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Potato Trials Field Day

4 February 2016

Manawatu

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FAR Potato Research 2015/16

Jen Linton, FAR

FAR's potato research for the 2015/16 season is well underway. This season's programme is similar to last season, but the focus has been further refined.

Psyllid work will continue, with trials established in Matamata, Manawatu and Canterbury. The incidence, importance and timing of pests varies markedly between potato growing regions in New Zealand. The aim of the three field trials is to develop regionally focused pest management strategies, initially focussing on tomato potato psyllid (TPP) and zebra chip disease, putatively caused by *Candidatus* Liberibacter solanacearum (CLso). This project will focus on developing 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 infected with CLso (TPP) or viruses (aphids).

FAR were successful with an application to MPI SFF for a project that will run for three years in Pukekohe, Manawatu and Canterbury and focus on *Increasing potato yield through understanding the impact of crop rotations and soil compaction*. Year 1 is well underway with eighteen commercial potato field crops being evaluated for this season. The desired outcome of the project is to better understand where potatoes fit in the rotation, how to reduce soil compaction and improve soil structure whilst understanding how all these factors impact of soil borne diseases. Comprehensively testing abiotic and biotic factors along with understanding the rotation and soil borne diseases over three years will give us the full spectrum of how and where potatoes fit best along with understanding where we can increase yield.

A soil borne disease trial has been established in South Canterbury to evaluate the efficacy of various different fungicides either applied to the seed or in furrow. We are looking at old chemistry and new SDHI chemistry for the control of mostly rhizoctonia and powdery scab. Low disease pressure last season at the two trial sites made it hard to interpret results. A tight potato rotation at the site should result in high disease pressure and some interesting results.

Investigating the water use efficiency of potatoes will be looked at again only in Canterbury. This year a shallow stony soil will allow us to understand the water use on a different soil type. Treatments replacing various soil moisture deficit volumes will identify when we see a yield loss from water stress, also identify where savings can be made through over watering and drainage events. Different stress timings will also be looked at. Often a decision needs to be made between watering one high value crop and another so better understanding when these timings will severely reduce potato yield are important.

Sustainable Farming Fund Project 2015-18 – the effects of crop rotation on soil quality and potato yields

Steven Dellow, Plant & Food Research

Background

- Over the past decade, potato yields have remained static at around 50-60 t/ha (Canterbury) and typically yield well below potential. These production levels are increasingly uneconomic for growers.
- In the 2012-15 seasons, Plant & Food Research monitored a total of 15 crops in Canterbury (Sinton et al. 2013, Michel et al. 2013, Sinton et al. 2014, Sinton et al. 2015) and found that the main factors limiting potato yields were:
    1. The presence of soilborne diseases reducing underground root and stem health, and
    2. Compacted soils restricting root growth and reducing the crop's ability to take up water and nutrients (Figure 1).

