effective at killing the psyllid it must not be used repeatedly or resistance will develop.
- Do not spray a product from the same group for more than 4 weeks (or as per label directions).
- Do not return to using a product from the same group for at least one insect generation (at least 4 weeks).

Application of agrichemicals

One of the most important factors in psyllid control is ensuring thorough coverage of the plants. TPP are usually found at the base of the plant, and often on the undersides of leaves throughout the canopy. This means that it can be difficult for agrichemicals to reach the psyllid on mature crops.

- To ensure thorough spray coverage of plants growers should **use sufficient water rates** and newer spray technologies (e.g. angled nozzles, air assist booms).
- The **addition of appropriate adjuvants** and the use of products with trans-laminar or systemic properties (i.e. products which spread through the leaf) should help to improve control.
- It is also important to **check the pH of the tank water** to ensure agrichemicals do not lose activity due to hydrolysis.

Psyllid monitoring

Yellow sticky traps: help identify the first influx of the potato psyllid, or peaks in adult numbers. Sticky traps **should be placed slightly in from the edges of potato fields** and changed every seven days.

Crop scouting provides more valuable information on whether the psyllid has established in a crop, the life stages present, and their numbers.

Recommended method: **count 2 middle leaves (off different stems) from 50 plants** (i.e. 100 leaves from 50 different plants). This will give a reliable estimate of psyllid numbers. It is also important to have a look well into the crop for eggs and nymphs each week.

Analysing potato agricultural chemical residue detections and non-compliances from MPIs total diet survey (TDS) 2016

1. Scope

This summary includes agricultural chemical residue detections for all four quarters of the 2016 total diet survey (TDS) and all types of potatoes (ie peeled, crisps, hot chips and with skin). The objective of this project is to assess if there are common non-compliances consistently detected so that additional work can be carried out to address these non-compliances with the crop group/s affected. The TDS includes elements – however this project focuses on agricultural chemical detections only and not elements.

Type of potato	Active (trade name/s examples)	Residue detected in TDS (mg/kg)	MRL (mg/kg)			Report/s	Comments
			NZ	Fiji [1] (refer to CODEX)	Japan		
hot chips	Benzalkonium Chloride (Graphic, Surrender, Spotless, Yield)	0.16	Default 0.1 when used as an agchem	None set	None set	**Q3**	Fungicide/ bactericide / processing agent / food additive used post-harvest? Not listed as used by NZ growers in the Agrichemical strategy, but may be used post-harvest as a food additive in water for sanitisation? Exempt in NZ when applied prior to flowering on some fruit crops, but default MRL applied if used in field as an agchem in NZ. Not registered for use on potatoes in NZ. Not listed on Japan's approved agrichemical list – therefore Nil Detection is required. Fiji may defer to NZ – but this would need clarification with MPI.
hot chips	Chlorpropham (Agpro Chloro IPC, CIPC, Sprout shield)	0.09, 0.11, 0.16, 0.21, 0.28, 0.31, 0.36, 0.39	50.00	30.00	30.00	**Q1 & 3**	Herbicide / sprout inhibitor. All detections are well below NZ, Japan and Fiji / Codex MRLs, therefore not an MRL breach in these three markets.
crisps		0.20, 0.67				**Q4**	

[1] Fijis Food Safety Regulation (2009) provides definitions and some limits for pesticide residues. This specifies that where no standard has been defined, Codex applies - subject to any variations between the Regulations and Codex. The Act also specifies that if there is a conflict between Codex and the Fiji Standard, the Fiji Standard will prevail unless otherwise directed. Reference: www.commcomm.gov.fj/pdfs/FoodSafetyRegulations2009.pdf

Type of potato	Active (trade name/s examples)	Residue detected in TDS (mg/kg)	MRL (mg/kg) NZ	Fiji [1] (refer to CODEX)	Japan	Report/s	Comments
hot chips	Carbon disulphide (CS2)	0.04	7.00[2]	0.2[3]	0.2[3]	**Q3**	Fungicide (most likely mancozeb). Residue of CS2 is total dithiocarbamates, determined as CS2 (except propineb). The detection is below NZ, Japan and Fiji / Codex MRLs, therefore not an MRL breach in these three markets.
peeled with skin	Fluazifop (Fluazifop)	0.02 0.09	Default 0.1	0.60[4]	0.10[5]	**Q3**	Herbicide. Both detections are under NZ's default MRL and under the proposed Codex MRL and Japan MRL. Therefore not an MRL breach in these three markets (the MRL for Codex is yet to be set so will have been a possible issue in the past ie 2015/16).
hot chips	Haloxyfop (Crest, Ignite, Valiant, Gallant Ultra, Steed, Scorp, Fopp, Hurricane, Smart X-grass, Haloxyken)	0.02	Default 0.1	None set / Nil detect	None set / Nil detect	**Q3**	Herbicide. No MRL set for potatoes in Japan or Codex / Fiji. If potatoes were exported to either of these markets as fresh or processed commodity there may have been a residue issue, however the residue detected (0.02) is at the limit of detection / LOD.
crisps	Metribuzin (Metriphar, Charger, Sencor, Sankey, Jazz, Challenger, Shield Xtra)	0.01, 0.02	Default 0.1	None set / Nil detect	0.60	**Q4**	Herbicide. These detections are under NZ and Japan's MRL. However, given Codex has no MRL set this may have been an issue if the potato was produced in NZ and exported as fresh or processed commodities to Fiji (unless Fiji would defer to NZ MRL which needs clarification with MPI). Also clarification is needed if crisps are exported to Fiji from NZ grown potatoes?

[2] MRL is for all vegetables
[3] As carbon disulphide, for ethylenebis- dimethyl- & propylenebis-dithiocarbamates
[4] MRL is pending
[5] Sum of parent plus the free acid and residues (conjugates) convertible to the acid, expressed as parent

Type of potato	Active (trade name/s examples)	Residue detected in TDS (mg/kg)	MRL (mg/kg) NZ	Fiji [1] (refer to CODEX)	Japan	Report/s	Comments
hot chips	Propham (Propham potato dust)	0.11	50.00	None set / NZ applies?	Nil detect	**Q1**	Sprout inhibitor. All detections are under NZ MRL. Propham is not on Japan's positive agrichemical list so nil detection (ND) is required. This means if any of these fresh or processed potatoes were exported to Japan there may have been a residue issue. NZs MPI recommends going with the NZ MRL for Fiji.
peeled		0.04, 0.55, 0.60, 1.59				**Q3**	
with skin		0.03, 0.07, 0.75, 1.52, 2.10				**Q1 & 3**	
crisps		0.08, 0.09, 0.12, 0.52				**Q4**	
hot chips	Spirotetramat (Movento)	0.01, 0.02, 0.02, 0.03, 0.05	0.50[6]	0.80[3]	1.00[3]	**Q1 & 3**	TPP insecticide. All detections are under NZ, Japans and Fiji / Codex MRLs. Therefore not an MRL breach in these three markets.
with skin		0.01				**Q1**	
peeled		0.01				**Q1**	
crisps		0.01, 0.02				**Q4**	

2. Other notes:

- No residues were detected for any potatoes or potato products in Q2.
- The above assumes all potatoes and processed commodifies (ie hot chips and crisps) were grown in NZ and not imported from overseas. MPI does not make a distinction in the report between domestic versus imported produce. It is recommended that PNZ Inc. asks MPI for this information.
- MRLs are set for fresh commodities and residue limits can change once the fresh potatoes are processed onto crisps / hot chips etc, depending upon the active and concentration factors.

[6] Sum of parent and its -enol metabolite

July 2014

Potato Update

Issue 1

Potatoes New Zealand — Growing together

Monitoring for tomato potato psyllid with sticky traps: a guide for growers

Why monitoring?

Crop monitoring techniques allow for the collection of information about pest insect populations throughout the growing season. This information is beneficial to both growers and researchers.

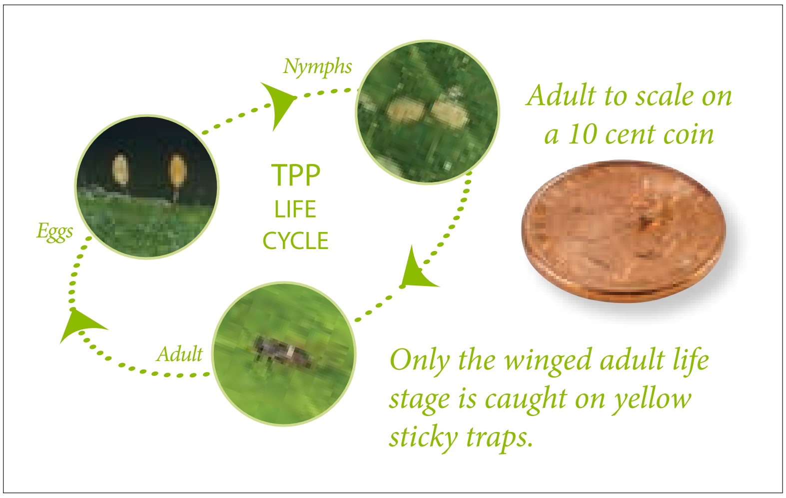

Figure 1. Life cycle of Tomato Potato Psyllid (TPP).

Trapping protocol

- Traps at the end of each pack may have `clean' sides, so to ensure both sides are coated in adhesive, press back-to-back with a sticky side to transfer the adhesive.
- Attach sticky traps to 1.5 m bamboo poles or similar using the twist ties provided with the traps and metal fold-back clips for extra security.
- Each trap should be positioned on a pole with the bottom edge of the trap level with the top of the crop canopy. Move the trap position upwards as the canopy height increases over the growing season.

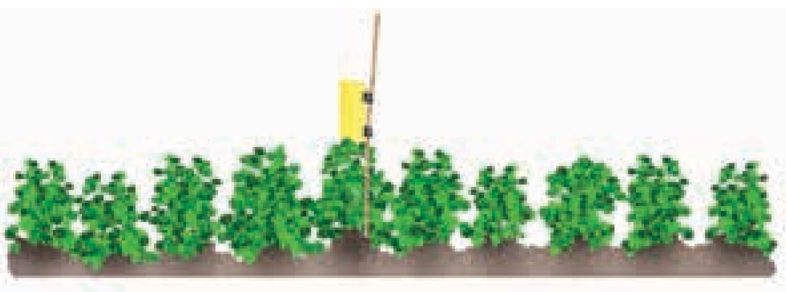

Figure 2. Trap positioning.

Tips for trapping

- Traps should be placed in your crops from planting until harvest. We recommend that you continue your trapping until four weeks after harvest.
- We recommend the use of 10 x 25 cm yellow sticky trap, see end of document for suppliers.
- Traps should be replaced weekly.
- Traps should be wrapped individually with cling film (e.g. GLAD® Wrap) in the field and taken to a more comfortable location for counting. If you send your traps away for assessment and there is a delay in posting them, store them in the refrigerator to help preserve the insects.
- As insecticides have specific modes of action, we recommend that sticky trap monitoring is carried out alongside visual plant assessment, to gauge the numbers of eggs and nymphs, and the presence and impacts of important insect predators. Examine middle leaves of plants, paying particular attention to the underside of each leaf selected.

Plant & Food RESEARCH
RANGAHAU AHUMĀRA KAI

Trap placement

- Use a minimum of five traps per field.
- Place four traps five metres into the crop from the field margin, one per side, and one in the centre of the crop.

