Potatoes NEW ZEALAND

Bluebird Foods Ltd Agronomists Forum 2019

The Addington Raceway and Events Centre,
75 Jack Hinton Dr, Addington Christchurch

Tuesday 13th August 9.30am-5pm
Followed by drinks & nibbles

Nau mai Haere mai, Welcome

Bluebird Foods Ltd. Agronomists Forum, 13th August 2019

Nau mai haere mai and welcome to Potatoes New Zealand Inc. and Bluebird Foods Ltd. Agronomists Forum for 2019.

Please peruse the following programme and additional background reading, which we hope will assist you to participate fully in the forum.

The programme has been designed to create an interactive knowledge sharing experience.

Potatoes New Zealand is seeking guidance and feedback from the industry on our current Research & Development Projects and our Strategy.

Thank you to Bluebird Foods Ltd. for sponsorship which has allowed this programme to occur as part of the Potatoes New Zealand 2019 Biennial Conference.

Chris
Claridge CEO

Potatoes New Zealand Inc.

Bluebird Foods Ltd. Agronomists Forum 2019

Tuesday 13th August 9.30am-5pm

The Addington Raceway and Events Centre, 75 Jack Hinton Dr, Addington Christchurch

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FORMAT FOR THE DAY – How will this work?

This year we will be dividing the room for each session, into sufficient groups to cover the PNZ projects to be discussed.

- Session 1 *DISEASE & PEST MANAGEMENT* requires 4 groups
- Session 2 *SOIL, WATER & ENVIRONMENT* requires 3 groups
- Session 3 *POST HARVEST* requires 4 groups

KNOWLEDGE SHARING

1. The scientist representing the PNZ project or specialized topic has 20 minutes to present to their group.
2. Each group will nominate a scribe, assigned with using flipchart and vivid pens to mind-map/bullet point or other notation to record the ideas discussed.

   POINTS TO BE COVERED IN THE Q&A within the hour-long group session:

   - Where are we at with this project?
   - Challenges & Successes
   - What are we missing?
   - Where to next?
3. FEEDBACK TO ALL

   At the end of the Q&A session there are 15-20 minutes allowed for the scribe to convey the information noted or discussed, back to all agronomists.

SUMMARY OF TOPICS COVERED

DISEASE & PEST MANAGEMENT

PNZ-69 TPP & Regreening

PMTV Literature Review

HIA Spongospora suppressive soils

Update on liberibacter & psyllid

SOIL, WATER & ENVIRONMENT

PNZ-62 Future Proofing Vege Production

PNZ-73 NZGAP Soil and Erosion

PNZ-12 NZGAP soil erosion & phosphates

NIWA Improving Water Efficiency

POST HARVEST

Seed

Storage

PNZ-57 Spectral imaging & NIR

PNZ-42 PEF project

Forum Schedule

	9:30am	Coffee Cart		
	10am	Chris Claridge	PNZ	**AGRONOMIST FORUM: Welcome and intro**
				Summary Initiatives from Business Strategy Plan
SESSION 1	10.05am	Iain intro & Gemma facilitate		**DISEASE AND PEST MANAGEMENT**
				DIVIDE ROOM INTO 4 GROUPS - **1 project per group to present & assign a scribe**
Concurrent group presentations	10.10am	Jessica Dohmen-Vereijssen	PNZ-69	Canterbury TPP Spray Programmes & Regreening
		Iain Kirkwood		PMTV Literature Review
		Richard Falloon		Spongospora HIA suppressive soils
		PFR MBIE team (Rebekah and Kye Chung Park)		Update on genetics of liberibacter & psyllid
	10.30am			**GROUP DISCUSSION AND Q&A**
	11.30am			**EACH GROUP SCRIBE FEEDS BACK TO WHOLE ROOM USING FLIPCHART**
	11.45am			**LUNCH**
SESSION 2	12.30pm	Iain intro & Gemma facilitate		**SOIL WATER AND ENVIRONMENT**
				DIVIDE ROOM INTO 3 GROUPS - 1 project per group to present & assign a scribe

Concurrent group presentations	12.40pm	Dan Bloomer	PNZ-62	Future Proofing Vege Production
		Andrew Barber	PNZ-73	NZGAP soil erosion & phosphate dashboard
			PNZ-12	"Don't Muddy the Waters"
		MS Srinivasan	NIWA	Improving Water Use Efficiency in Agriculture - Opportunities & Barriers
	1pm			**GROUP DISCUSSION AND Q&A**
	2pm			**EACH GROUP SCRIBE FEEDS BACK TO WHOLE ROOM USING FLIPCHART**
	2.15pm			**COFFEE BREAK**
SESSION 3	2.30pm	Iain intro & Gemma facilitate		**POST HARVEST**
				DIVIDE ROOM INTO 4 GROUPS - 1 project per group to present & assign a scribe
Concurrent	2.35pm	Iain		SEED
		Maarten Van Delden		International storage advice
		Chris Thorman		Short version: Domestic storage advice
		Abhimanyu Garhwal	PNZ-57	Spectral imaging and NIR
		Indra Oey	PNZ-42	PEF
	2.55pm			**GROUP FEEDBACK AND Q&A**
	3.55pm			**EACH GROUP SCRIBE FEEDS BACK TO WHOLE ROOM USING FLIPCHART**
	4.15pm			**BREAK**
SPONSOR SESSION	4.30pm	Bluebird Foods Ltd special presentation		
	5.15pm			**DRINKS & NIBBLES**
	6.15pm			**END OF AGRONOMOISTS FORUM**

Current R&D Project Summaries

PNZ 1 PFR MBIE Realising Potato Export Value

Lead Organisation: Plant & Food Research

Project Leader: Gail Timmerman-Vaughan

Objectives

1. Understanding and manipulating insect behaviour
2. Population genetic variation of TPP in relation to NZ growing regions and the distribution of Lso and Zebra Chip disease
3. Understanding host plant response

Update

Monitoring of tomato potato psyllid olfactory receptor neurons' responses to individual chemical compounds from a host plant (boxthorn) and non-host green leaf extract has shown that psyllid antennae contain olfactory receptor neurons with some degree of specificity for different plant volatile compounds, providing a lead toward understanding psyllid recognition of host plants.

Tomato potato psyllid behaviour in response to acoustic signals, including stridulatory signals (produced by rubbing together of body parts), has been characterised using web cams and laser vibrometry to reveal that most activity occurs in the hours of darkness, and that male psyllids respond to the female calling with both copulation with females and pseudocopulation with males.

This is the type of new knowledge that is needed to devise control strategies based on disrupting insect behaviour. A method for real-time monitoring of the movement of the products of photosynthesis (carbohydrates) in potato plants has been demonstrated based on measuring the Bremsstrahlung radiation produced by ^{14}C, providing the programme with a fundamental tool for understanding at the whole plant level of the disruption to carbohydrate metabolism caused by psyllid feeding and/or *Candidatus* Liberibacter solanacearum (Lso) infection.

A PFR potato breeding line showing tolerance to TPP/Lso has been identified from experiments involving controlled systematic infection. Infected tubers of this line display reduced Zebra Chip symptoms (darkening upon frying) versus other infected potato lines and cultivars. This is a significant step toward developing resistant or tolerant cultivars and provides a valuable research tool for understanding host plant susceptibility and the processes leading to the Zebra Chip phenotype.

PNZ 10 Tamarixia

Lead Organisation: Market Access Solutions

Project leader: Sally Anderson

Objectives

This project will identify effective release strategies of *T. triozae* in New Zealand using a series of pilot releases adjacent to field crops (potatoes). Multiple releases will then be made around the country to ensure the establishment of *T. triozae* in New Zealand horticultural environments. The project will evaluate the establishment of *T. triozae* as a Biological Control Agent (BCA) of TPP in these horticultural environments through post-release monitoring. Information gathered on *T. triozae* distribution, survival and parasitism rates from these pilot releases will be used to assist growers from all industries to integrate *T. triozae* into each of their pest management programmes.

Update

The releases by Plant & Food research (PFR) are completed. The target to rear 5,000 *Tamarixia* was well and truly met, with a total of 6,700 *Tamarixia* being released over a 4-month period to a number of growers. Post-release survey of 'non-PFR' release sites where personnel outside PFR released the parasitic wasp completed. Post-release survey of experimental sites where PFR staff released T. triozae are completed.