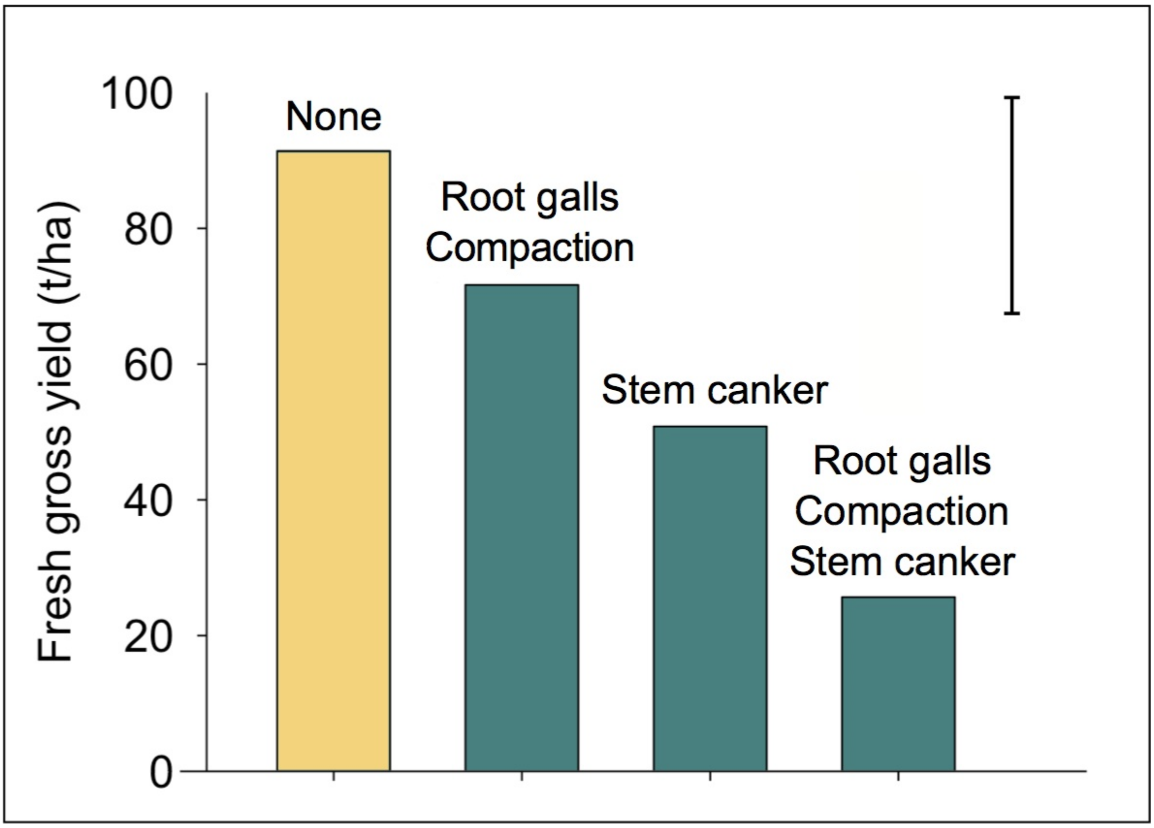


Figure 1. Fresh gross tuber yield from targeted areas in 11 potato crops in the 2012-13 season.

Current Research

- To capitalise on these initial findings, a three year nationwide SFF project has been initiated by FAR, to investigate how previous crop history and management influences soil quality and the presence of soilborne disease and thus yield. Plant & Food Research is providing the expertise to carry out the work and interpret the findings.
- Currently, 18 monitoring sites are being investigated:
    - Three in Pukekohe/Pukekawa
    - Three in Manawatu
    - 12 in Canterbury

Soilborne diseases

- In conjunction with a soil health testing method developed in Australia (SARDI Predicta Pt test), to measure pre-plant levels of several soilborne pathogen DNA (30 sampling points combined to give one result per field), the same 1 hectare area is being intensively monitored at each site:
    - Soil was removed and individually bagged (pre-plant) from 10 pre-determined points within the 1 ha area and placed in a shadehouse at Lincoln. Clean seed (formalin - treated from the same line as the site) was planted in each of 10 bags from each site, to help determine the source of any soilborne disease that appears in the original field crop.
    - Selected plants in the field are removed from the 10 points, washed and scored for presence of soilborne disease at key crop development stages:
        1. Emergence
        2. Full canopy
        3. Four weeks post full canopy
        4. Harvest
- The team are checking for any relationships between the pre-planting pathogen DNA levels and disease levels in the shadehouse experiment and in the individual crops.
- Potentially, the SARDI test could be used as a management tool to select paddocks with low disease potential.

Diseases observed this season include; *Rhizoctonia* stem canker, *Spongospora* root galls and *Sclerotinia* stem rotting. At emergence, soilborne disease symptoms on the underground stems ranged from mild to severe across the monitored crops, and by the full canopy stage many crops were showing symptoms severe enough to begin slowing tuber yield accumulation.

Soil Quality

- Soil quality assessment measurements:
    - A soil disturbance scoring system developed in the USA and modified for NZ conditions is being used as a measure of soil quality. Individual tillage passes will be scored on a 5-point scale for the degree of soil disturbance caused by inversion, mixing, lifting, shattering, aeration and compaction.
    - Penetration resistance (soil moisture adjusted) of subsurface layers using a penetrometer.
    - Aggregate distribution and stability
    - Bed shape, plant root distribution and vigour.