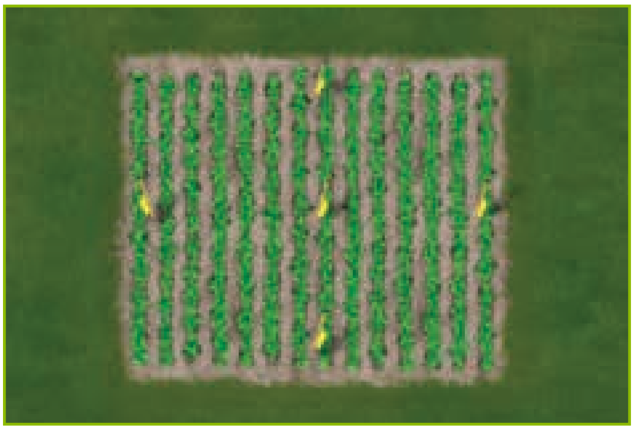

Figure 3. Trap placement.

Trap assessment

- If you send traps away for assessment, they must be clearly labelled with your name, site details, date put in the crop, date removed from the crop and position of the trap in the field.
- If you are assessing your own traps, you will require a magnifying glass (or access to a microscope), a permanent marker for circling TPP and a recording sheet. (http://bit.ly/GGHO8F).

Figure 4. Trap assessment label sample.

How you can help

Allow access to your spray diary information – this can help explain fluctuations in the numbers of TPP caught on your traps.

Provide information about the types of vegetation (weeds, shelter plants) surrounding your crops.

Inform us of anything out of the ordinary in relation to pest or disease incidence and yield you observe in your crops from year to year.

Resources

Plant & Food Research
Auckland 09 925 7000 or Lincoln 03 977 7340
www.plantandfood.co.nz

Suppliers of both sticky traps and crop monitoring services

Fruitfed Supplies:
www.fruitfed.co.nz or 06 873 0956
Horticentre:
www.horticentre.co.nz or 0800 855 255

Suppliers of sticky traps only

CRT Farmlands:
www.crt.co.nz or 0800 278 583

Crop monitoring service providers only

SGS: www.sgs.co.nz or 0800 747 2474

Psyllid resources

Potatoes New Zealand:
www.potatoesnz.co.nz

Acknowledgements

This work was funded by the Ministry for Primary Industries, Sustainable Farming Fund SFF 11/058: IPM Tools for psyllid management.

For further information

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Potato Update

Issue 2

Potatoes NEW ZEALAND Growing together

Degree Days and how to use them in tomato potato psyllid management decisions

How do insects grow and develop?

- Heat is required for insects to develop from one stage in their life to another, i.e. eggs – nymphs – adults.
- The warmer the weather the faster they develop and the cooler the temperature the slower they develop.
- All insects have a cut off temperature below which development is negligible (lower development threshold) and a maximum temperature at which the rate of development stops (upper development threshold). These thresholds can be used in predicting insect development.

What are Degree Days and how are they calculated?

- Degree days measure insect growth and development in response to daily temperatures.
- In a 24 hour period degree days can be calculated as follows:

[(Temp Min + Temp Max)/2] - Lower development threshold = DD

- One degree day accumulates for each degree the average temperature remains between the lower and upper development threshold over 24 hours.
- Several degree-days can accumulate during a 24-hour period.
- For example with TPP (7.1–33.6°C development range), on a day when the average temperature is 18.1°C, 11 degree days would accumulate.
- It takes 358 degree days for TPP to develop from an egg to an adult, i.e. to complete 1 generation (Tran et al. 2012. Environmental Entomology 41: 1190-1198).

Tips for trapping

- Tomato potato psyllid (TPP) development occurs between 7.1 and 33.6°C.
- The warmer the weather the faster TPP develop, therefore it is possible to use degree days to predict their development.
- It takes TPP 358 degree days to develop from an egg to an adult. Thus, if the average temperature was 17.1°C it would take 35.8 days to go from an egg to adult.
- Degree days can be useful early in the season to time first insecticide application.
- Degree days are best used in conjunction with monitoring to decide on spray timings.

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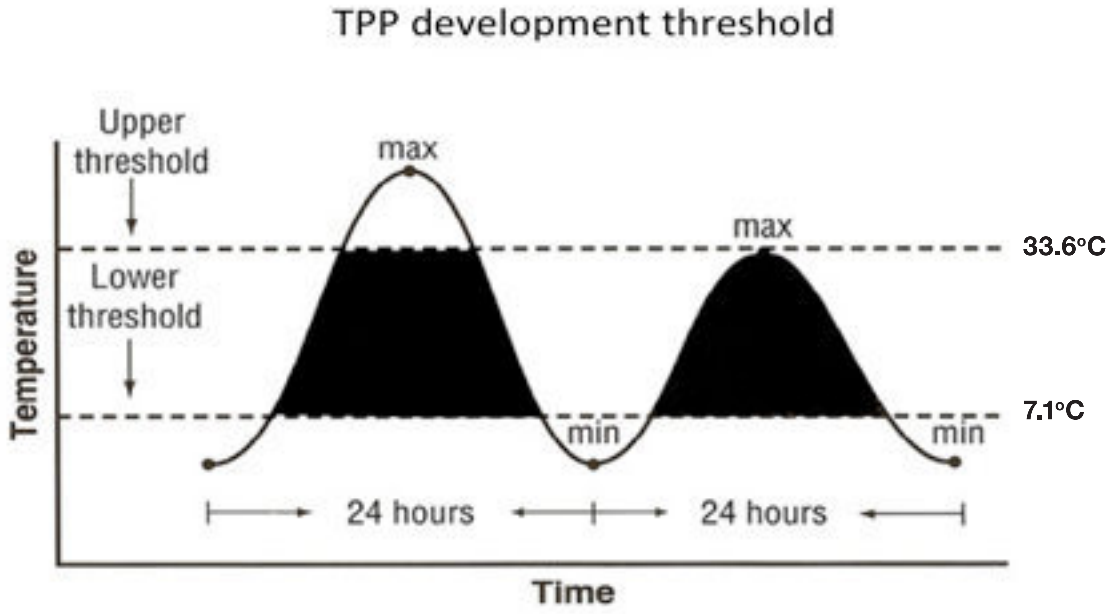

Figure 1. TPP development threshold.

Using degree days for tomato potato psyllid management

- Accumulated degree days can be an important decision support tool in Integrated Pest Management (IPM) programmes.
- Depending on weather conditions insect development varies between years and locations. For TPP, by January insect development can be one to two weeks faster in a year with warm spring weather than in a year with cold spring weather. Similarly, insect development may be several weeks faster in Pukekohe than Chertsey (Canterbury).
- Degree days can be used to optimise the timing of insecticide applications rather than relying on calendar dates.
- Degree days are most useful early in the season, as insecticide applications, rain and irrigation may alter TPP populations. Once eggs are found in your crop, 358 degree days later those eggs will potentially be adults.
- As the season progresses you will have all TPP life stages in your crop.

Things to consider

- Psyllids are active throughout the year, even in frosty areas.
- Degree days are best used in conjunction with crop monitoring using sticky traps and plant sampling. Crop monitoring provides valuable information on TPP arrival, population build up and the life stages present in your crop and you can choose your insecticide accordingly (see the PNZ TPP management poster and the other factsheets).
- It is important to be aware of other plants near your crop that can sustain TPP and act as a source of infestation. These include African boxthorn, thornapple and Poroporo but also volunteer potatoes (please see Potato Update 3 'Non-crop host plants of tomato potato psyllid in New Zealand' for more information).

Acknowledgements

This work was funded by the Ministry for Primary Industries, Sustainable Farming Fund SFF 11/058: IPM Tools for psyllid management.

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Potato Update
Issue 3

Non-crop host plants of tomato potato psyllid in New Zealand

What is a host plant?

A host plant is a plant on which TPP completes its full lifecycle from egg through to adult.

What crops are host plants of TPP?

Crops belonging to the Solanaceae and Convolvulaceae family, which includes potatoes, tomatoes, capsicums, chilli peppers, goji berries, tamarillos, eggplant, tobacco, kumara/sweet potato and taewa/Māori potatoes.

Why do you need to be aware of non-crop host plants of TPP?

Some of the species described below such as African boxthorn, Jerusalem cherry and Poroporo have all life stages of TPP on them all year round. This is the case for all of New Zealand, even frosty areas. This means that whether you have a crop in the ground or have harvested your crop and it is the middle of winter, TPP are potentially surviving and breeding on non-crop plants in or near your crop.

Key points

- Tomato potato psyllid (TPP) can complete its lifecycle on a number of crop and non-crop plants.
- Some non-crop host plants can provide a host for TPP all year round even in frost prone areas.

Non-crop host plants in New Zealand

Following is a list of the most important host plants that may be present around your potato crop.

Common name: African boxthorn
Botanical name: *Lycium ferocissimum*
Description: Evergreen perennial. Chinese boxthorn is similar but is deciduous.
Distribution: Throughout New Zealand, predominantly in coastal areas.

Photo: John Barkla.

Photo: Anna-Marie Barnes.

Common name: Poroporo
Botanical name: *Solanum laciniatum or S. aviculare*
Description: Perennial shrub.
Distribution: *S. laciniatum*: throughout New Zealand; *S. aviculare*: throughout NI and SI as far south as Banks Peninsula and south Westland.


Photo: Anna-Marie Barnes.


Photo: Phil Bendle.

Common name: Thornapple
Botanical name: *Datura stramonium*
Description: Summer annual.
Distribution: Common in the North Island. Scattered in northern/central South Island.


Photo: H. Zell.


Photo: H. Zell.

Common name: Apple of Peru
Botanical name: *Nicandra physalodes*
Description: Frost tender annual. Often found in association with thornapple.
Distribution: Occasional to common in frost-free North Island localities. Occasional in warmer South Island places as far south as Canterbury.


Photo: Peter de Lange.


Photo: John Smith-Dodsworth.

Common name: Jerusalem cherry
Botanical name: *Solanum pseudocapsicum*
Description: Evergreen perennial shrub.
Distribution: Occasional in warmer, frost-free areas of both North and South Islands.

Photo: H. Zell.

Common name: Chinese boxthorn
Botanical name: *Lycium barbarum*
Description: Deciduous perennial shrub.
Distribution: Occasional throughout New Zealand.

Photo: Pancrat.

Common name: Field bindweed
Botanical name: *Convolvulus arvensis*
Description: Perennial.
Distribution: Occasional throughout New Zealand. Common in Hawke's Bay, Nelson, Marlborough and Canterbury.

Photo: Mike Lusk.

Acknowledgements

This work was funded by the Ministry for Primary Industries, Sustainable Farming Fund SFF 09/143: Sustainable psyllid management and the Plant Biosecurity Cooperative Research Centre PBCRC2079: Understanding the role of alternative host plants in tomato potato psyllid and Liberibacter life cycle and ecology.

For further information

For more detailed information and additional photographs on the above plants please refer to the New Zealand Plant Conservation Network webpage (http://www.nzpcn.org.nz) or Nature Watch NZ (http://naturewatch.org.nz). We would like to thank the New Zealand Plant Conservation Network for providing most of the pictures.

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July 2014

Potato Update

Issue 4

Potatoes NEW ZEALAND Growing together

Oils and selective insecticides for tomato potato psyllid management in potato

Introduction

This factsheet aims to introduce oils and selective insecticides suitable for inclusion in developing integrated pest management (IPM) programmes to combat TPP in potatoes. When developing effective and sustainable pest management strategies, and especially when it involves insect vectors, it is important to not rely on chemical control alone – other control mechanisms (cultural, physical and biological) should always be included to minimise the build-up of insecticide resistance, minimise insecticide use and optimise pest control.