Key findings

PFR have established that *Tamarixia* will survive over winter. PFR recovered the parasitic wasp from two sites in Hawke's Bay and both sites in Canterbury. Where *Tamarixia* were recovered, percent parasitism ranged between 4 and 40%.

Extension activities

An article on *Tamarixia* was published in the February 2019 issue of NZ Grower.

Dr Jessica Dohmen-Vereijssen presented an update regarding the release of T. triozae to Australian and New Zealand growers during a field walk in Canterbury, organised by Potatoes NZ, on 13 February 2019.

PNZ 12 Don't Muddy the Waters

Lead Organisation: AgriLink

Project leader: Andrew Barber

Objectives

Develop a tool that will inform practices and will be incorporated into farm specific environment plans that will have to be developed for growers (this is the case already for the Horizons region). It will also provide the basis for a robust independent farm plan audit through NZGAP. Trial results will be incorporated into an excel based tool that can be used to aid decision making by farmers and regulators on erosion and sediment control measures.

Update

Project Extended - Project due for Completion by the end of June 2019. A draft report is being prepared by Andrew Barber.

Two case studies were completed. Two workshops held in May 2019, one Pukekohe, one at Woodhaven gardens (Levin). One more to be held in Pukekohe and a presentation at the PNZ Conference in August is planned.

PNZ 15 Effect of cultivar type and soil properties on cadmium concentrations in potatoes

Lead Organisation: LandCare

Research Project Leader: Jo-Anne E Cavanagh

Overview

Potatoes are a staple food in New Zealand and a contributing source of dietary cadmium (Cd), although there is little information nationally on the soil and plant factors that affect Cd concentrations in the crop. We measured Cd concentrations in 10 commercial potato cultivars grown in three field sites across New Zealand and assessed the soil factors that affect Cd concentrations. Cadmium concentrations in potato tubers ranged from 0.004 to 0.574 mg kg-1 DW (0.001 – 0.113 mg kg-1 FW), although overall Cd concentrations were lower than the maximum limit of 0.1 mg kg-1 FW for human consumption. There were significant differences (2.8-fold) in Cd concentrations between potato cultivars, although these varied by site. No significant relationships were found between soil properties and Cd concentrations in potatoes. Management of Cd in potatoes is likely to be most effective by avoiding growing high-Cd-accumulating cultivars in soils with elevated Cd. Further studies could determine if other management factors such as irrigation or type and rates of fertiliser affect Cd concentrations in potatoes.

Project Completed – Final report received

PNZ 17 Quick N Measure it and Manage it

Lead Organisation: FAR

Project Leader: Matt Norris

Objectives

This project will deliver a practical, reliable and cost-effective in-field approach to nitrogen management for farmers and consultants. The project deliverables will be disseminated through a range of field demonstrations, industry events and popular press articles. At the completion of this project farmers will have a cheap, (each quick test strip costs < $1), and quick, (results are immediately available), and validated alternative to the standard Mineral N test and a QTMB field guide to assist with the development of crop mass balance budgets for fertiliser decisions.

Project completed - Final report produced - Over the past 3 years, the approach has been tested and refined across 18 trial sites located on commercial cropping enterprises around New Zealand. Crops have included maize (five sites), potatoes (six sites), broccoli (two sites), cabbage (one site), lettuce (two sites) and spinach (two sites). At each site two N management approaches were compared (each replicated five times) and these included:

A standard grower area where side-dressing N was applied at rates equivalent to the cooperating grower's application regime in the rest of the field.

A QTMB area where pre-planting and side-dressing N applications were based on outputs from the N mass balance.

PNZ 24 Maximising the Value of Irrigation

Lead Organisation: Plant & Food Research & Landcare

Project leader: Carolyn Hedley

Objective

The 2013–2019 MBIE programme 'Maximising the Value of Irrigation' (MVI) is undertaking research to develop management strategies and new technologies that support industry to improve productivity, minimise wasted water, and reduce negative environmental impacts from irrigated land.

Update

Objective 1 Spatial information for irrigation equipment selection and operation-

Soil informatic systems have been developed to make soil data (e.g. soil moisture) more easily available at the relevant spatial scale and temporal frequency for timely irrigation scheduling.

A soil sensor survey method has been developed to classify soil differences for targeted soil sampling, and the acquired soil data have been correlated, using soil hydraulic properties, with Smap siblings mapped within the target area.

Connected wireless sensor networks (soil, crop, rain) have been created, built and shared with participating farmers through smart phone apps and web browsers to support irrigation scheduling decisions.

Objective2 Soil management to capture more water and reduce water losses

Tillage and soil surface management can reduce irrigation requirements and water losses.

The temporal change of soil water properties in cultivated soils has been quantified, and will assist with irrigation scheduling aimed at applying the right amount at the right time.

Objective 3 Crop monitoring techniques for accurate water scheduling

Crop water use can be measured spatially.

Integrating real-time data streams from sensors with models can improve irrigation scheduling.

Objective 4 Integration to develop tools for improving irrigation efficiency

A web-based tool has been developed that interrogates the Smap database to locate the required sibling and automatically provide a soil file for APSIM modelling.

The APSIM model has been developed for cost–benefit analysis of spatial and temporal variations of irrigation scheduling.

The APSIM model has been developed to predict water loss, storage and drainage in structured and (for example) water repellent soils.

PNZ 26 Exploring Spongospora suppressive soils

Lead organisation: Plant & Food Research

Project Leader: Richard Falloon

Objectives

This project is investigating, in different field soils, previously indicated suppression of potato diseases (tuber powdery scab and root galling) caused by the pathogen Spongospora subterranea. The research focuses on fields in the North Island of New Zealand, where evidence exists of differences in conduciveness/suppressiveness to diseases caused by Spongospora. Laboratory and greenhouse experiments (Phase 1) will determine the extent of disease "suppression" that occurs, and (in parallel) characterise the physical, chemical and biological properties of the different soils. Phase 2 will aim to determine the mechanism(s) of disease suppression identified in the first phase of the study. These may include biological (and possibly transmissible) suppression, or chemical/physical general suppression (which may be manipulable).

PNZ 27 SFF Precision Agriculture

Lead organisation: Potatoes New Zealand Inc & Plant & Food Research & Landcare Research

Project leader: Iain Kirkwood

Objective

This project will use precision agriculture technologies to detect plants which are re-greening and target further application of desiccants and insecticides only to this small area of the paddock. It will use hyperspectral technology to detect Liberibacter infected plants enabling these plants to be targeted with hand rouging to reduce infected seed tubers. It will use precision agriculture maps of re-greened plants or zebra chip infected areas (high risk areas) and using guidance systems at harvesting to either avoiding harvesting these areas or segregating at risk tubers on the harvester. Information will be transferred to farmers throughout the project by involving them as host farmers, running field days and producing fact sheets.

Update

An update has been received from Plant & Food Research (PFR)

A hyperspectral camera was used on potted plants in a greenhouse. A UAV was used to detect re-greening in the field. The aims of these trials were to:

1. Establish a hyperspectral finger print of potato plants grown from CLso-infected mother tubers to aid detection of CLso-infected potato plants in a seed crop early in the season (a collaboration between Manaaki Whenua - Landcare Research (MWLR) and PFR.
2. Establish a hyperspectral fingerprint of potato plants infected by CLso-positive B. cockerelli to aid detection of CLso-infected potato plants in a seed crop early in the season (a collaboration between MWLR and PFR).
3. Detect re-greening in the crop with a UAV, so growers can reduce time and costs spent on desiccation.

PNZ 28 PFR SPTS13802 Potato Breeding Program

Lead Organisation: Plant & Food Research

Project Leader: Samantha Baldwin

Objective

The Plant & Food Research (PFR) potato breeding programme focuses on improving yield and quality (increasing marketable volume from current production), whilst also exploring higher value new products (increasing value). The breeding pipeline is developing new fit-for-purpose varieties that are adapted to lower inputs under NZ environmental conditions, as well as having heavy selection for increased tolerance to diseases such as Zebra Chip. The breeding effort is part of an integrated science research programme that is developing genetics for a future where sustainable growing systems are compulsory, access to healthy food is a priority and niche products are a premium.