- Two extreme examples from the 2012-13 season findings are illustrated in Figures 2 and 3. Crop 8 (Figure 2, top) had a long cropping history (including potatoes), resulting in high levels of soilborne pathogen DNA and subsequent severe crop infections, as well as a hard cultivation pan at 23 cm depth which prevented the roots exploring deeper. By full canopy, no roots were observed growing under the furrows (wheel or bed). This crop had a final yield of 56 t/ha (measured in observation plots) from an estimated potential (based on climatic conditions) of 80 t/ha.
- In contrast, Crop 7 (Figure 2, bottom) was mostly in pasture for the previous ten years and was never planted in potatoes. Soilborne disease symptoms were mild compared to Crop 8. The grower used machinery that attempts to minimise the effects of soil compaction. There was no compaction layer evident at the typical cultivation zone depth and the potato roots were seen under both the bed and the wheel track furrows, as well as observed roots tracking beyond 30 cm depth below the ridge. Final yield in the observations plots were 87 t/ha, similar to the estimated potential yield for that crop.

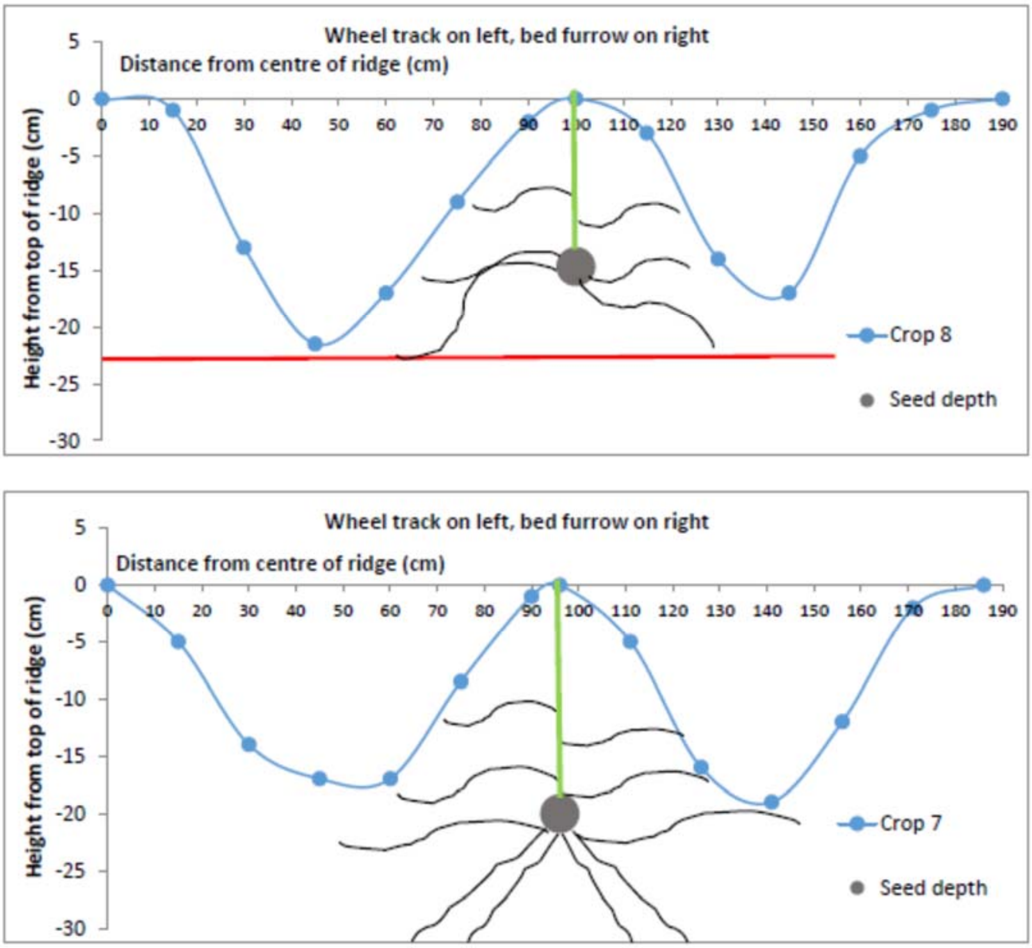