Oils are active against pest insect species but are less harmful than broad-spectrum insecticides to non-target species, reducing disruption of biological control agents.

Selective, narrow-spectrum insecticides also cause less harm to some types of insects than they do to others (please see Potato Update 5 'Protecting beneficial insects in potato crops' for more information).

Reduced spray programmes

These are part of sustainable pest management strategies and decrease the chances of pest insects developing resistance to insecticides. Options to reduce the number of insecticide sprays are:

- Incorporating oils into the spray programme.
- Increasing spray intervals, e.g. from 7 to 10 days.
- Using monitoring (plant and/or sticky traps) to determine the start of a spray programme.
- Using developed action thresholds to determine the start of a spray programme (Auckland only).
- Using Degree Days to determine the start of a spray programme.

Key points

- Both oils and a number of selective insecticides can be used in IPM programmes to control tomato potato psyllid (TPP).
- IPM programmes reduce the number of insecticide sprays and reduce the risk of resistance.
- Monitoring, using sticky traps or plant sampling, along with action thresholds and an understanding of insect development in degree days can be used to guide the start of spray programmes.
- Insecticide spray programmes should use a range of different insecticide mode of action groups to reduce the risk of resistance.

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Considerations for best practice for Insecticide Resistance Management (IRM) in potatoes

	Auckland and possibly rest of North Island	Canterbury
Emergence until December	Thiamethoxam should not be needed. Beneficial insects should control early season aphids and TPP.	Thiamethoxam is widely used. Effect of beneficial insects on pest insects present not determined early season.
December onwards	Think about which reduced spray programme would work for you. A best practice programme includes: • spirotetramat (2 applications) • abamectin (4 applications) • spinetoram (4 applications) • cyantraniliprole (3 applications) is also available for early use, but is mainly untested. • Then, other mode of action (MoA) insecticides should be used to protect the crop from late season TPP and potato tuber moth (PTM). Note that resistance to synthetic pyrethroids (SPs) is reported for PTM in the north of the North Island. • Protect the crop from TPP and PTM right through until harvest, including after desiccation.	Think about which reduced spray programme would work for you. A best practice programme includes: • spirotetramat (2 applications) • abamectin (4 applications) • spinetoram (4 applications) • cyantraniliprole (3 applications) is also available for early use, but is mainly untested. • Then, other mode of action (MoA) insecticides should be used to protect the crop from late season TPP. • Protect the crop from TPP right through until harvest, including after desiccation.

Points to remember

- Rotate your different mode of action insecticides to decrease the risk of insecticide resistance in insects. Some active ingredients have the same modes of action; please check the Potatoes NZ poster, the product label and the Novachem manual for more information or visit the Insecticide Resistance Action Committee (IRAC) website (www.irac-online.org) for comprehensive data and default recommendations on IRM strategies.
- Visit www.sripmc.org/IRACMOA/IRMFactSheet.pdf for more information on IRM.
- Check the product label, the Potatoes NZ poster or the Novachem manual for more details on maximum number of applications for a product and recommended spray intervals.

Summary of effects of oils and selective insecticides on transmission of *Candidatus* Liberibacter solanacearum (CLso) and individual tomato potato psyllid life stages from SFF 11/058 laboratory studies. Symbols: ✔ = significant effect observed; (-) = slight or limited/short-lived effect observed; (✔) = potential residual effect on egg hatching rate; 0 = no significant effect was observed; NA = product/insect combination was not tested.

Product	Active ingredient	Classification	Mode of action	CLso transmission reduction[1]	Reduced oviposition or egg hatching[2]	Increased nymph mortality[2]	Adult repellence[1]	Increased adult mortality[1]
Organic JMS Stylet-Oil®	Mineral oil + adjuvant	Contact	Suffocation	0	(✔)	✔	✔	0
Excel® Oil	Mineral oil	Contact	Suffocation	✔	(✔)	✔	✔	0
Sap Sucker Plus/ Thunderbolt	Oxygenated monoterpenes, neem oil, dispersants and adjuvants	Contact	Inhibits feeding behaviour and development	0	(✔)	✔	✔	0
Benevia®	cyantraniliprole	Translaminar, systemic (xylem), contact (minor)	Disrupts muscle function, inhibits feeding behaviour	0	✔	✔	0	✔
Movento®	spirotetramat	Translaminar, systemic (phloem + xylem)	Reduces adult fertility and survival of offspring	0	✔	✔	NA	(-)
Sparta™	spinetoram	Contact, translaminar	Nerve poison, inhibits feeding behaviour	0	(-)	✔	(-)	✔
Avid®	abamectin	Translaminar	Nerve poison, inhibits feeding behaviour	✔	✔	✔	NA	✔

[1] Based on residual activity only.
[2] Based on residual and/or direct spray effects.

Acknowledgements

This work was funded by the Ministry for Primary Industries, Sustainable Farming Fund SFF 11/058: IPM Tools for psyllid management.

For further information

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Potato Update

Issue 5

Potatoes New Zealand
Growing together

Protecting beneficial insects in potato crops

Introduction

Tasmanian lacewings, hoverflies and eleven-spotted ladybirds are all predators of the tomato potato psyllid (TPP) and they will eat all life stages of this pest, being adults, nymphs and eggs, although this latter life stage is less preferred. If given a chance, these beneficial insects will get into potato crops and attack pests 24/7. Research in the SFF 11/058 programme has shown that there are selective products that will help control the psyllid but cause little or no short-term mortality to the key beneficial insects in New Zealand potato crops.

To keep beneficial insects working in your crops for longer:

- Minimise insecticide use if possible
- Use selective products, especially early season when beneficial insects are most likely to make an impact on TPP populations
- Save other products for use later in the season

Key points

- Lacewings, hoverflies and ladybirds are all predators of tomato potato psyllid.
- Selective insecticides can help control tomato potato psyllid but cause little damage to beneficial insects.

The following is a summary of non-target impacts of selected insecticides and oil-based products on key New Zealand beneficial insects, based on short-term laboratory assays conducted for SFF 11/058 (2012–14). Note that field impacts on beneficial insects may be less severe because the amount of exposure will differ. Assay results are indicated by two triangles, the first summarising direct spray assays, the second summarising residue assays. Symbols follow the IOBC (International Organisation for Biological Control) non-target impacts classification for laboratory trials: ▲ = <30% mortality (harmless or slightly harmful), ▶ = 30–79% mortality (moderately harmful), ▼ = >79% mortality (harmful). NA indicates that a species/product combination was not tested.

Active ingredient (product and adjuvant actually tested)	IRAC[1] group (sub-group or exemplifying active ingredient)	HSNO environmental hazard classifications:	New Zealand beneficial insect species		
			Tasmanian lacewing larvae (*Micromus tasmaniae*)	Small hoverfly larvae (*Melanstoma fasciatum*)	11-spotted ladybird adults (*Coccinella undecimpunctata*)
methamidophos (Tamaron®)[2]	1 (organo-phosphates)	Tamaron: 9.1A,9.2B,9.3A,9.4A	▼▼	▼▼	▼▼
spinetoram (SpartaTM plus Bond®Xtra)	5 (spinosyns)	Sparta: 9.1A,9.4A	▲▼	▶▶	NA
abamectin (Avid® plus Eco-Oil®)	6 (avermectins)	Avid: 9.1A,9.2C,9.3B,9.4A	▲▲	▲▶	NA
spirotetramat (Movento®)	23 (tetronic and tetramic acid derivatives)	Movento: 9.1B	▲▲	▲▲	NA
cyantraniliprole (Benevia® plus Actiwett®)	28 (diamides)	Benevia: 9.1A,9.4B	▲▲	▲▶[3]	NA
paraffinic mineral oil (JMS Organic Stylet Oil®)	-	OrganicJMS Stylet Oil: 9.1B	▶▲	▲▲	▲▶
paraffinic mineral oil (Excel® Oil)	-	Excel Oil: 9.1D	▶▲	▲▲	▲▶

[1] IRAC stands for Insecticide Resistance Action Committee, see http://www.irac-online.org/ for more information.
[2] Please note that Tamaron is no longer commercially available.
[3] Mean mortality < 30% but some surviving larvae unable to move normally and unlikely to complete development.

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Acknowledgements

This work was funded by the Ministry for Primary Industries, Sustainable Farming Fund SFF 11/058: IPM Tools for psyllid management.

For further information

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Potato Update

Potatoes NEW ZEALAND Growing together

Issue 6

Effect of irrigation rates and timings on marketable tuber yield of Russet Burbank potatoes

Introduction

In Canterbury, irrigation is essential for maximising potato yields, as summer rainfall is often inadequate. Since all crops need irrigation during this period and water is a limited resource in most farming systems, it is helpful to know where water savings can be made for potato crops, without compromising yield. Additionally, excessive watering can risk drainage and leaching. This project investigated a range of irrigation amounts and timings to test their impact on tuber yield and quality.

Method

The research was undertaken on a commercial farm at Dorie, Mid Canterbury, using the processing cultivar 'Russet Burbank'. The soil type was a deep Templeton silt loam with storage to 50 cm depth of about 80 mm of crop-available water when full. The crop was planted on 30 September 2014 and received the same management and inputs that the grower used except for the water application. The trial was set up with four replicates of seven irrigation treatments and each plot was four rows by 10 m. Soil water content was monitored using time domain reflectometry (TDR) sensors, which were placed in the ridge to a depth of 50 cm and under the furrow to a depth of 25 cm. Water was applied weekly through drip irrigation set up along the top of the ridge.

The treatments were:
1. No irrigation (rain fed only).
2. Replace 33% of soil water deficit (SWD) weekly.
3. Replace 66% of SWD weekly.
4. Replace 100% of SWD weekly.
5. Replace 100% of SWD weekly until canopy closure, then replace 50% of SWD weekly.
6. Replace 50% of SWD weekly until canopy closure, then replace 100% of SWD weekly.
7. Replace 100% of SWD weekly, except once after canopy closure.

Final harvest was carried out for the middle two rows by 4 m of each plot and graded into three tuber size classes; 0-60 mm (reject) 60-90 mm and >90 mm.

Key points

- An irrigation trial (drip tape) with seven treatments ranging from no irrigation (rain fed) to 100% replacement of the soil water deficit was established in a commercial 'Russet Burbank' crop at Dorie, Mid Canterbury.
- Marketable yield was reduced from 79 t/ha to 40-60 t/ha when weekly irrigation fell below 66% of the soil water deficit.
- Irrigation reduced the amount of small (<60 mm) and medium (60-90 mm) sized tubers and increased the yield of large tubers (>90 mm).
- Replacing 66% of the soil water deficit weekly was the most water use efficient.
- Replacing only 50% of the soil water deficit after canopy closure gave a yield penalty of 10 t/ha.
- The treatment which applied only 50% of the deficit up until canopy closure, then 100% thereafter, had a similar size distribution and yield to the full irrigation treatments.
- Similarly, missing one week's irrigation at canopy closure did not influence marketable yield.

Results

Treatment 4 (fully irrigated) along with treatments 6 and 7 produced the highest marketable yields at 79 t/ha (Figure 1). Irrigation replacing less than 66% SWD reduced marketable yield by 40 t/ha for treatment 1 (rain fed) and 15 t/ha for treatment 2 (33% SWD replaced). There was no significant difference between full irrigation and only replacing 66% of SWD (76 t/ha vs 79 t/ha). Constant water stress after canopy closure (treatment 5) reduced yield to 69.5 t/ha. Stress before canopy closure (treatment 6) had no effect on yield.