PNZ 29 Agroecological Crop Protection

Lead Organisation: Horticulture New Zealand

Project Leader: Stephen Ogden

Objective

The PGP programme will position New Zealand to become one of the most desirable sources of food in the world, based on the agroecological crop protection practices that will be adopted by the horticulture, arable and wine sectors. There will be greater focus on overall plant health and the plant at the centre of the agroecosystem, and crop protection programmes will be built around that. There will be a reduction in agrichemical use over time, and overall crop protection will have a lighter touch on the environment and be more sustainable.

Update – Not yet started

PNZ 42 Pulse Electric Field Project

Lead Organisation: Otago University

Project Leader: Indrawati Oey

Objective

Pulsed electric field technology (PEF) applies microsecond pulses of electricity to alter cell permeability and structure and is used commercially overseas as a unit operation in potato fry and crisp manufacture. The use of PEF to mitigate the effects of *Candidatus Liberibacter solanacearum* infection of potatoes on final fry quality has not been previously reported. The ability of PEF in fry and crisp manufacture to reduce the amount of sugar in the potato and to a lesser extent to reduce frying time and temperature were the rationale for using PEF to mitigate to the adverse effect of *Liberibacter*-infection on potato fry quality. A pilot PEF plant was leased and a series of trials run at a commercial French fries processing plant in New Zealand.

Update

A workshop was held in Dunedin at Otago University in 2019 .

Three varieties (300 tubers) with high levels of Liberibacter delivered to Otago Uni and run through the PEF line. Results currently being analysed and a report has been provided.

PNZ 57 Spectral Imaging Project

Lead Organisation: Massey University

Project leader: Richard Archer

Objective

The project seeks to apply vision-processing techniques to hyperspectral video images to generate a flat surface map of each rolling tuber, from which the probability of Liberibacter infection is calculated. Thus allowing the opportunity to selectively grade out infected tubers prior to processing (or marketing in the case of table potatoes).

Update

700 Kg's of Russet Burbank were delivered to Massey Uni and analysed using the hyperspectral camera. Results currently being analysed and report due 1/7/19

PNZ 62 Future Proofing Vegetable Production

Lead Organisation: LandWise

Project Leader: Dan Bloomer

Objective

Manawatu's and Gisborne's intensification and vegetable focused regional economic growth goals require new growing systems as waterways are under severe stress. This project introduces common pool resource management and draws on and supplements recent and current research to develop new generation good management practices.
New production and nitrogen mitigation techniques will be developed and tested, industry trained and case studies presented nationally via publications, online, field days and workshops.

Update

Landwise has designed a simple draft Nitrogen Budget Tool for Vegetables as a quick calculator to help growers estimate nitrogen need and determine the amount of nitrogen unaccounted for at the end of a crop. This is now ready for testing and feedback. Four growers in the Arawhata catchment were supported to create an Overseer analysis of representative blocks on their farms. The process helped growers to engage with nutrient cycles, and better understand their growing systems from a nutrient management perspective.

Project team meetings in Levin (27th of February, 2019), and Gisborne (27th March, 2019) have facilitated discussion between growers and members of the regional and district council's. This has resulted in progress towards water quality monitoring for both areas, and an enhanced sense of trust and understanding between the two groups. Councils are planning to monitor drainage and surface water using SOE reporting protocols. Farmers intend monitoring the same points frequently using Quick Nitrate Test strips calibrated for surface water.

PNZ 65 Economic Modelling for Potatoes

Lead Organisation: The AgriBusiness Group

Project leader: Stuart Ford

Objective

Develop at gross margin models for seed, process and table potato production in New Zealand in order to monitor the Strategic Objective 'Increase profit from productivity by $150 per ha per annum'.

Update

A draft spreadsheet model has been received awaiting review with Stuart Ford.

PNZ 67 Remote Sensor Nutrient Management Trials

Lead Organisation: Potatoes New Zealand Inc.

Project leader: Chris Claridge

Objective

Establish the operational capabilities of Teralytic probes in New Zealand.

Update

9 probes were leased from Teralytic and were trialled in Matamata, Levin and Rakia. The probes were connected to the Spark network and data was broadcast and observed. Due to the late of arrival of the probes they were only operational for a few months. The data observed was compared to standard soil tests and this is currently be analysed. The probes require further testing to validate and calibrate for New Zealand conditions. This is planned for the 2019-20 season.

PNZ 69 Reduced Spray Program – Canterbury Psyllid Management Trials

Lead Organisation: Plant & Food Research

Project leader: Jessica Dohmen-Vereijssen

Objective

This trial was designed to test a future-proof insecticide programme and further develop reduced insecticide programmes for the management of tomato potato. This study aimed to:

1. Develop a future-proof reduced insecticide programme for TPP management for potato growers in Canterbury
2. Further develop reduced insecticide programmes using Degree Day (DD) accumulation and agricultural oils in a standard Canterbury insecticide programme.

Results

The first TPP adults were trapped on yellow sticky traps on 6 December 2018, only 8–10 days after 100% crop emergence. On plants, TPP eggs, and small and medium nymphs were found at the first assessment date on 17 December 2018. Counts for all TPP life stages varied between the treatments but this was primarily because of the higher counts for the unsprayed Control treatment than for other treatments, plus the absence of all nymph classes for the standard Canterbury insecticide programme (SE).

Overall, neither marketable weights nor numbers varied significantly among the treatments, and neither did unmarketable weights or numbers. Mean ZC score did not vary significantly with treatment at harvest and was highest for the unsprayed Control treatment and lowest for the future proof insecticide programme (F). Overall, ZC incidence did not vary significantly between treatments, and neither did the percentage of crisps with slight and medium ZC discolouration. However, the highest percentage of crisps with slight and medium ZC discolouration were for the unsprayed Control treatment, and the lowest for treatment F.

The relative profit for each treatment with penalties over ZC scores higher than 2 varied from 70.9 for C to 103.5% for F, when SE 'profit' was set at 100%, a similar trend was observed for ZC>4. The 3.5% increase in profit for F compared to SE comes mainly from a low percentage of tubers with ZC, as the yield was lower than for SE. The option of no TPP management did not pay off in this trial this year, with the lowest yields and the highest ZC percentage, resulting in the lowest relative profit.

In contrast to this study, in previous trials, alternation with Excel® oil from emergence was the best treatment. In this trial, with a different base insecticide programme, the alternating with Excel oil from either emergence (treatment AE) or 716 DD (treatment AD) produced little benefit, with an AD being slightly worse than AE insecticide programme.

It was interesting to note that the 716 DD (reached on 28 December 2018) did not coincide with 3 TPP per trap per week (reached between 8 and 10 December), where normally for the South Island these two variables vary by 2–13 days. Using the adjusted African boxthorn degree days (600 instead of 716DD), which was reached 9 December 2018, would have been closer to the trap threshold. Applying treatment AD 2–3 weeks earlier may have made a difference to the performance of this insecticide programme.

It is suggested to repeat the insecticide programmes for at least another one to two seasons to obtain a good feel for the effectiveness of these programmes and their resilience, and adjust where needed. In addition, a future-proof insecticide programme using either a trap or DD threshold, or including alternation with an agricultural oil would be a logical next step to make TPP management more sustainable.

PNZ 72 Day Degree Graphs

Lead Organisation: Plant & Food Research

Project Leader: Iain Kirkwood

Objective

PFR have provided regional degree day graphs to Potatoes NZ for the Matamata, Manawatu, Mid Canterbury, South Canterbury and Pukekohe growing areas. These graphs indicate the number of potential generations of TPP from 1 July. In the graphs, the current year tracks against a historic warm and cold year for that region, which growers use to assess the possible extent of the TPP problem in their crops this season.

Update

Graphs are sent to Potatoes NZ on a weekly basis (a Monday) by PFR Project Leader Entomology. Start of providing the graphs is negotiated with PNZ Project Leader. Last graphs are submitted on 6 May 2019.

PNZ 73 NZGAP Soil Erosion and Phosphate Dashboard

Lead Organisation: Agrilink

Project leader: Andrew Barber

Objective

Preparation of 4 Erosion & Sediment Control Plans (Waikato x 2, Levin, & Cant.). These are required as a component of a Farm Environment Plan 1.

Pilot online data collection tool (DELV 2 or Formstack) with four EMS members (NZ GAP to select). This will test functionality and identify issues. Investigate how the information can flow through for council reporting. Testing will be conducted on the soil management module of the FEP and EMS checklist.

Prepare and work through with the 4 growers who the E&S Control Plans were prepared for, the NZ GAP: Checklists, Corrective/Development Actions, BMPs, Auditing, and Tracking. Report on the process and outcomes.