Figure 2. Potato bed profiles for Crop 8 (top) and Crop 7 (bottom), wheel track furrow on left, bed furrow on right. On the vertical axis, zero is the top centre of one ridge. Seed tuber position is denoted by the brown circle, the green vertical line represents the underground stems. The black wavy lines represent root vigour, direction and extent. A total of two root lines denotes very poor root growth and 10+ root lines excellent root growth. The solid red line denotes a compaction zone. No red line indicates that little or no root restriction was measured.

Figure 3. Poor root distribution of a low yielding crop in a poorly structured compacted soil (Crop 8, left), and excellent root vigour and distribution in a high yielding crop with no soil compaction (Crop 7, right).

- Higher yields from the observation plots in the crops were associated with increased root vigour (density and spread) (Figure 4). Crops with root systems that are largely restricted to the ridge zone are at greater risk of progressive yield loss when the crop's daily water requirement is higher than the soil can supply. This signals that the ability to provide an environment that will maximise root growth is a key consideration when selecting fields and planning cultivation techniques for potato crops.

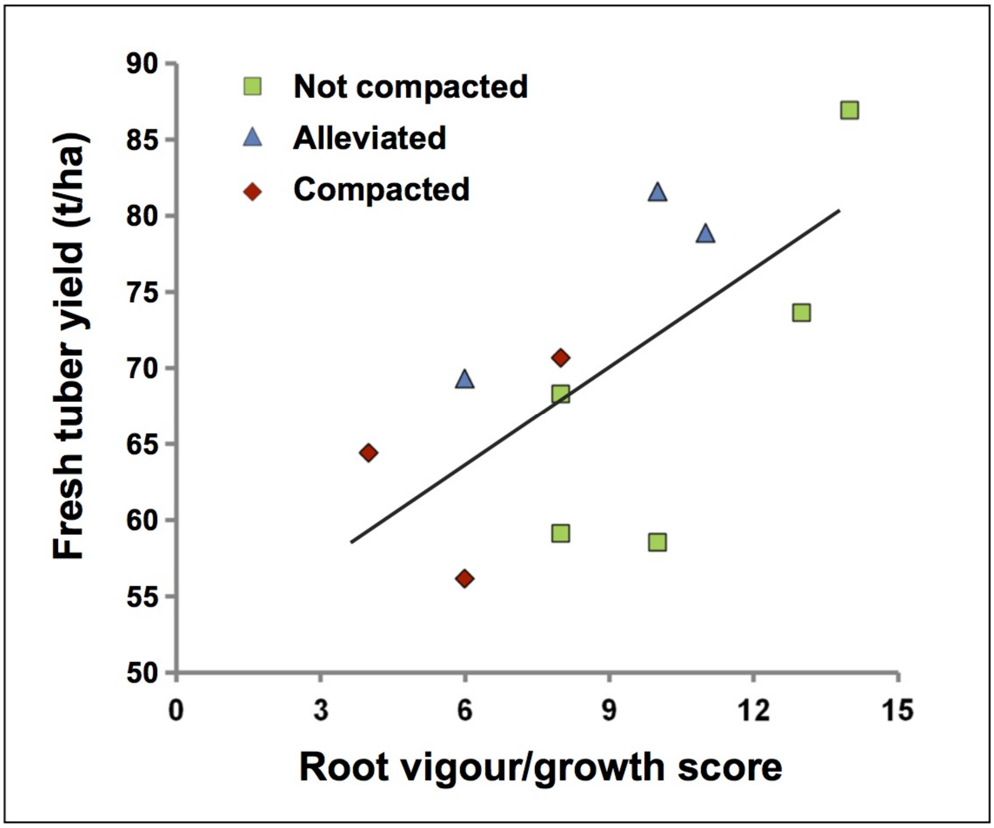


Figure 4. Relationship between root growth (2 = very poor growth, 14 = excellent growth) at crop maturity and fresh tuber yield from observation plots of the 11 monitored potato in the 2012-13 season.