Irrigation reduced the yield of small tubers (0-60 mm) from 2 t/ha under nil irrigation to 1 t/ha under all the other treatments (Figure 2). Similarly, irrigation reduced the yield of medium sized tubers from 21 t/ha under nil irrigation to between 12 and 14 t/ha under adequate irrigation (treatments 3, 4, 6 and 7). Conversely, the yield of large tubers of >90 mm increased when adequately irrigated (17 t/ha with no irrigation compared to about 65 t/ha for treatments 3, 4, 6 and 7). There was a similar marketable yield and tuber size distribution pattern for treatments 3 and 4 (66% and 100% SWD replacement).

Replacing 50% of SWD after canopy closure reduced the >90 mm tuber yield by 14 t/ha, compared to treatments 3, 4, 6 and 7. Reducing irrigation to 50% prior to canopy closure (treatment 6) did not influence the yield or size distribution of potatoes. Similarly missing a week's irrigation (e.g. irrigator breakdown) at canopy closure (treatment 7) did not influence yield or tuber size distribution.

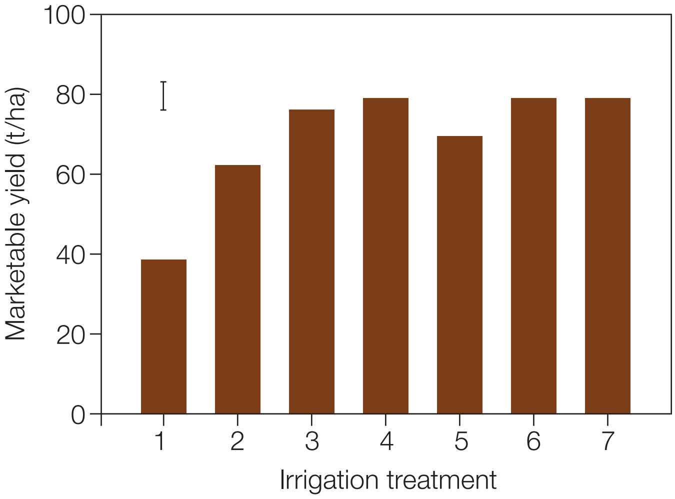

Figure 1. Marketable yield (t/ha) for 7 irrigation treatments, cv. 'Russet Burbank' at Dorie, Mid Canterbury. Bar represents LSD (p = 0.05, df=18).

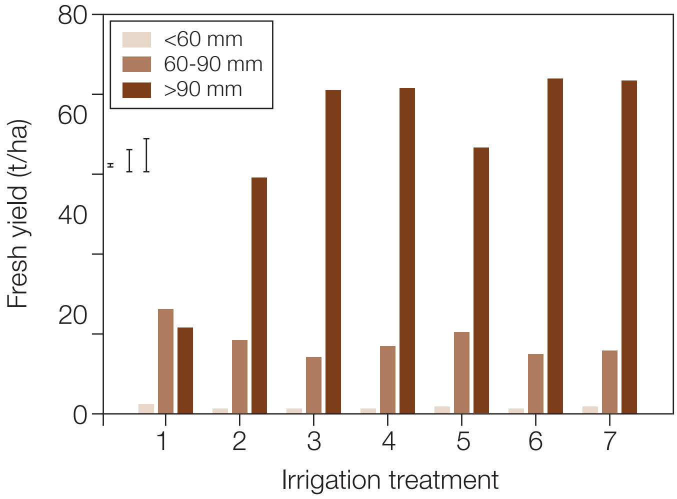

Figure 2. Distribution of tuber size in diameter <60 mm, 60-90 mm and >90 mm (fresh yield t/ha) for 7 irrigation treatments, cv. 'Russet Burbank' at Dorie, Mid Canterbury. Bars represents LSD (p = 0.05, df=18).

Discussion

In this situation (deep soil, drip irrigation), replacing 66% of SWD weekly yielded the same as 100% replacement, showing that matching water supply closely to crop needs can save water and reduce the risk of leaching and drainage. For 'Russet Burbank', early water stress had less impact on yield than did stress during the main period of tuber bulking. However, other cultivars may be more sensitive to early water stress during tuber initiation. As water infiltration and runoff patterns are likely to be different under sprinkler irrigation, growers should be wary of applying any of the 'optimum' irrigation regimes discussed here to sprinkler irrigated crops.

Acknowledgements

We thank Geoff Maw and Kyle Grey for hosting the trial and management of the crop, Plant & Food Research for their collaboration and input on the project and the FAR team for their effort throughout the season.

Potato Update

Issue 7

Potatoes NEW ZEALAND Growing together

Development of region-specific sustainable management programmes to lower zebra chip disease in process potatoes

Introduction

The incidence, importance and timing of pests varies markedly between potato growing regions in New Zealand. The aim of the three field trials in Pukekohe, Manawatu and Canterbury was to develop regionally focused pest management strategies, initially focussing on tomato potato psyllid (TPP) and zebra chip disease. This project focussed on developing sustainable, reduced insecticide management strategies by: using thresholds to commence a spray programme (psyllid-count based or Degree Days) and incorporation of agricultural oils into a spray programme to protect the crop from insect pests and consequently from being affected by zebra chip disease and viruses (aphids).

Method

The research was undertaken on commercial farms in the three main potato growing regions. All crops were planted and maintained by the growers except for the insecticide treatments.

Location	Cultivar	Planted	Harvest
Mauku, Pukekohe	'Moonlight'	5 November 2014	21 April 2015
Cheltenham, Manawatu	'Nadine'	11 September 2014	26 February 2015
Southbridge, Canterbury	'Agria'	23 October 2014	16 April 2015

Five yellow sticky traps per crop were replaced and assessed weekly to keep count of TPP numbers. The trials were set-up with six replicates of six treatments. Insecticides were applied using a knapsack sprayer at 400L/ha and 420 kPa pressure. Each plot was six rows by 7 m.

The treatments were:

No.	Description
1	Standard: Weekly insecticides from emergence
2	Weekly insecticides from 980 degree days (DD) after 1 July
3	Weekly from 3TPP/trap/week
4a	Alternating with an agricultural oil the first 6 weeks from 980 DD after two sprays of Spirotetramat (Pukekohe only)
4b	Alternating with an agricultural oil from emergence after two sprays of Spirotetramat (Manawatu and Canterbury)
5	Mesh crop covers added before emergence, no insecticides
6	Untreated control, no insecticides

Key points

- The incidence, importance and timing of pests varies markedly between potato growing regions in New Zealand.
- Field trials were established in Pukekohe, Manawatu and Canterbury to develop regionally focused pest management strategies, initially focussing on tomato potato psyllid (TPP) and zebra chip disease.
- The accumulated degree days trigger used in treatment 2, has not worked in Canterbury for two years in a row. This is in contrast to trials in the North Island where these treatments work well. This season, a refined trigger will be tested in Canterbury.
- Zebra chip disease incidence can be highly variable in a crop. It is determined by TPP distribution in a field and how many psyllids carry the bacterium that causes the disease.
- Spray timings seem to be quite important to manage zebra chip disease.

FAR

Harvest was carried out for the middle two rows by 5 m of each plot and graded on a commercial grader into marketable (>100g), unmarketable (<100g) and reject (diseased/green/insect damage) tubers. Of a subset of marketable tubers, 1 slice (crisp) per tuber was taken and fried for 2 min at 190 °C. Thirty slices per plot were assessed for zebra chip disease on a scale from 0-9.

Results

Because of the very short season and low numbers of TPP, the Manawatu trial was not analysed.

Pukekohe

Psyllid numbers on the traps increased after 1 January. Shortly after that date, the spray for 980 DD (treatment 2 & 4a) was due as well as the spray for the threshold of 3 TPP/trap/week (treatment 3) (Figure 1). Except for mesh crop covers (treatment 5, 45.5 t/ha; 281,000 tubers/ha), marketable weights and numbers for all treatments were higher than for the unsprayed control (68 t/ha; 365.000 tubers/ha, Table 1). As expected, the insecticides used in the different programmes led to a yield increase, up to 16% in this trial.

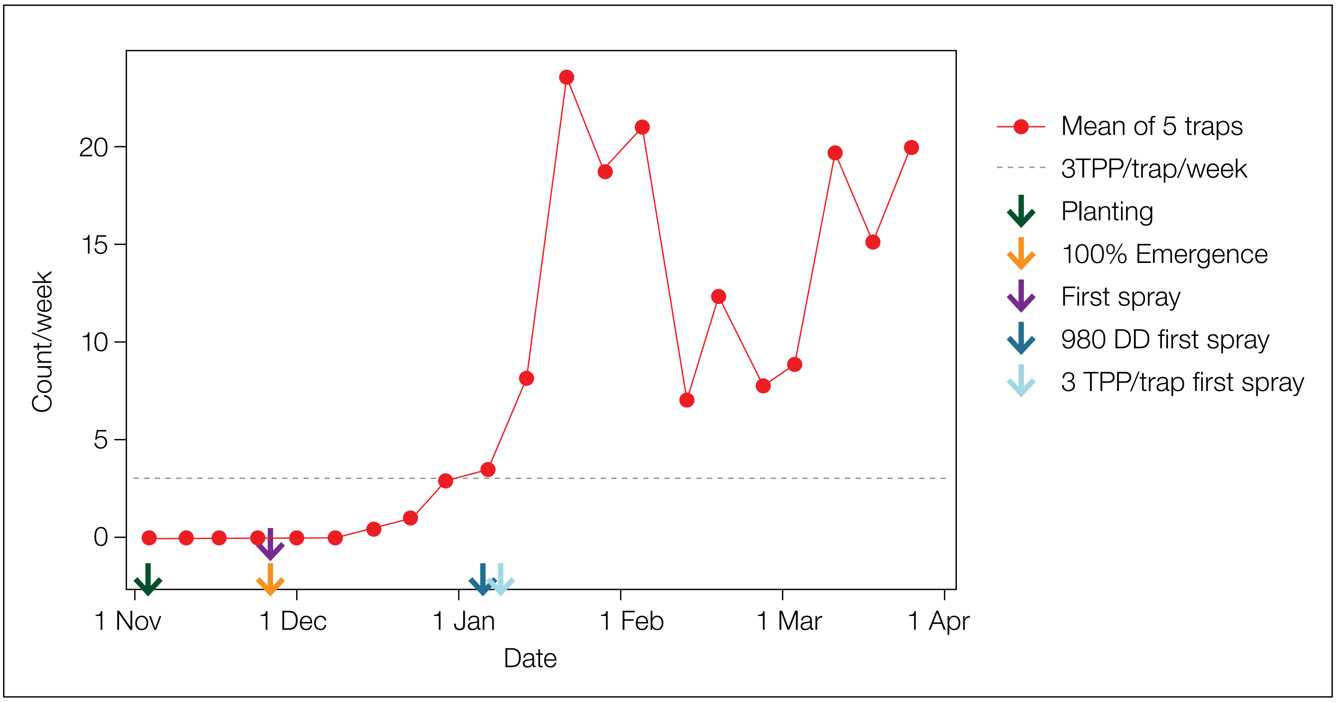

Figure 1. Mean number of TPP caught on yellow sticky traps in Pukekohe. There were 5 sticky traps in the crop.

Zebra chip disease incidence did not vary significantly between the treatments at harvest, although it was highest for the control. The percentage of tubers with zebra chip scores greater than 2 did not vary significantly between treatments. To calculate the profitability of a treatment, the insecticide costs per hectare (including application) were deducted from the marketable yield. In addition, the efficacy of each programme results in more or fewer tubers with zebra chip, which also needs to be accounted for in the profitability. Therefore the treatment with the highest marketable yield may not be the most profitable one. Although the relative profit for all treatments using insecticides was similar, treatment 4a resulted in the highest profit (Table 1).