Evaluation of the soil component of the FEP process. 1. Plan development, 2. Audit process, and 3. Do the mitigations lead to environmental change? Linking research to implementation and outcomes. Outcomes focused rather than process. The use of NZ GAP by Pukekohe/Waikato growers as part of Plan Change 1 requirements.

The capturing and use of soil metrics. Determine what metrics can be recorded and tracked. Present the concept of how these metrics could be used in both a national level dashboard and in an individualised benchmarking report (similar to the SWNZ reports but based on soil health). The metrics may be based on the NZ GAP checklist and DMTW app on mitigation measure changes.

PNZ 74 PMTV Survey

Lead Organisation: Potatoes New Zealand Inc.

Project Leader: Iain Kirkwood

Objective

To determine the extent and national distribution of Potato Mop Top Virus, through a nationwide survey of the 2018/19 seed, table and process potato crops.

Update

80 seed paddocks have tested in Canterbury. One was found to be positive. A further 108 Commercial paddocks samples have been collected throughout New Zealand. A total of 188 paddocks sampled – results have returned so far for approximately 120 paddocks.

PNZ 75 Consumer Desired Flavour

Lead Organisation: Plant & Food Research

Project leader: Marion McKenzie

PNZ 76 Potato Metabolites

Lead Organisation: Plant & Food Research

Project leader: Marion McKenzie

PNZ 77 GI Impact of Potato Varieties

Lead Organisation: Plant & Food Research

Project leader: Marion McKenzie

PNZ 78 Ag Chemical Strategy Project

Lead Organisation: Market Access Solutions

Project Leader: Rebecca Fisher

Objectives:

Since 2015 a project to develop a vegetable industry agrichemical strategy has been coordinated by Market Access Solutionz. Two years ago the project moved to a maintenance phase involving annual updates of tick sheets, crop profiles, risk assessments, analysis of control priorities and possible replacement agrichemicals.

Update

Fourteen exceedances of MRLs were detected from these datasets which include samples from NZGAP's agrichemical monitoring programme between December 2017 and December 2018, and from MPI's FRSP for the period of August 2017 to June 2018. Most exceedances were of the default MRL of 0.10mg/kg, rather than situations where an MRL was set for the crop. The exception to this was a detection of procymidone on a sample of endive. One residue of phorate, a compound that is no longer approved for use (as of 1 July 2016 and the residue was detected in January 2018), was detected in a carrot sample, and detections of acephate, methamidophos and diazinon were detected on endive, kalian and chilli peppers respectively. These represent off-label use of these compounds, which is prohibited. Two exceedances appear to be a result of growers treating an MRL as applicable to an entire crop group, when it is actually specific to an individual crop. Five other residues exceed the MRL but also represent relatively low residues. These cases were probably attributable to the grower applying the product off label too close to harvest, without observing a withholding period that would have allowed residues to sufficiently decay. This report makes some recommendations for helping to address these issues and lessen their likelihood of re-occurring in future.

PNZ 79 Nutrient Emissions Project

Lead Organisation: Potatoes New Zealand Inc.

Project leader: Chris Claridge

Objectives

This project is currently under development and more details will be released shortly.

Additional Reading

PNZ 26 Exploring Spongospora suppressive soils

This is an abstract from a grower profile which first appeared in Grower Success Stories, a levy-funded booklet published by AUSVEG to promote real results from levy investment, and was featured in the AUSVEG Weekly Update published 11 December 2018 and was then republished with permission in NZ Grower and on the Potatoes NZ website.

Project PT16002 is a three-year project examining if different field soils affect the development of powdery scab in potato crops across New Zealand. In collaboration with scientists, A S Wilcox and Sons collected soil samples to study links between soil biology and powdery scab, looking to assist growers in selecting those soils as preferable locations for ware potato production.

"It's critical to focus energy in regions growing potato seed crops, otherwise we, as growers, are just inoculating new land all the time with this disease" says Wilcox grower, Bryan Hart.

"Powdery scab is the scourge of ware crop growers and costs the business a lot of money every year. Current chemical controls aren't effective to meet our customer demands (of perfect skin finish) and increasing knowledge of the disease is fundamental to developing long-term solutions," he says.

A project is being conducted to determine if different field soils affect the development of powdery scab on potatoes. Phase two of the project will investigate whether soil physical, chemical and/or biological characteristics influence this disease.

Exploring Spongospora suppressive soils in potato production (PT16002) is a strategic levy investment under the Hort Innovation Fresh Potato and Potato Processing Funds. It is supported by Hort Innovation and Potatoes New Zealand Incorporated.

During the project, Wilcox has collected soil samples from a number of farms with a range of cropping history to help determine if there was a link between soil biology and disease presence and expression in potato crops.

Photography credits: Nigel Marple.

"We are interested in this because currently there are few tools of limited effect at managing the disease, especially when you receive seed lines that are infected or you grow varieties that are highly susceptible to the disease," Bryan says.

Results from the project identified different levels of several physical and chemical factors from similar soil types including soil texture, organic matter, and fertility and nutrient availability. Bryan says this raises questions around what makes these soils different.

"It is very early in the piece, however if there are biological organisms in those suppressive soils, then long-term it may be possible for either selecting those soils as preferable locations for potato production or potentially even for the manufacture of those organisms to be incorporated in-furrow at planting."

"If these facets turn out to be realized, then I would encourage all growers to adopt them."

Exploring Spongospora suppressive soils in potato production has been funded by Hort Innovation using the fresh potato and potato processing research and development levies and contributions from the Australian Government.

The project is supported by Hort Innovation and Potatoes New Zealand Incorporated.

PNZ 28 PFR SPTS13802 Potato Breeding Program

Copied from www.plantandfood.co.nz

Potatoes for boiling, crisping or chipping

New potato cultivars that meet the needs of the domestic and export markets

New Zealand produces 586,000 tonnes of potatoes each year, with a value of $570 million. The majority of the harvest is eaten by the domestic market, but 18% of the value is generated by exports of processed potatoes, mainly French fries.

The potato breeding programme develops cultivars for both the fresh and process markets. Resistance to pests and diseases found in New Zealand – such as the tomato-potato psyllid, powdery scab and potato virus Y – is important in the development of a new cultivar, as are yield and other production traits. For the process market, potatoes that have the right shape and size for processing are preferred, as are those not affected by storage disorders at low temperatures, such as cold induced sweetening. The fresh market requires potatoes that are attractive and have good taste profiles.

Plant & Food Research has released nine potato cultivars to the New Zealand market since 1995. The most grown of these is 'Moonlight', a high yielding potato with good pest and disease resistance, suitable for pre-packing and processing into French fries. It is estimated around 12% of the total area of potato production in New Zealand is planted with 'Moonlight'.

The New Zealand potato breeding programme is funded by Potatoes New Zealand and Plant & Food Research.

PNZ 42 PEF research on NZ potatoes

Indrawati Oey, Pat Silcock, Sze Ying Leong and Phil Bremer
Department of Food Science (University of Otago)

Scientists at the Department of Food Science (University of Otago) have been working closely with PotatoNZ and the Potato Industry to explore the potential of using Pulsed Electric Fields (PEF) technology for French fries and potato chips production. PEF technology uses brief (microseconds) pulses of high voltage electricity to disrupt cell membrane. Hence it can be used to modify the structural integrity and microstructure of plant tissues, with the goal of improving mass transfer processes. To assess the potential of PEF in the New Zealand potato industry, a 3-month industry trial has been carried out using a high-throughput pilot scale PEF unit provided by Elea Germany. We investigated the effect of different PEF process parameters on different potato cultivars. The colour and texture of French fries, produced at commercial scale using either untreated or PEF-treated potatoes was compared with commercially produced fries (using pre-heated potatoes). The same PEF process parameters were also trialled with either uninfected or Liberibacter-infected potatoes to assess PEF's ability to mitigate zebra chip symptoms.

Applying PEF treatment to Liberibacter-infected potatoes, appears to "at least partially" ameliorate the visual impact of infection as is facilitates the development of even browning across the entire fry. The results from the industry trial demonstrated the potential of PEF technology to produce French fries with frying qualities similar to commercial fries without the need for the energy, time and water intensive pre-heating step. Overall, compared to pre-heated potatoes, i.e. commercial fries, PEF-treated fries showed the same extent of browning after frying and developed a crispier crust while preserving the internal mealy texture of fries. An unexpected finding from the industry trial was that PEF treatment appeared to reduce the browning anomaly in fries caused by plant physiological processes (other than Liberibacter infection) for certain potato varieties. Therefore, fries with even browning across the entire fry can be produced through a PEF pre-treatment of the tubers.