Summary

- Previous research indicates that the presence of soilborne diseases and soil compaction are contributing to potato yields that are below potential.
- This project hopes to develop quick methods for growers to more closely monitor soil quality and underground crop health, and to produce a set of guidelines to allow more informed paddock selection before deciding where to plant potato crops.
- The next 2 years of the project will continue the nationwide crop monitoring, and also investigate the efficacy of rotation crops such as; mustard, oats and linseed for minimising soilborne diseases.

References

- Michel A, Brown H, Sinton S, Meenken E, Dellow S, Searle B, Reid J 2013. Potato Yield Gap project – Nutrient supply effect on potato yield. Plant & Food Research confidential report no. 8620.

- Sarah Sinton, Richard Falloon, Farhat Shah, Esther Meenken, Alex Michel, Steve Dellow, Sarah Pethybridge 2014. Potato Yield Gap 2013-14. Plant & Food Research confidential report no. 10111.

- Sinton S, Falloon R, Shah F, Michel A, Dellow S 2015. Potato yield gap 2014-15. Plant & Food Research confidential report no. 11950.

- Sinton S, Falloon R, Brown H, Tregurtha C, Michel A, Dellow S, Reid J, Shah F, Pethybridge S, Searle B 2013. Potato yield gap investigation 2012-13. Plant & Food Research confidential report no. 8706.

For further information, please contact:

Steven Dellow

Email: steven.dellow@plantandfood.co.nz

Phone: 027 378 7107

Region-specific pest and disease management strategies for potatoes

Natasha Agnew, Plant & Food Research

This project is a partnership between Potatoes NZ, FAR, Plant & Food Research and The Future Farming Centre. It is now into its second year of trials.

Three regions: Matamata, Manawatu and Canterbury

Aim

The aim of this work is to develop region-specific pest and disease management strategies for potatoes in New Zealand.

- Thresholds based on Degree Days or trap counts to initiate sprays
- Incorporating agricultural oils
- Using mesh covers

2014-15 season

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
4	Alternating with Excel oil from emergence after two sprays of Movento - **Manawatu and Canterbury**
5	Mesh crop covers added before emergence, no insecticides
6	Untreated control, no insecticides

Threshold background

980 Degree Days

Was developed from national monitoring data, using mainly North Island information from unsprayed crops. Observed to be the point at which exponential increase in TPP numbers appears to occur (see Degree Day factsheet for more information about Degree Days).

3 TPP/trap/week

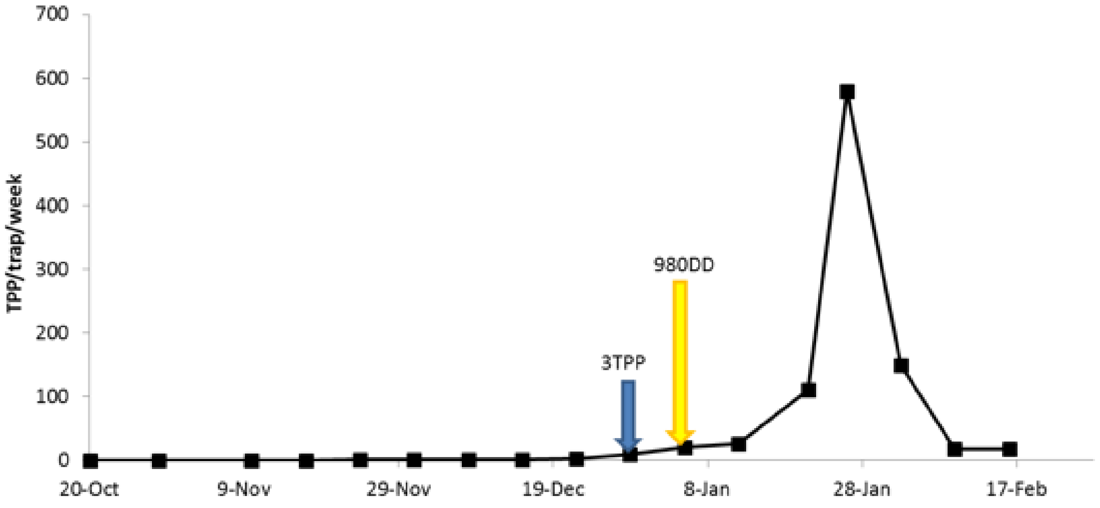
Came from work (again mainly in NI) to develop economic action thresholds to minimise insecticide use based on phenology of TPP in a region.