Table 1. Mean number of TPP caught on yellow sticky traps in Pukekohe. There were 5 sticky traps in the crop.

Trt	Number of insecticide sprays	Number of marketable tubers (per 7.5m^2)	Marketable yield (t/ha)	ZC adjusted marketable yield (t/ha)[1]	Relative profit adjusted for ZC[2]
1	16	277.3	76.7	73.9	100
2	11	280.3	79.4	73.7	100.2
3	10	278.3	76.6	74.5	101.4
4a	6 + 5 oils	289.8	77.4	76.2	104.0
5	0	211.8	45.5	45.0	60.8
6	0	274	68.4	67.7	93.7

[1] The weight of marketable tubers with zebra chip discolouration that is generally unacceptable for processors has been deducted from the original marketable weight.
[2] The cost of the insecticides and labour/ha for applying them was deducted from the marketable weight. Treatment 1, the full spray programme, is set at 100. For treatment 5 (mesh covers), a total of $1025/ha was used to cover the cost of the mesh and labour to apply it – this may however not be representing the real costs correctly.

Canterbury

Psyllid numbers on the traps increased after 1 January. Shortly after that date, the 3 TPP/trap/week spray (treatment 3) was due (Figure 2). However, the 980 DD treatment date (treatment 2) was not due until 22 January. Marketable weights and numbers did not vary significantly between the treatments (Table 2). As expected, the insecticides used in the different programmes led to a yield increase, up to 9% in this trial.

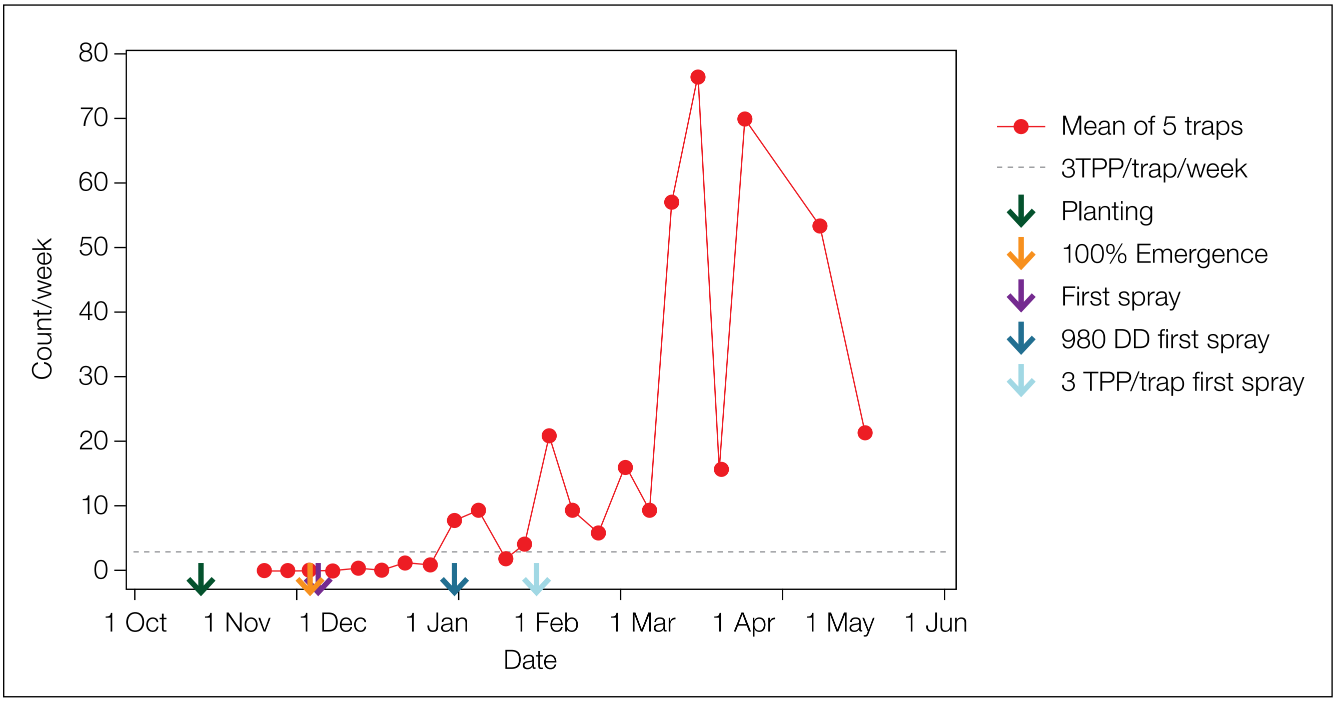

Figure 2. Average number of TPP caught on yellow sticky traps in Canterbury. There were 5 sticky traps in the crop.

Zebra chip disease incidence at harvest varied somewhat between the treatments, with incidence lower for all treatments than for the unsprayed control, and significantly so for treatment 3. The percentage of tubers with zebra chip scores greater than 2 did not vary significantly between treatments at harvest.

Table 2. Marketable yield (number of tubers and t/ha), the zebra chip (ZC) adjusted marketable yield and ZC adjusted relative profit for each of the treatments in the Canterbury trial.

Trt	Number of insecticide sprays	Number of marketable tubers (per 7.5m^2)	Marketable yield (t/ha)	ZC adjusted marketable yield (t/ha)[1]	Relative profit adjusted for ZC[2]
1	18	216.7	64.0	61.2	100
2	9	171.2	54.4	51.4	84.5
3	12	178.7	52.5	51.1	83.5
4b	11 + 7 oils	186.8	55.1	53.3	87.1
5	0	177.7	56.7	56.1	92.6
6	0	193.8	58.6	54.7	91.9

[1,2] For footnote explanations see Table 1.

Discussion

In Pukekohe, similar to the Sustainable Farming Fund field trial in 2013/14, treatment 4a was the most promising and profitable treatment of the reduced spray programmes.

In Canterbury, similar to the Sustainable Farming Fund field trial in 2013/14, treatment 4b was the most promising of the reduced spray programmes. For profitability, it was just slightly lower than mesh or no insecticide use. The accumulated DD trigger used in treatment 2 has not worked in Canterbury for two years in a row. This is in contrast to trials in the North Island where the DD treatments work well. This season, a refined trigger will be tested in Canterbury.

In general, zebra chip disease incidence can be highly variable in a crop; it is determined by TPP distribution in a field and how many of them carry the bacterium that causes the disease. The potato plant itself also adds variability: how it responds to the disease, when it was infected, and yield in general. Spray timings seem to be quite important to manage zebra chip disease. So keep an eye on the sticky traps and on TPP in your crop.

Acknowledgements

We thank Andy Bailey, Ian Corbett and Bruce and Wayne Carter for hosting the trial, Peracto for applying the insecticides and agricultural oil, Charles Merfield (Future Farming Centre) for supplying the mesh cover, Plant & Food Research for their project management and effort throughout the season and the FAR team for their collaboration.

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Potato Update

Issue 8

Potatoes NEW ZEALAND
Growing together

Evaluation of seed tuber and in-furrow fungicides on the control of soil-borne diseases in potatoes

Introduction and methods

Soil-borne diseases are prevalent in potato crops and are often likely to reduce crop yields. However, due to the wide range of soil-borne diseases occurring in potato crops, it is often hard to identify how much of a role fungicide plays in suppressing and controlling them. In order to investigate this, a replicated trial was set up in a commercial potato crop at Levels, South Canterbury with the cultivar Innovator (planted 12 October 2015). The trial site was last in potatoes four years previously, so disease pressure was likely to be high.

The aim of the trial was to evaluate different fungicides and application methods in order to evaluate their efficacy for control of soil borne diseases (Table 1). The chemical treatments were applied either directly to the seed tubers or as in-furrow sprays at planting, prior to closing the furrows. Standard crop management was undertaken by the grower for the remainder of the season. Disease assessments were carried out at two crop growth stages, full canopy, 14 weeks after planting, and late canopy, 18 weeks after planting. A final yield assessment based on marketable tubers (t/ha of tubers >65 mm) was carried out at crop maturity.

Table 1. Treatments, their active ingredients, target disease and application methods (either applied to the potato seed or in-furrow at planting) assessed in South Canterbury in the 2015/16 season.

Treatment	Active ingredient	Application method	Target diseases*
Nil (control)	-	-	-
Monceren®	pencycuron	seed tuber	*stem canker, black scurf
Monceren® + Amistar®	pencycuron + azoxystrobin	seed tuber + in-furrow	*stem canker, black scurf, silver scurf
Amistar®	azoxystrobin	in-furrow	*black scurf, silver scurf
Amistar® × 2 rate	azoxystrobin	in-furrow	*black scurf, silver scurf
F15/02	penflufen	in-furrow	(Experimental black scurf
F15/02 + F15/03	penflufen + *Bacillus subtilis*	in-furrow	(Experimental) black scurf, soilborne diseases
Nebijin®	flusulfamide	in-furrow	*powdery scab

* Indicates registered use.
Nebijin® is a product registered for control of powdery scab.

Key points

- A replicated trial was set up in a commercial crop at Levels, South Canterbury with potato cultivar Innovator, planted on 12 October 2015. The trial site was four years out of potatoes.
- A number of diseases were found in the sampled plants and tubers including *Spongospora* root galling and tuber powdery scab; *Rhizoctonia* stem canker and tuber black scurf; *Sclerotinia* white mould on stems, black leg on stems, and common scab on tubers.
- *Rhizoctonia* stem canker and *Spongospora* diseases predominated, while the other diseases were at very low incidence levels.
- Nebijin® reduced the severity of powdery scab on tubers at both assessment timings and this reduction was statistically significant when compared to the nil treatment. None of the other treatments affected any of the diseases observed in the trial.
- There were no statistically significant differences between the treatments for unmarketable or marketable yields. Overall mean yield of marketable tubers was equivalent to 82.8 t/ha.

FAR®

Results

The diseases found in the sampled plants and tubers included *Spongospora* root galling and tuber powdery scab; *Rhizoctonia* stem canker and tuber black scurf; *Sclerotinia* white mould on stems, black leg on stems, and common scab on tubers. *Rhizoctonia* stem canker and *Spongospora* diseases predominated, while the other diseases were at very low incidence levels.

Less *Rhizoctonia* stem canker was recorded for the first (full canopy) assessment than for the late canopy assessment as disease severity increased during the trial. However, this disease was very common and severe on the assessed plants, and severity of stem canker was similar for all of the different treatments, including the nil experimental control. Severity of powdery scab was strongly affected by assessment date, with an overall mean severity score for the first (full canopy) assessment of 1.2 (equivalent to 6% of tuber surface affected), and 1.8 (9% tuber surface affected) for the second (late canopy) assessment. Nebijin® reduced the severity of powdery scab at both assessment timings and this reduction was significant when compared to the nil treatment (Table 2).

There were no statistically significant differences between the treatments for unmarketable or marketable yields (Table 3). Yields of harvested marketable tubers were high, with an overall mean equivalent to 82.8 t/ha.