In conclusion, the industry trial provided a valuable opportunity to test the capacity of PEF technology to process potato tubers which are highly heterogeneous in terms of their physiological, chemical and microstructural properties. The trial demonstrated that the pre-treatment of variable raw potatoes with PEF under commercial scale process conditions, led to fries with a more uniform colour and a crispier crust compared to untreated fries. The results were consistent across three different potato cultivars on different production days and importantly PEF treatment appeared to reduce the extent of uneven browning in fries produced from Liberibacter-infected potatoes.

A one day workshop was held on the 19th February 2019 in Dunedin, jointly funded by the University of Otago, PotatoNZ and MBIE funded Food Industry Enabling Technology (FIET) project. At the workshop we shared our findings from the industry trial and discussed with representatives from the potato industry the potential of PEF technology. In addition, we provided to the industry representatives the opportunity to have a hands-on experience working with PEF on potatoes using the PEF facility available at the University of Otago.

This year PotatoNZ has provided us with more than 300 tubers of Liberibacter infected and uninfected potatoes for 2 cultivars. Two new Otago PhD student who have recently joined the project will study in-depth how different cultivars impact on the effectiveness of PEF and they will also develop a mechanistic understanding of how frying impacts on PEF-treated potatoes. This research will involve modelling mass transfer and validating mathematical models. Our other FIET investigators i.e. Assoc. Prof. David Burrit (Botany, Otago University), Prof. Mohammed Farid (University of Auckland) and Dr. Samantha Baldwin (Plant & Food Research) will be intensively involved in these interdisciplinary research activities. More exciting research activities and findings are expected in the next coming months.

Picture 1: PEF resulting in a more flexible potato texture

Picture 2: Group photo taken during one-day workshop on 19th February 2019 at Otago University, Dunedin

Picture 3: Hands-on experience working with PEF on potato at PEF facility in Dunedin

PNZ 57 Potatoes Spectral Imaging and NIR

Figure 1. Bin of potato send by Potato NZ

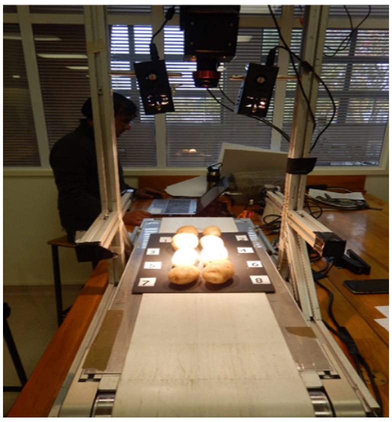

Figure 2. Potatoes Hyperspectral Image capturing on moving belt

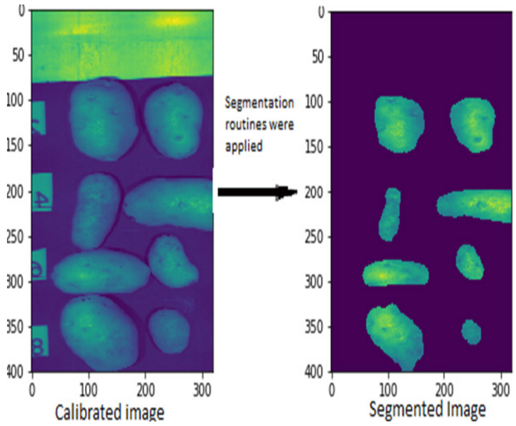

Figure 3. Potato Hyperspectral image before and after segmentation

This project seeks to detect non-invasively tubers likely to be infected with Liberibacter. It investigates a camera able to capture a chemical image of the tuber (hyperspectral 'HS' imaging) that can utilized assess the tubers rolling on a grading line. Infected tubers could then be graded out (by robot or manually if identified by laser pointer) prior to processing.

The grading of the tubers with this technology involves a mathematical model that uses the hyperspectral images to score the tuber as infected or healthy. The feasibility of this technology has been assessed using washed and dried Russet Burbank potatoes. A total of 3736 tubers supplied by Potato NZ (Figure 1) were individually identified, then scanned by the HS camera in a conveyor belt using illumination easily replicated at a grading line as represented in Figure 2. All tubers were peeled, inspected by eye and assigned "diseased" or "healthy": 1970 (~53%) were diseased and 1766 healthy. A subset of 364 were peeled, cut and fried and rated for severity of zebra chip defect. These conditions mimic an industrial setup involving multiples tubers in the same image and a common potato variety.

We employed segmentation routines to extract the pixels belonging to an individual potato from the rest of an image (Figure 3). Then a large oblong of 400 pixels was subsampled from the centre of each potato and the corresponding spectral data was processed to remove noise and effect of other unwanted experimental variation. Several algorithms have been investigated to develop the model to classify the tubers into diseased or healthy. Classification rates ranged from 51% to 91% for healthy potatoes detection and 54% to 88% for diseased potatoes detection. This is far from perfect but is a promising start.

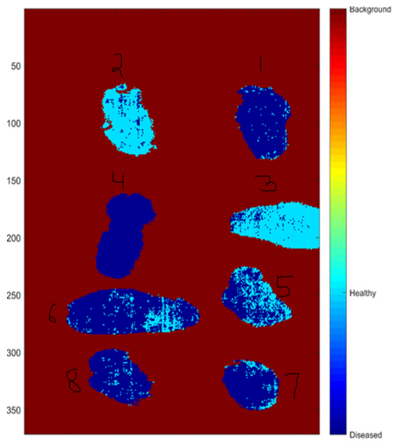

Figure 4. Surface Map of potato image

With the best model is possible generate surface maps as shown in Figure 4, where each pixel in the image is classified as infected of healthy. Here dark blue show pixels with a spectral signature indicative of disease and light blue healthy. The background is brown. In this surface map potato numbers 1, 4, 6 and 8 are confirmed diseased and that matches our ground truth. Potato numbers 2, 3, 5, 7 are healthy as per our recorded data but the surface map is showing potato 2 and 3 to appear healthy while 5 and 7 appear diseased. We are in the process of optimising feature detection in the surface map to give us at least 95% accuracy.

Our work to date has shown potential in hyperspectral imaging for identifying Liberibacter infected potatoes. We are progressing optimising performance. Later it can be applied to other varieties and ideally applied directly to dry brushed potatoes without prior washing and drying. Once a model has been enhanced and proven, focus shifts to operation: how the system will operate at the grading line in the pack house?

PNZ 62 Future Proofing Vegetable Production

The following extract can be found at
http://www.landwise.org.nz/projects/future-proofing-vegetable-production/

Future proofing vegetable production requires ongoing rapid change in farm practice to meet cost pressures and increasingly stringent demands from regulators and markets for enhanced environmental performance and water quality.

With support from the MPI Sustainable Farming Fund (https://www.mpi.govt.nz/funding-and-programmes/sustainable-food-and-fibre-futures/), industry and regional councils, we're starting the journey.

Landwise is partnering with growers and our funders to develop and test new production and nitrogen mitigation techniques. The project draws on and supplements recent and current research to develop new generation good management practices.

We have four main areas of focus:

1. Precise nutrient prescription (how much is required)
2. Precise application (is it going where it is needed when it is needed)
3. Maximising retention (ensuring leaching is minimized)
4. Recapturing nitrates that move beyond the root zone (constructed wetlands and wood-chip bioreactors)

Test strip used to determine available N in a soil sample

Ensuring the prescribed rate of fertiliser is applied

Installing a wood-chip bioreactor (Lincoln Agritech image)

Sediment and Drainage (http://www.landwise.org.nz/projects/fert-calibration/), and other projects including current research on quick tests for soil nitrate (http://www.landwise.org.nz/soil/ matthew-norris/), fluxmeter monitoring of leaching and the use of wood-chip bioreactors (http:// www. landwise.org.nz/soil/aldrin-rivas/) to strip nitrate from drainage water.

The research side will be supported with considerable extension and training. We are aware that numerous computer based decision support tools (http://www.landwise.org.nz/projects/ fert-calibration/on-line-resources/) have been developed, but we have identified that many

growers need considerable support and upskilling to have the knowledge, skills and experience to effectively use them.