Results

Manawatu

- 980 Degree days was reached on 4th January, 6 days after 3 TPP action threshold (29th Dec).
- Unfortunately the crop senesced earlier than expected. Unable to make a comparison between treatments.

Figure 1. TPP sticky trap catches Manawatu 2014-15



Pukekohe

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

Treatment	**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
4	6 + 5 oils	289.8	77.4	76.2	104.0
Mesh	0	211.8	45.5	45.0	60.8
Control	0	274	68.4	67.7	93.7

- Except for mesh crop covers (45.5 t/ha), marketable weights and numbers for all treatments were higher than for the unsprayed control (68 t/ha).
- The insecticides used in the different programmes led to a yield increase, up to 16% in this trial.
- Zebra chip disease incidence did not vary between the treatments at harvest, although it was highest for the control
- Profitability of a treatment = the insecticide costs per hectare (including application) - the marketable yield. ZC incidence was also taken into consideration. Although the relative profit for all treatments using insecticides was similar, treatment 4 (alternating insecticides with Excel oil) resulted in the highest profit (Table 1).

2015-16 season

Treatments

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
4	Alternating with Excel oil from emergence after two sprays of Movento
5	Alternating with Excel oil from 980 DD or 3TPP/week after two sprays of Movento
6	Untreated control, no insecticides

Assessments

During growing season

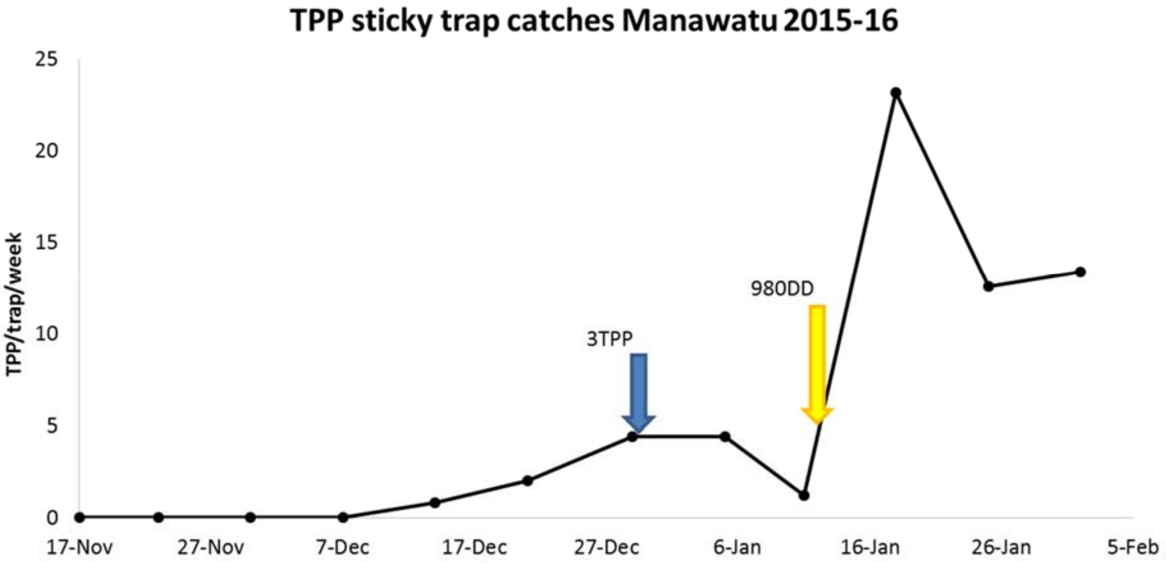
- Yellow sticky traps (10 x 25 cm) in crop prior to emergence, following protocol from FAR/PNZ crop monitoring factsheet. Changed and assessed weekly.
- Leaf assessments for TPP life stages, hoverfly & lacewing life stages, potato tuber moth, blight.