Discussion

Potatoes had been grown in the field four years previously, and a commercial "Predicta Pt" test on soil from the area used for this trial indicated that the trial site had "medium to high" risk of soil borne diseases. Of the different fungicide treatments applied in the trial, only the Nebijin® in-furrow treatment affected incidence and severity of disease. Effects of Nebijin® were detected at both the full canopy and late canopy disease assessments. Nebijin® did not reduce severity of *Spongospora* root galling, but did reduce incidence and severity of powdery scab on the harvested tubers. None of the other treatments affected any of the diseases observed in the trial, including *Rhizoctonia* stem canker which was of high incidence. Although *Rhizoctonia* stem canker and *Spongospora* root galling were common, the yield assessments indicated that these diseases were not at levels sufficient to reduce tuber yields. Furthermore, although powdery scab was reduced by one of the treatments, this reduction was not manifested in a yield response.

These results are very similar to the results from two trials carried out in the 2014/15 season where a range of fungicide seed and soil treatments did not reduce disease incidence or increase yields. The results from the 2015/16 season indicate that in some situations pre-planting fungicide treatments have limited efficacy for management of soil-borne diseases, and did not increase tuber yields. Further work is needed to identify when and which fungicide seed and soil treatments will reduce disease and increase yields.

Table 2. Mean powdery scab severity scores for potato tubers, grown from different fungicide treatments applied at planting, assessed at full and late canopy at Levels, South Canterbury in the 2015/16 season.

	Mean powdery scab severity score*	
Treatment	Full canopy	Late canopy
Nil (control)	1.1	1.9
Monceren®	1.2	1.9
Monceren® + Amistar®	1.1	1.8
Amistar®	1.3	1.7
Amistar® × 2 rate	1.2	1.8
F15/02	1.1	1.6
F15/02 + F15/03	1.2	1.9
Nebijin®	1.0	1.4
LSR (α = 0.05), df = 75	**0.25**	

* Mean score: 1.0 = 2% tuber surface affected, 1.9 = 5% tuber surface affected.

Table 3. Treatment effect on potato tuber total yield and marketable yield (t/ha) at Levels, South Canterbury in the 2015/16 season.

Treatment	Unmarketable yield (t/ha)	Marketable yield (t/ha)
Nil (control)	2.2	84.0
Monceren®	2.9	80.7
Monceren® + Amistar®	2.6	81.5
Amistar®	2.2	82.5
Amistar® × 2 rate	2.3	83.9
F15/02	2.7	85.1
F15/02 + F15/03	2.6	82.4
Nebijin®	1.9	82.4
Mean	**2.4**	**82.8**
LSD (P < 0.05), df = 35	**1.1**	**7.1**

Acknowledgments

Plant & Food Research for expertise with disease assessments and Morgan Bowles for providing the trial site and assistance with planting the trial.

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Potatoes Industry Strategy Refresh 2017

Potatoes New Zealand Inc.

February 2017

Executive Summary

This document outlines the Potato Industry strategic framework and targets refreshed in 2016.

Potato Industry Strategy Targets

The 2016 industry targets remain unchanged from the 2013 strategy. This is appropriate given the timeframe extends to 2025:

1. Increase profit from productivity by $150 per ha per annum
    - Continuous productivity improvement underpins the competitiveness of the industry, both domestically (for resources) and internationally (versus other exporters)
    - Equates to a 12% yield increase and $1500 per ha over ten years

2. Double the value of fresh & processed New Zealand based exports by 2025.
    - Aligned with objectives of the government's business growth agenda
    - Implies volume and value growth

3. Enhance the value of the domestic market by 50% by 2025
    - Implies value growth on stable volumes, above CPI

Contents

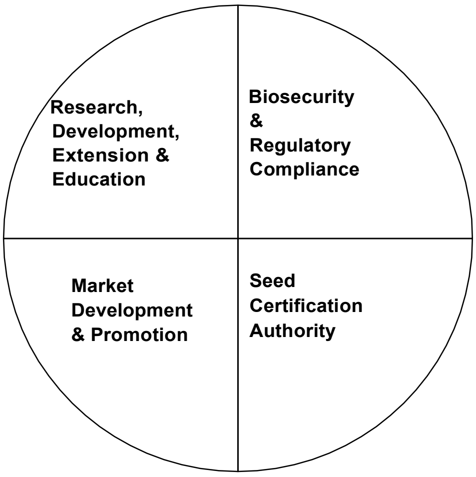
Overview

Potatoes New Zealand Structure and Roles

The 2016 Potato Industry Strategy clarifies the four key roles for Potatoes New Zealand in regards to achieving industry objectives. These are shown below:

Direct R&D initiatives to continuously improve grower productivity, develop new cultivars, use science to resolve major threats and test options. Extension and Education to facilitate adoption by growers.

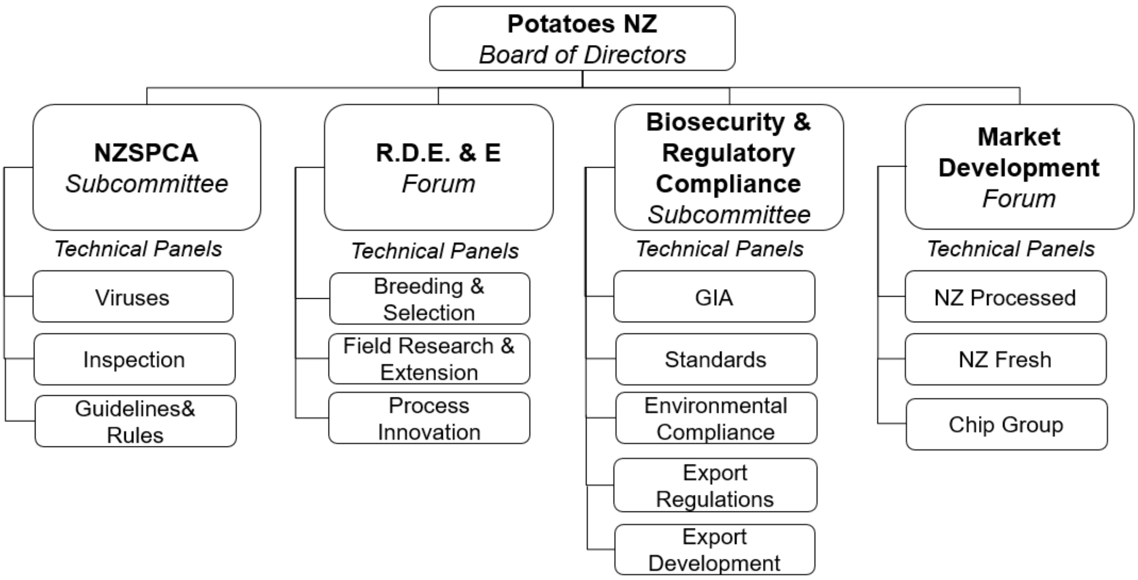
Develop improved access to targeted export markets to enable growth of the New Zealand Industry. Develop, protect and enhance key markets.



Protect the reputation of NZ potatoes, coordinating industry stakeholders in regards to compliance, biosecurity and product standards

Manage an efficient and consistent national seed quality assurance programme

Aligned to these key roles, the 2016 strategy recommends a revision to the industry governance structure with subcommittees, forums and technical panels as per the following chart. Each Sub-committee, Forum and Panel will be responsible for recommending the priorities in its own area of focus.



Refreshed Potato Industry Strategy

The 2016 Industry Strategy comprises three core strategic themes, and two enablement areas for Potatoes NZ.

Core Industry Strategies

Quality
- Standards
- Compliance
- Biosecurity

Markets
- Process Export Markets
- Fresh Export Markets
- Domestic Markets

R.D. & E.
- Productivity Research
- Productivity Development and Extension On-Farm
- Process innovation

Potatoes NZ Enablement Strategies

Industry Good Process
- Coordinated Planning Cycles
- Reporting and Accountability

Industry Good Structure
- Industry Governance
- Relationship Management

The Quality theme comprises the four essential industry functions of maintaining compliance, biosecurity and standards. Potatoes New Zealand performs an essential function in representing growers' interests, keeping growers informed of developments and coordinating industry initiatives.

The Market theme comprises both export and domestic markets. It recognises that manufacturing is a vital mainstay of the New Zealand industry, for both domestic and export markets. It also recognises the opportunity to enhance the value of fresh markets.

The Research, Development and Extension (R. D.& E.) theme comprises both on-farm productivity and manufacturing innovations. The first includes fundamental research that drives on-farm productivity innovations, including plant breeding, and also the development and extension activities on-farm to achieve actual gains for growers. The second part focuses on process innovations for the manufacturing sector to increase manufacturing productivity, and includes new product innovations and the utilisation of waste streams.

The Industry Good Process theme seeks to clarify and align planning processes with partners/contractors to provide clear and timely direction for investment. It also deals with establishing processes and expectations for reporting and accountability

The Industry Good Structure theme is concerned with how industry good is governed particularly in regards to responsible use of the Potatoes Commodity Levy, and the accountability to stakeholders, as well as efficient management of the organisation.

Alignment to the 2013 Strategy

The original eight themes described in the 2013 strategy are aligned to the three 2016 themes as follows. Neither Industry Good Process nor Industry Good Structure were included in the 2013 strategy.

Quality

2. Process Value Chain
3. Quality Fresh Produce

Markets

4. Develop Targeted Fresh Export Markets
5. Develop Targeted Process Export Markets
6. Protect and Enhance Domestic Process Market
7. Protect and Enhance Domestic Fresh Market

R. D. & E.

1. Improve Grower Productivity
8. Manage Waste Streams

Potato Industry Strategy Initiatives

There are a total of nineteen initiatives aligned to the strategic themes, and these include those continued from the 2013 strategy. There are two internal enablement strategies. These are outlined below, with current status, the party partnered with or contracted for delivery of the result, and the stakeholders for each one.

Strategic Initiative	Description	Status	Partner	Stakeholders
Theme 1 Research & Development & Extension				
1	Industry Plant Breeding	Current	PFR	PCT
2	Crop Productivity	Current	FAR	PFR
3	Disease & Pest Management	Current	MAS/FAR	MPI / PFR
4	Soil, Water & Environment	Current	FAR	Processors / Institutes
5	Crop Profitability	Current	FAR	
6	Novel Waste and Product Development	Current	PFR/MU	Processors / Institutes
7	Process Improvement	Current	Otago	Processors / Institutes
Theme 2 Markets				
8	Targeted Asian Market Development – Fresh Potatoes	Current	Internal	Exporters / MPI
9	Targeted Asian Market Development – Processed Potato Products	Current	Internal	Processors / Exporters / MPI
10	The Chip Group	Current	MOH	Processors / Retailers
11	Media Coordination of Key Messages and marketing	Current	Internal	
12	Complimentary Foods Marketing Initiative	Current	Internal	
13	Annual Domestic and Export Market Value Fresh & Processed	Current	Internal	
14	Develop Annual Marketing Plan	Proposed	Internal	
Theme 3 Quality				
15	GIA	Current	MAS	
16	NZ Table Potato (Ware) Quality	Proposed	Internal	Retailers / Exporters
17	Potato Post Harvest Storage and Handling	Proposed	Internal	Growers / Exporters / Producers / Retailers
Theme 4 Industry Good Process				
18	Coordinated Planning Cycles	Proposed	Internal	Contractors
Theme 5 Industry Good Structure				
19	Industry Good Governance	Current	Internal	
20	Industry Good Structure	Current	Internal	

Industry Targets

The 2013 strategy set targets in three areas”

- Profit from productivity
- Value of exports (fresh and processed)
- Value of the domestic market

Target 1: Profit from Productivity

*Increase **profit from productivity** by $150 per ha per annum*

The potatoes industry invested in the “Yield Gap” project during the 2012/13 growing season which sought to identify factors responsible for the reduced yields (the “yield gap”) between actual potato production and computer-modelled production in Canterbury. Potato yields in Canterbury have remained static at 50 to 60 t/ha (paid yield), despite computer-based modelling predicting that yields of 90 t/ha are theoretically possible in most years.