To stay in touch about this project, subscribe to our newsletter for updates! (http://www.landwise. org. nz/home/newsletter/)

This project is funded by the Ministry of Primary Industries Sustainable Farming Fund, Horizons Regional Council, Gisborne District Council, Ballance AgriNutrients, Vegetable Growers and LandWISE.

PNZ 69 Psyllid Management

The tomato potato psyllid, Bactericera cockerelli (Šulc) (TPP) vectors the bacterium Candidatus Liberibacter solanacearum (CLso). CLso is the putative agent of zebra chip (ZC) disease in potato tubers. Zebra chip disease makes potatoes unsuitable for processing, causes disease in seed tubers, and affects the taste as well as their internal appearance. In previous field trials we tested action thresholds based on sticky trap counts and accumulated degree days to commence insecticide programmes, and incorporation of agricultural oils.

In the Potatoes NZ funded 'Future-proof spray programme Canterbury' trial we test different spray programmes using integrated pest management tools. Insecticide resistance management and product label have been taken into account when developing these spray programmes with industry.

The spray programmes consist of:

1. A positive control - a standard Canterbury spray programme
2. Alternating the Canterbury programme with Excel oil from emergence
3. Canterbury programme but only start when degree day threshold is reached
4. Alternating the Canterbury programme with Excel oil but only start when degree day threshold is reached
5. A future proof spray programme without neonicotinoids and organophosphates, and
6. A negative control that will not be sprayed.

TPP adults are monitored using 5 yellow sticky traps in the crop, which are collected and replaced on a weekly basis from crop emergence. A sticky trap is placed on each side of the crop, about 5 m into the crop. The fifth trap is placed in the centre of the crop.

At harvest total yield (kg) per plot, weight and number of marketable and reject tubers, dry and wet weight of 30 tuber sub-sample of marketable tubers to calculate Specific Gravity, and Zebra chip incidence and severity of 30 marketable tubers per plot will be taken for frying to assess ZC.



A tomato potato psyllid adult and yellow eggs on stalks. Copyright © The New Zealand Institute for Plant & Food Research Limited. All rights reserved.

Foliar symptoms in potato related to an infection by the bacterium Candidatus Liberibacter solanacearum. (A) Foliar symptoms early in the eason consist mainly of cupping of the leaves. (B) Later in the season, purpling of the leaves occurs, as well as thickening of the nodes and the growth of aerial tubers.

Raw tuber symptoms as a result of an infection with Candidatus Liberibacter solanacearum.

Zebra Chip disease (dark/flecked slices) in potato

PNZ 69 Tamarixia Trials

A Sustainable Farming Fund (SFF) project aims to establish self-sustaining populations of Tamarixia triozae, a tiny parasitic wasp (around 2 mm long) of TPP, in New Zealand.

To date; around 2800 adults of the small wasp were released between Nov 2016 and Feb 2017, across two sites in Canterbury, three sites in Hawke's Bay and one site in the Auckland region. The challenge has been to find release sites where year-round populations of the psyllid are present and that are not exposed to insecticides. We have therefore focused on sites in Canterbury and Hawke's Bay where the perennial TPP host plant, African boxthorn. The Auckland site was a tomato grower's property.

PNZ 69 Regreening

The Regreening Project is another SFF project in which we hope to develop Best Practice Protocols for spraying off seed crops to prevent and/or control re-greening.

One of the greatest challenges is in the post-spray-off period, when we see the highest risk of Liberibacter infections and also ongoing risk throughout the season. We aim to provide growers with guidelines for optimum spray off.

Re-growth plants act as a magnet to tomato potato psyllids and large populations can often be found inhabiting this foliage. Obtaining a rapid and efficient kill is a vital component in seed crop disease management.

Candidatus Liberibacter

The potato psyllid, *Bactericera cockerelli*, feeds on a potato and infects it with *Candidatus* Liberibacter solanacearum, the bacterium that causes zebra chip disease.

Image (wikipedia): The parasitic wasp Tamarixia triozae parasitizing a tomato potato psyllid nymph.

• *Chloropicrin soil fumigation*

This project is investigating the use of soil fumigation to manage soil borne disease load.

Chloropicrin has a long track record of effectiveness on many soil-borne pathogens, including verticillium wilt, scab, Colletotrichum (black dot), rhizoctonia, fusarium, and phytophthora.

Chloropicrin advocates in the U.S. and Canada say, because the product can be selectively injected into just the seedbeds, rather than throughout the whole field, this reduces the environmental impact. Because fumigation can mean healthier crops, it can be argued that this also helps reduce the overall carbon footprint of potato farming.

Once your plant is healthy then it may not need as many other inputs.

If growers promote the healthy growth of the potato crop, with a much healthier root system then the plant may be better able to scavenge and make use of applied water, nitrogen or fertilizer. All that translates into healthier growth, higher yields and higher quality.

In an article on www.spudsmart.com proponents say this:

Regardless of what type of applicator is used, *"it's a closed system, moving right from the container that the product is delivered in, to the soil."*

The fumigant is in a liquid form until it's injected underground, when it then changes from a liquid into a gas that moves throughout that soil profile.

"Chloropicrin is degraded in the soil by microbes, so over a very short period of time, less than three or four days, it is chewed up and degraded into some very safe products. One is carbon dioxide, others are nitrogen and a little bit of chlorine. Basically no residue is left behind."

"A lot of people have a perception that soil fumigants sterilize the soil, and that's simply not the case, in fact, they're fairly specific on the types of organisms that they do suppress, and there are several 'beneficial' organisms that really rebound well, say in the case of chloropicrin. They come back in and re-inhabit the soil, you can see massive growth in these populations. We think that that provides some of the growth benefit that you see in the crop, the fact that after the application, you get rebound in populations of beneficials."

A post-release survey that began in December 2018, has recovered the tiny wasp from both sites in Canterbury and two sites in Hawke's Bay.

- Plant & Food Research supplied T. triozae to Bioforce, a company that produces biological control agents, and the company is now selling the wasp as a commercial product.
- PFR also supplied Lincoln University, who are successfully rearing the wasp to supply further releases as part of the SFF project.
- Further releases, as part of the SFF project, have been made by growers and other industry personnel keen to establish the wasp on their farms since December 2018.

July 2019
No. 4

Plant & Food RESEARCH
RANGAHAU AHUMĀRA KAI

Potatoes NEW ZEALAND

Technical Bulletin

Management of tomato potato psyllid in New Zealand potato crops

Introduction

Zebra chip disease of potato tubers is caused by the plant pathogenic bacterium *Candidatus* Liberibacter solanacearum (CLso). This bacterium is transmitted to the plant by the insect tomato potato psyllid (TPP; *Bactericera cockerelli* (Šulc)). Zebra chip disease (ZC) lowers yield and tuber quality, affects the taste of potato and causes darkening of the chips when fried. The psyllid was first found in New Zealand in 2006, and it wasn't until 2 years later that CLso was discovered, so we're dealing with a quite new to science complex with still many questions around how the insect, bacterium and plant interact. After 10 years of research, one of the only ways to reduce ZC in a crop is by managing TPP. Other cultural control methods are: harvesting before Christmas (NI), growing short season crops and making sure there is no re-greening after desiccation as this attracts the psyllid and infection with CLso can still take place.

The Seed Potato Certification Authority has set a 0.2 % tolerance for CLso. For process potatoes, each processor will have its own tolerances for discolouration caused by ZC and other factors.

This technical bulletin provides an update on the current PNZ funded TPP management research, where we're at and what is next.

Tomato potato psyllid

TPP is a small insect, approximately the size of an adult winged aphid (Figure 1). It starts with a yellow egg on a white stalk laid on the leaf. A small nymph will emerge from the egg and will go through 4 more stages, growing bigger every time (Figure 2), before an adult emerges. When the adult emerges, it has a yellow to light-green colour and the white stripe on its abdomen (or back) is not yet visible but will become more visible as the adult psyllid darkens with age.