This project was conducted by the NZ Institute for Plant & Food Research. The field research project[1] aimed to identify factors responsible for the reduced yields (the “yield gap”). The project was funded by Potatoes NZ, the McCain growers group, Ravensdown Fertiliser and Plant & Food Research.

The project confirmed the magnitude of the yield gap (20 – 40 tonne/ha), and identified seed and soil-borne diseases as both prevalent and as key factors in this reduced yield. This was reinforced by finding that healthy plants were producing close to potential. Conversely, fertiliser rates were found to be near optimum (i.e. this does not appear to be the rate limiting factor under current circumstances). Other factors such as seed quality were suggested but not confirmed as affecting yield.

The project identified future areas for investigation to include:

- Further information to quantify effects of diseases on potato yield, for cost/benefit analysis.
- Consultation between researchers and growers so that current crop management can be better understood.
- Defining nutrient response curves to quantify the cost/benefit of fertiliser inputs.

Unfortunately, limited progress[2] has been made in actually improving yield since 2013. However, some new projects are now underway including:

1) Seed treatments to control seed/soil borne diseases (2nd season)
2) SFF crop rotations, bio fumigant crops and soil quality (1st season)
3) Irrigation research

Aside from progress on understanding and closing the productivity gap, actually setting a target for profit from productivity requires development of a specific methodology/tool set and then maintaining a consistent data gathering, calculation and reporting process.

Profit from productivity (PFP) is defined as the difference between actual operating profit and the operating profit that would have occurred with no productivity changes since a base year (i.e. in the absence of production increases and with operating expenses per kilogram of production increasing annually at the rate of farm input price inflation). In essence, PFP is a measure of cost-efficient potato production increases since the base year valued at the end year operating profit margin per kilogram of production. It generally excludes the cost of capital, although depreciation and changes in hectares utilised are accounted for.

[1] The sole focus of this second phase was on using research based trials to confirm potential productivity gains.

[2] Acknowledging that research timeframes and new cultivar development timeframes are longer than 2 years, as is the typical adoption timeframe, hence measurable progress would have relied on initiatives that preceded the 2013 strategy.

A methodology for calculating profit from productivity for potatoes has not yet been established, and therefore there is no reliable basis to assert any progress on this measure. FAR does have an online paddock recording software system (ProductionWise) consistent with gross margin calculation for potatoes. In New Zealand, 400 arable farmers are participating and 250 of these are regular users.

This system potentially lends itself to calculating total factor productivity, albeit with additional coding required. This is the first season since an important October 2015 upgrade that includes a mobile phone app, and is now collecting data that will be useful for benchmarking at the end of the 2015/16 harvest. FAR has employed 3 students to work part-time on extension jobs across the software delivery around New Zealand.

Recommendation: Establish a project with FAR for calculating profitability per hectare[3].

Target 2: Value of Exports

Double the value of fresh & processed New Zealand based exports by 2025.

The potato export industry in New Zealand has not grown significantly over the past 3 seasons. Exports figures are most dependent on the export of frozen potato products (i.e. fries) which comprises about 70% of total export value. Fresh exports (excluding seed) are the next biggest sector.

Processed export markets account for NZ$92 to NZ$105 million per annum, with the majority of this (NZ$74 – NZ$87 million) coming from sales of frozen fries. There are also exports of potato crisps worth of over NZ$16 million FOB per annum. Australia is the main export destination for New Zealand fries, where EU product is also competing. New Zealand fry exports tend to be lower value product ($1.24 per kg FOB) compared to the 15,000 MT of mainly Australian frozen potato imports valued at an average of $1.60 per kg CIF. New Zealand has a competitive advantage in the supply cost of raw potatoes, but with a small domestic market has struggled for local investment in innovation and is also isolated. The export market is dominated by multinational company McCains, who also have Australian manufacturing operations, as well as the two main domestic manufacturers Talleys and Mr. Chips.

Fresh export markets account for NZ$15 to NZ$20 million per annum, with a small amount (NZ$270,000 to $380,000) from seed potatoes. Market access for fresh potatoes can be contentious, as they are a vector for disease. 98% of fresh exports by value go to the Pacific Islands. The Pacific Islands are relatively low value markets ($0.72 - $1.00 per kilogram in 2015). Fiji is the main export destination (75% of value). The Pacific trade is unsophisticated, with bulk shipments in un-refrigerated, 'door-off' containers. In 2016, fresh exports top Fiji were rejected because of health and sanitary issues (i.e. soil, sprouts) Singapore is a higher value destination at $1.29 per kg in 2015, but very small at 267 MT.

The New Zealand industry has not taken advantage of new fresh market access opportunities in Vietnam, nor previously in regards to Taiwan. The Australian industry has vigorously lobbied against New Zealand access.

Recommendation: Develop the NZ Table Potato Quality Initiative for both the domestic and export markets

[3] This recommendation is a first step. The future work to develop a measure of productivity is contingent on achieving that.

Target 3: Value of Domestic Market

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

The New Zealand domestic market comprises fresh and processed product, sold through a variety of channels including retail and food-service. Fundamentally, domestic sales reflect the consumption of potatoes by New Zealanders. There are two main threats: imports of processed product, and a drop in per capita consumption. The domestic process market is exposed to international trade and local manufacturers must compete by being more efficient and innovative. Promotion of processed potatoes (chips) has been the domain of “The Chip Group”. Promotion of fresh table potatoes has been the domain of “vege.co.nz”, under Horticulture NZ. There has been no overall strategy lifting the profile of potatoes as a healthy, economic staple food.

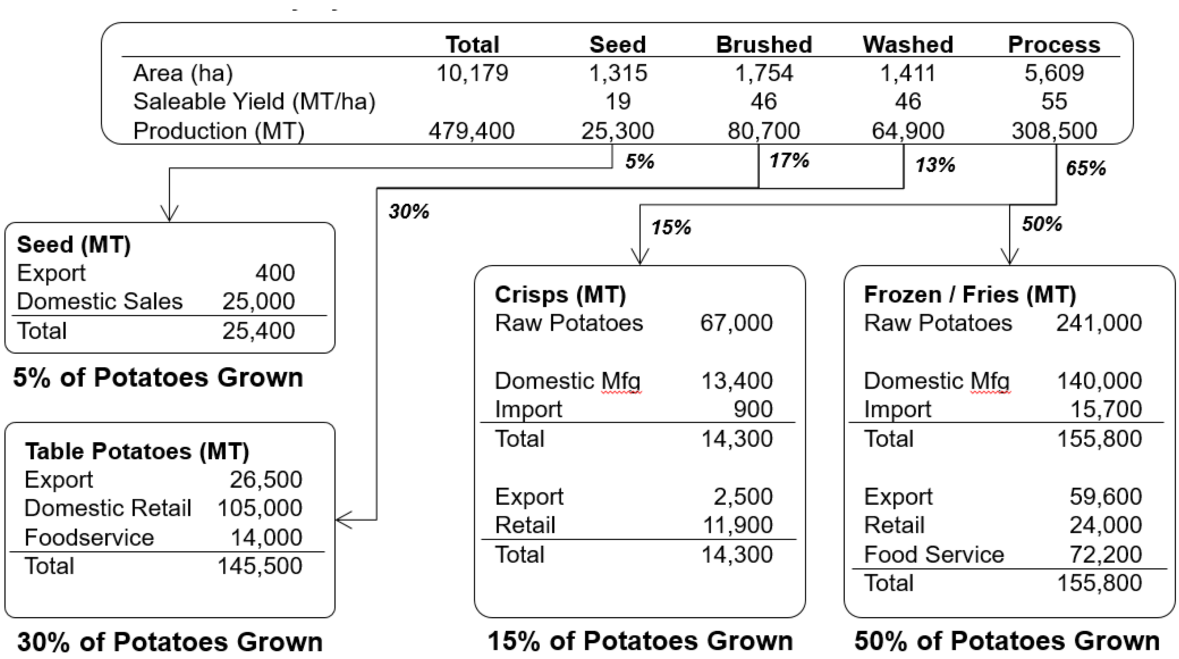
Sales volume for fresh potatoes is currently estimated around 100,000 MT per annum. Anecdotally, the total spend on table potatoes is stable on lower volume. Within the category, sales of bulk bags (i.e. 5kg, 10kg bags) are continuing to fall while sales of smaller packs at a higher per kilogram cost are rising. However, it is unlikely that there will be increased demand in the unpeeled, whole product format.

In summary, the industry is on target to achieve the growth target for the value of the domestic market.

Recommendation: Capture annual retail data for processed and fresh potato sales, and publish these.

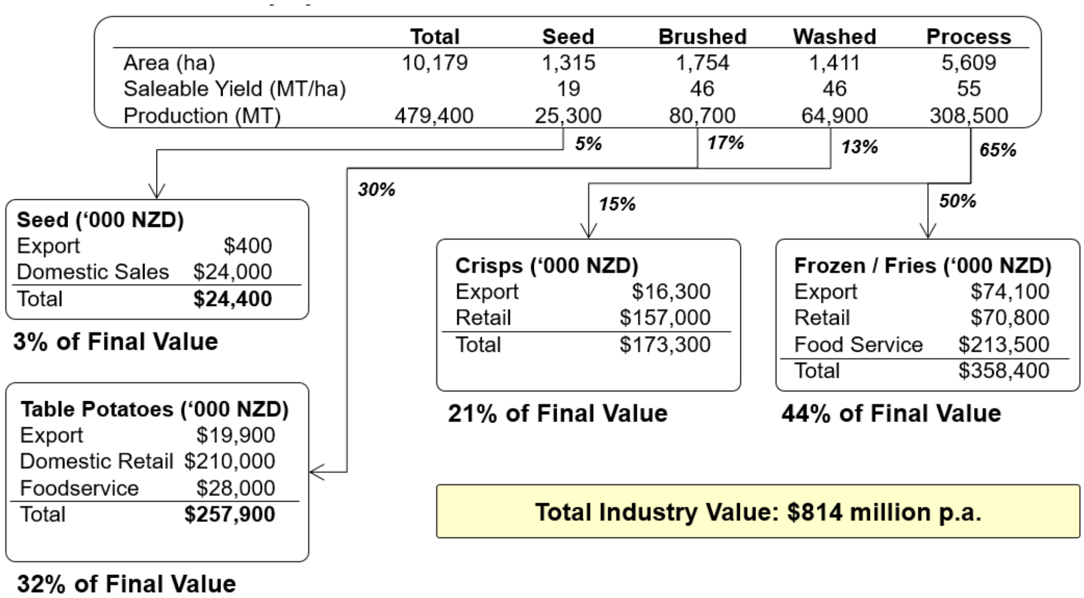
The 2016 Strategy provides a benchmark for the current understanding of the NZ potato industry in terms of volume and value. The 2012 value was estimated at $500 million. The current domestic market is valued at $703 million. The industry is, therefore, well on track to meet an increase of 50% to $750 million by 2025

2015 NZ Potato Industry by Volume



Source: JMC Analysis (assumes no other uses of potatoes)

2015 NZ Potato Industry by Value



Source: JMC Analysis (assumes no other uses of potatoes)

Note: Total Industry Value based on final sales value in New Zealand (or FOB)

Research & Development & Extension

Strategy

Potatoes New Zealand Inc.

February 2017

Theme 1: Research & Development & Extension

Objective: Increase potato industry productivity

The first parts of this theme comprise the fundamental research that drives on-farm productivity innovations, including plant breeding, and also the development and extension activities on-farm to achieve actual gains for growers. The second part focuses on process innovations for the manufacturing sector to increase manufacturing productivity, and includes new product innovations and the utilisation of waste streams.

Part A:

On-farm Productivity R, D & E is defined as activities to improve the productivity of potato growing. Improving productivity means increasing production relative to inputs. It does not mean just increasing yield, as this can be achieved at a higher marginal cost without adding value. The scope has four parts: breeding, seed management, bed preparation and crop management as shown below. Overall, these four parts must combine to achieve an overall improvement in productivity. R, D&E must be integrated to ensure research relevance and rapid adoption by growers.

Productivity Research, Development and Extension

Overall Productivity Target: Increase Profit from Productivity by $150 per ha per annum[1]

Breeding	Seed management	Bed preparation	Crop management

Example Hypotheses:
• Plant breeding could accomplish an 0.5% gain in productivity per annum based on other crops/plants2.
	Example Hypotheses:
	• NZ potato seed performance is adversely affected by:
	  • Infected seed
	  • Poor seed storage
		Example Hypotheses:
		• NZ potato productivity is adversely affected by:
		  • Soil-borne disease
			Example Hypotheses:
			• Inefficient use of inputs (agrichem, water, nutrients) leads to both sub-optimal productivity and also nutrient leaching (a new constraint)

Example Target: • 0.5% gain in productivit y p.a	**Example Target:** • Reduce disease incidence by 90% • Reduce loss of seed in storage by 50%	**Example Target:** • Reduce soil-borne disease	**Example Target:** • Develop guidelines for minimum/optimal inputs and nutrient leaching

General Recommendations for On-farm Productivity R. D. & E.:

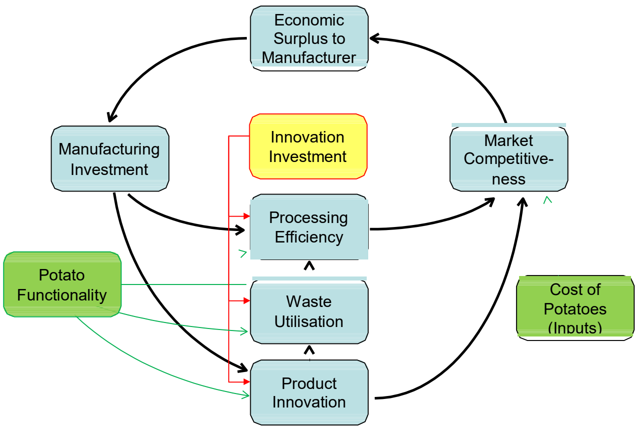
- Governance of productivity R. D.& E. and use of the levy, must reside solely with Potatoes NZ.
- Develop a common framework and definition for measurement of productivity.
- Develop an overarching strategy with clear objectives in each of the four parts of the program.
- Demonstrate how this strategy will contribute to the overall benefit of the industry and NZ Inc.
- Engage providers on projects with specific milestones to meet these objectives
- Develop joint bids for industry-government research partnerships (linked across R. D. & E. program).

Part B:

Process Innovation R, D & E is concerned with the NZ industry beyond the farm gate. The performance of this sector is vital as potatoes grown for processing represent 65% of the total crop. Processed potato products are exposed to competition from international marketers. Productivity improvement across the value chain is necessary to increase competitiveness, and thereby both protect the domestic manufacturing base and also position for growth in exports. Productivity in manufacturing requires investment in R.& D. to minimise waste, utilise waste in new products, and develop more efficient processing.

The starting point for developing the R&D investment strategy for processing is to understand the overall system as shown in the figure below. Potatoes NZ objective is for sustainable growth of the sector, and this requires a virtuous cycle of growing investment and returns to manufacturing and growing, i.e.

- More efficient processing
- Product innovation
- Improved market competitiveness



A reliance on driving down the cost of potatoes to the manufacturer will not create a sustainable advantage by itself.

However, highly productive growers can potentially attract investment in New Zealand processing infrastructure.

Investment in processing innovation is equally important

R. D. & E Initiatives:

There are seven initiatives associated with the R. D. & E theme. The first six were outlined in the 2013 strategy, and have been revised. The fifth initiative is new.

Initiative		Status	Partner	Stakeholders
1	Industry Plant Breeding	Current	PFR	PCT
2	Crop Productivity	Current	FAR	PFR
3	Disease & Pest Management	Current	MAS/FAR	MPI / PFR
4	Soil, Water & Environment	Current	FAR	Processors / Institutes
5	Crop Profitability	Current	FAR	
6	Novel Waste and Product Development	Current	PFR/Mas	Processors / Institutes
7	Process Improvement	Current	Otago	Processors / Institutes

1. Industry Plant Breeding

Status: Current

Partners: Plant and Food Research

Key Objective: Better alignment of interests through an industry-good owned breeding evaluation in conjunction with Plant and Food Research, i.e.:

- Paid yield (aligned with purpose, e.g. solids for process applications)
- Resistance to pests & diseases
- Flavour profile
- Fit for purpose

2. Crop Productivity

Status: Current

Partners: FAR

Key Objective: To identify reason for yield gap between observed and theoretical yields in Canterbury

3. Disease & Pest Management

Status: Current

Partners: Market Access Solutions, FAR

Key Objective: Growers have the tools necessary to deal with existing pests and diseases, and are protected from further incursions, i.e.:

- Published up-to-date protocols and methods for pest and disease control
- Ongoing investment in testing agri-chemicals and alternative management plans
- Growers interests are represented with respect to a potential Government-Industry Agreement (GIA) around bio security

4. Soil, Water & Environment

Status: New

Partners: FAR, Plant & Food Research

Key Objective: Growers develop infrastructure and methods to improve water use efficiency, and the industry maintains priority access to water resources for growers

5. Crop Profitability

Status: Not Actioned

Partners: FAR

Key Objective: To measure crop profitability

6. Novel Waste and Product Development

Status: Current

Partners: PFR/Massey

Key Objective: To identify higher-value options to:

- use low value potatoes, or potato waste, in applications for animal feed, and/or
- use potatoes, or potato waste, in novel applications

7. Process Improvement

Status: Current

Partners: Otago University

Key Objective: To improve potato processing productivity Actions:

1. Undertake a research collaboration investigation
2. Pulse electric field project with Otago University

Potatoes Research Programme for 2017/2018

Research Area	Supervisor	PNZ #	Funders	Project/Activity Description
Industry Plant Breeding	PFR	28	PFR, PCT	Industry Plant Breeding SSIF (Core)
Crop Productivity	FAR	1	PFR	MBIE "Realising Potato Exports Value"
Crop Productivity	FAR	2	MPI, Potatoes NZ	SFF Increasing Potato Yield through understanding the impact of crop rotation and soil compaction. (408117)
Crop Productivity	FAR	3	Potatoes NZ	Nutrient Management
Crop Productivity	FAR	4	Potatoes NZ	Potato Irrigation trials
Crop Productivity	FAR	5	MPI, FAR, Potatoes NZ, AS Wilcox,	SFF Transforming Variability into Profitability
Crop Productivity	VR&I	25	VR&I	Vegetable Industry Agrichemical Strategy Coordinator
Crop Productivity	PFR	29	PFR/PNZ	Crop Productivity SSIF (Core)
Disease & Pest	FAR	6	Potatoes NZ, Lincoln University	PhD student grant: Effects of Biofumigation on *Rhizoctonia solani* and evaluation of non-target effects.
Disease & Pest	FAR	7	Potatoes NZ	Psyllid Management trials.
Disease & Pest	FAR	8	Potatoes NZ	Soil Borne Disease management
Disease & Pest	FAR	9	Potatoes NZ	Psyllid degree day graph
Disease & Pest	FAR	10	Tomatoes NZ, Tamarillos NZ, Heinz-Wattie, Potatoes NZ (via FAR) + PNZ direct.	Tamarixia Biological Control (404861)
Disease & Pest	MAS	11	HortNZ, groups	PGP agrichemicals
Disease & Pest	MAS	21	VR&I	Monitoring Bio-Security Risks
Disease & Pest	FAR	22	Potatoes NZ	Detection of Lso-infected TPP taken from Sticky Traps
Disease & Pest	VR&I	24	VR&I, MBIE	MBIE Maximising the value of irrigation
Disease & Pest	FAR	27	MPI, Potatoes NZ	SFF Improving the quality of seed potatoes using precision agriculture
Disease & Pest	PFR	30	PFR/PNZ	Disease & Pest Management SSIF (Core)
Soil, Water & Enviro	FAR	12	MPI, VR&I, Potatoes NZ, Regional Councils: Waikato, Gisborne, Hawke's Bay, ECan, Northland	SFF Don't Muddy the waters
Soil, Water & Enviro	FAR	13	MPI, FAR, PotatoesNz, HortNZ (Through VR&I), Ravensdown, Horizons RC, Hawke's Bay RC, ECan.	SFF Fluxmeter project
Soil, Water & Enviro	FAR	14	MPI, HortNZ (through VRI), WRC	SFF Root Zone Reality Fluxmeter extension project (PUK)
Soil, Water & Enviro	FAR	15	MPI, FANZ, FAR, Bay of Plenty RC, Landcare.	MPI Cadmium Project
Soil, Water & Enviro	FAR	16	FAR, HortNZ. Overseer Mgmt Serv.	Overseer Evaluation Project
Soil, Water & Enviro	FAR	17	FAR, PNZ, councils	SFF Measure it (Quick N)
Soil, Water & Enviro	FAR	26	HIA, FAR, Potatoes NZ,	Exploring Spongospora suppressive soils in potato production
Crop Profitibility	FAR	18	FAR	Monitoring Profitability of potato crops
Novel Waste	PFR	31	PFR	Novel Waste Product Development SSIF (Core)
Administrative	FAR	19	Potatoes NZ	FAR Potato Extension and Comunication
Administrative	FAR	20	FAR /NZPPS	International Expert Visitor

NB: Yellow shows PFR Core/SSIF funded projects

Potatoes NZ Inc Research, Development & Extension Initiatives Aligned to PFR Research Programmes

PNZ #	PNZ R, D & E Initiative	Aligned PFR Research Programme	Project/s Description	Project Leader
28	Industry Plant Breeding	SSIF (Core)	• Maintenance of potato germplasm • Potato nursery implementation • Screen new potato lines for target traits • Production of high health tissue cultures • Crop management that optimises PFR cultivar performance	Gail Timmerman-Vaughan (Lincoln)
29	Crop Productivity	SSIF (Core)	• Seed health trial • Bed architecture	Sarah Sinton (Lincoln)
30	Disease & Pest Management	SSIF (Core)	• TPP rearing • TPP regional spray programmes • Biological Control Agents evaluation (Tamarixia?) • Impact of CLso -ve psyllid feeding at different physiological growth stages of potato • Pests and diseases in commercial seed crops monitored and impact of post dessication treatments on TPP/CLso established • Examine the impacts of crop soil on expression of soilborne disease	Jessica Dohmen-Vereijssen (Lincoln)
		MBIE 'Realising Potato Export Growth'	Tools to control TPP and CLso using: 1. sensory cues 2. population genetics and distribution of CLso and zebra chip 3. Plant breeding for tolerance	Gail Timmerman-Vaughan (Lincoln)
31	Novel Waste & Product Development	SSIF (Core)	• Identifying high-value potato products with consumer desired traits (health and flavour) • Determine molecular and biochemcial contributors underlying identified consumer desired traits, health and flavour.	Marian McKenzie (Palm Nth)