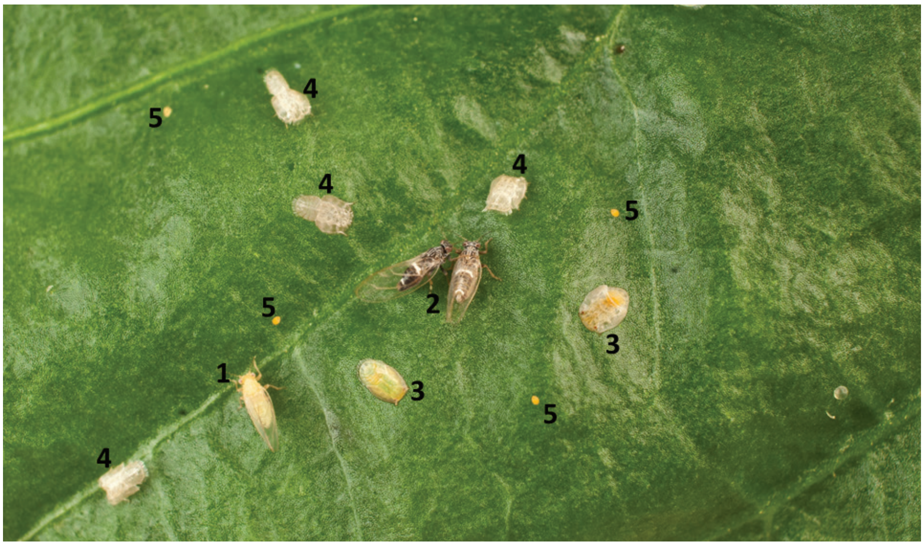

Figure 1. One immature (green/yellow) (1) and two mature adult tomato potato psyllids (2), two nymphs (3), some skins from moulting (4), and a few eggs (5).

Figure 2. One large tomato potato psyllid nymph, 3 small nymphs to medium, 1 egg and psyllid sugars on a capsicum leaf.

In the United States they have 4 TPP haplotypes (Central, Western, and Northwestern, Southwestern) which all feed on potato, in New Zealand we have the Western haplotype.

Adults and nymphs feed on the phloem in a plant and do so by puncturing the leaf. Both adults and nymphs can carry and transmit CLso. Only a small percentage of the TPP population tests positive for the bacterium, generally around 3-5%. Similar results have been found in the United States. Adults have to be screened with molecular techniques (polymerase chain reaction or PCR), to ascertain whether they carry the bacteria. Non-infected TPP can acquire CLso when they feed on an infected potato plant.

Tomato potato psyllid affects a wide range of cultivated solanaceous crops including potato, tomato, tamarillo, capsicum, cape gooseberry, and eggplant. The psyllid has a number of known weed hosts in New Zealand: African boxthorn (***Lycium ferocissimum*** Miers), Chinese boxthorn (***L. barbarum*** L.), Poroporo (***S. aviculare G.*** Forster), Jimsonweed (***D. stramonium*** L.), Apple of Peru (*Nicandra physalodes* (L.) Gaertner), Jerusalem cherry (***S. pseudocapsicum*** L.), and field bindweed (*Convolvulus arvensis* L.). Jerusalem cherry and Jimsonweed (also known as thornapple) have tested positive for CLso and consequently can act as reservoirs for the bacterium outside the potato growing season.

In a recent visit to New Zealand Prof. Neil Gudmestad from North Dakota State University, a global expert on the Zebra Chip Disease Complex, gave a presentation to Canterbury growers on how ZC is managed in US potato crops. He outlined their TPP management, cultural and chemical approaches. For more information on what insecticides have a label for TPP management in potato in New Zealand, and what life stages they affect, please refer to the 'tomato potato psyllid control' poster on the PNZ website.

Prof. Gudmestad also detailed three biological control agents (***Chromobacterium subtsugae, Beauvaria bassiana*** and pirate bugs) which are used in the US to manage TPP populations. These are more effective as part of an IPM (Integrated Pest Management) strategy. Potatoes New Zealand is part of a programme that looks into the efficacy biocontrol agents.

Other control measures used in the US include hydrolyzed fish waste the smell of which may mask volatiles that attract TPP and Kaolin which appears to deter adult psyllids from landing on treated foliage. A copy of Prof. Gudmestad's presentation is available on the Potatoes New Zealand website under *https://potatoesnz.co.nz/updates/research-updates/management-of-zebra-chip-in-the-usa/*

Candidatus Liberibacter solanacearum and Zebra chip disease

In the Unites States, two CLso haplotypes that affect potato are present: A and B, of which B causes more severe ZC symptoms. In New Zealand, only haplotype A is present. Other haplotypes of CLso are present around the world (C, D, E, F and U) but these affect plants in the Family Apiaceae (e.g. carrot, celery, parsley) and nettle (U). These haplotypes are vectored by different psyllid species, not TPP. None of these CLso haplotypes have so far been found in New Zealand.

Once TPP has infected a plant with CLso there is no way back; the plant is infected and some degree of damage will be done, depending on the time of infection. CLso cannot be prevented from reaching the tubers. 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 degree at which raw tuber symptoms are visible depends on the potato cultivar. The darkening happens while frying the chips (Figure 3), and is caused by the increased sugars as a result of an infection with CLso.

Figure 3. Fried chips from individual potato tubers from a field trial, with the two dark chips showing symptoms of zebra chip disease.

Similar tuber symptoms can be caused by Verticillium, drought, and high sugars (e.g. cultivar Nadine). The foliar and tuber symptoms are a response of the plant to being infected with CLso.

Similar foliar symptoms can also be caused by Rhizoctonia or virus infection, and a check of the stems and tubers is necessary to confirm.

In lieu of CLso-tolerant or -resistant cultivars, or post-harvest treatments, the only way to reduce ZC in a crop is to manage the insect vector, TPP.

Management of tomato potato psyllid to lower zebra chip disease in a crop

In the 2018-19 season, a field trial in Southbridge, Canterbury was conducted with the aim to

1. Develop a future-proof insecticide programme for TPP management for potato growers in Canterbury, and
2. Further develop reduced insecticide programmes using Degree Day (DD) accumulation and agricultural oils in a standard Canterbury insecticide programme. This trial builds on research previously conducted in a Sustainable Farming Fund project (2012-15), Potatoes NZ funded regional pest management trials (2014-15 & 2015-16) and Potatoes NZ funded end-of-season TPP and desiccation management (2016-17).

The trial was planted with 'Agria' on 17 October 2018, with 100% emergence in the week of 22 November. The randomised trial consisted of six replicates of six treatments (Table 1). Insecticide applications for treatments SE, AE and F started from crop emergence, whereas treatments SD and AS started at reaching 716 Degree Days.

PDF Download link:
https://potatoesnz.co.nz/updates/research-updates/management-of-zebra-chip-in-the-usa/

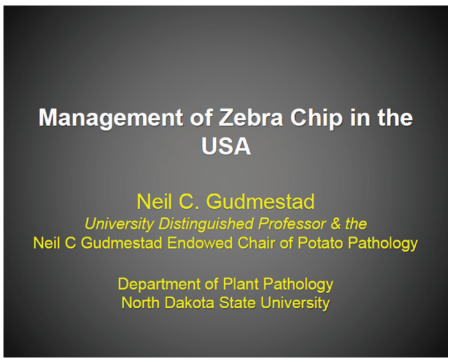

Table 1. Description of the insecticide programmes to manage tomato potato psyllid used in the potato field trial in Southbridge, Canterbury in the 2018-19 growing season.

Abbreviation	Description
SE	Positive control - a standard Canterbury insecticide programme
AE	Alternating standard Canterbury programme with Excel® oil from emergence
SD	Standard Canterbury programme started when 716 DD was reached
AS	Alternating standard Canterbury programme with Excel oil from when 716 DD was reached
F	Future proof insecticide programme without neonicotinoids, synthetic pyrethroids and organophosphates
C	Negative control - not sprayed with insecticides

To monitor TPP life stages during the season, we placed 5 yellow sticky traps in the field on 2 November 2018 which were replaced on a weekly basis, and conducted three plant assessments (early, mid and late season). The first TPP adults were trapped on yellow sticky traps on 6 December 2018, only 8–10 days after 100% crop emergence. The number of TPP caught per trap per week was generally quite low (Figure 4). On potato plants, TPP eggs, and small and medium nymphs were found at the first assessment date, 17 December 2018. Counts for all TPP life stages varied between the treatments but this was primarily because of the higher counts for the unsprayed Control treatment than for other treatments, plus the absence of all nymph classes for the standard Canterbury insecticide programme (SE).

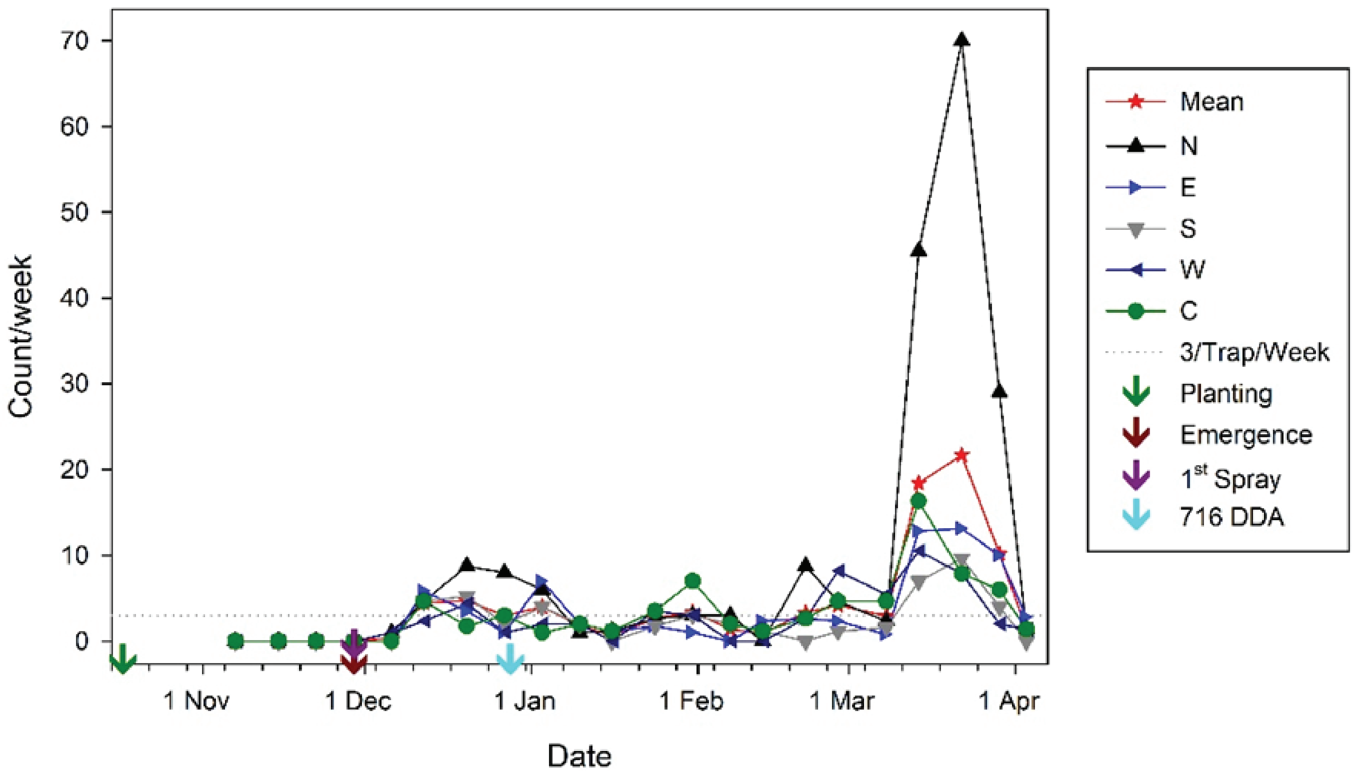

Figure 4. Mean number of tomato potato psyllid adults caught on yellow sticky traps in a potato crop ('Agria') over the 2018-19 growing season in Southbridge, Canterbury. N, E, S, W: cardinal directions; C: centre of crop; 3/trap/week: mean of 3 TPP per trap per week, a threshold previously used to commence insecticide programmes, but not used in this trial; DDA: degree day accumulation; emergence: indicates 100% emergence; 1st spray: first insecticide application.

The trial was harvested by hand on 2 and 3 April 2019, and all tuber were weighed and counted at Plant & Food Research Lincoln. All tubers over a 5 m length of the two datum rows from each plot were harvested and bagged. Overall, neither marketable weights nor numbers varied significantly among the treatments, and neither did unmarketable weights or numbers. Mean ZC score did not vary significantly with treatment at harvest and was highest for the unsprayed Control treatment and lowest for the future proof insecticide programme (F). Overall, ZC incidence did not vary significantly between treatments, and neither did the percentage of crisps with slight (ZC>2) and medium (ZC>4) ZC discolouration. However, the highest percentage of crisps with slight and medium ZC discolouration were for the unsprayed Control treatment, and the lowest for treatment F.

The relative profit for each treatment with penalties over ZC scores higher than 2 varied from 70.9 for C to 103.5% for F, when SE 'profit' was set at 100%, a similar trend was observed for ZC>4. The 3.5% increase in profit for F compared to SE comes mainly from a low percentage of tubers with ZC, as the yield for F was lower than for SE. The option of no TPP management did not pay off in this trial this year, with the lowest yields and the highest ZC percentage, resulting in the lowest relative profit.

In contrast to this study, in previous trials, alternation with Excel® oil from emergence was the most profitable treatment. In the 2018-19 trial, with a different base insecticide programme, the alternating with Excel oil from either emergence (treatment AE) or 716 DD (treatment AD) produced little benefit, with AD being slightly worse than AE insecticide programme.

It was interesting to note that the 716 DD (reached on 28 December 2018) did not coincide with 3 TPP per trap per week (reached between 8 and 10 December), where normally for the South Island these two variables vary by 2–13 days. Using the adjusted African boxthorn degree days (600 DD instead of 716 DD when the crop is adjacent to African boxthorn), which was reached 9 December 2018, would have been closer to the trap threshold. Applying treatment AD 2–3 weeks earlier may have made a difference to the performance of this insecticide programme.

It is suggested to repeat the insecticide programmes for at least another one to two seasons to obtain a good feel for the effectiveness of these programmes and their resilience, and adjust where needed. In addition, a future-proof insecticide programme using either a trap or DD threshold, or including alternation with an agricultural oil would be a logical next step to make TPP management more sustainable in Canterbury.

Potatoes NEW ZEALAND Growing together

Plant & Food RESEARCH RANGAHAU AHUMĀRA KAI

POTATO STORAGE

Advice from NZ based expert Chris Thorman
CThorman@eit.ac.nz

The main challenge for storage in New Zealand is simply ensuring growers are well informed. As the market requirements increase in all areas of production, the risks of crop failure need to be further mitigated.

The solution lies in looking at individual grower production processes. We need to analyse the handling and storage systems, in light of the latest research.

- Each grower would benefit by doing a self-evaluation – including moisture loss eg: weight before and after storage.

Eg: In Scotland a grower weighed every bin he put into his store, totalling 1133 tonnes. He then weighed output of the store, after 5 months of storage. His saleable yield was 940 tonnes of seed. He'd lost 16 tonnes of sprouts and 44 tonnes of soil and grade outs. The overall weight loss was 149 tonnes or 13%. This was mostly due to limited air flow and no temp control. The grower upgraded his storage, based on the proposed protocol and one year later, the weight loss was reduced to 7%.

ASK YOURSELF: What % marketable yield am I losing? What is that worth in dollars? What if I could halve that loss?

- PNZ are planning workshops for 2020 to facilitate assessing your potato production process – from burn-off to delivery. In these workshops we will discuss the latest research, look at disease physiology, examine best practice and growers will evaluate their postharvest practice against a protocol. No one system is right, and there are many factors to take into account, but the aim is to place a spot light on storage and allow growers to look for focus points, that will help decide on where, when and how improvements can be made.

FAST FACTS

CURRENT RISKS – disease, sprouting & marketable yield loss

SOLUTION – individual evaluations, education on overall concept of storage and potential problems and developing a protocol for your business.

Wind rowing to dry seed potato

Tent drying of tubers

Notes:

Notes:


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STAUNCH SUPPORTERS OF THE
ALL BLACKS
Bluebird
Snag & Sauce
FLAVOURED POTATO CHIPS
STAUNCH SUPPORTERS OF THE
ALL BLACKS
Bluebird
PRAWN COCKTAIL
FLAVOURED POTATO CHIPS
STAUNCH SUPPORTERS OF THE
ALL BLACKS
TACKLE THESE LIMITED EDITION FLAVOURS
THE SILVER FERN DEVICE AND ALL BLACKS® ARE REGISTERED TRADEMARKS OF NEW ZEALAND RUGBY.