At harvest

- Marketable # and yield
- Unmarketable # and yield
- Diseased # and yield (green, PTM damage, rot, cut tubers etc)
- ZC fry test, 0-9 scoring

Results so far

Figure 2



- 980 Degree days was reached on 14th January, 16 days after 3 TPP action threshold (29th Dec).

December

- 10 TPP eggs and 2 nymphs
- Few lacewing and hoverfly eggs
- No blight

January

- 266 TPP eggs (0.67/leaf)
- 171 small nymphs (0.43/leaf), 24 medium nymphs (0.06/leaf), 10 large nymphs (0.0025/leaf)
- Increase in lacewing eggs and hoverfly eggs and larva
- Blight

Standard: Weekly from emergence	Weekly from 980 DD	Weekly from 3TPP	Alternating with oil from emergence	Alternating from DD OR 3 TPP	Control
Movento			Movento		
Movento			Movento		
Avid			Avid		
Avid			Excel oil		
Avid			Avid		
Sparta			Excel oil		
Sparta	Movento	Movento	Avid	Movento	
Sparta	Movento	Movento	Excel oil	Movento	
Sparta	Avid	Avid	Sparta	Avid	
Proteus	Avid	Avid	Excel oil	Excel oil	
Proteus	Avid	Avid	Sparta	Avid	
Proteus	Sparta	Sparta	Excel oil	Excel oil	
Metafort	Sparta	Sparta	Sparta	Avid	
Metafort	Sparta	Sparta	Excel oil	Excel oil	
Metafort	Sparta	Sparta	Sparta	Sparta	
Metafort	Proteus	Proteus	Excel oil	Excel oil	
Metafort	Proteus	Proteus	Metafort	Sparta	
Metafort	Proteus	Proteus	Metafort	Excel oil	

July 2014

Potato Update

Issue 1

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.

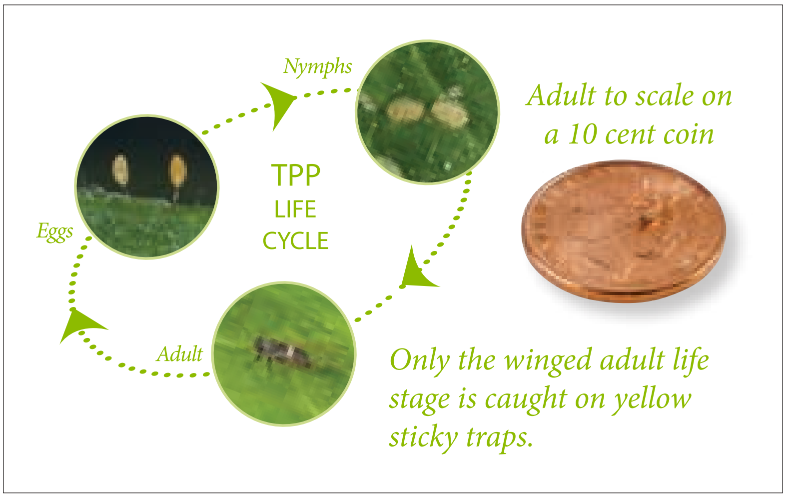


Figure 1. Life cycle of Tomato Potato Psyllid (TPP).

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.

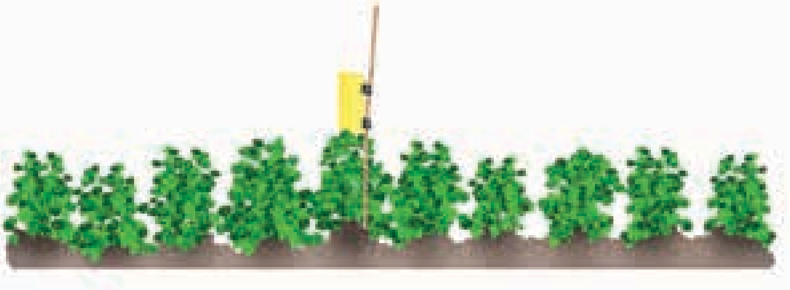


Figure 2. Trap positioning.

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.

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.

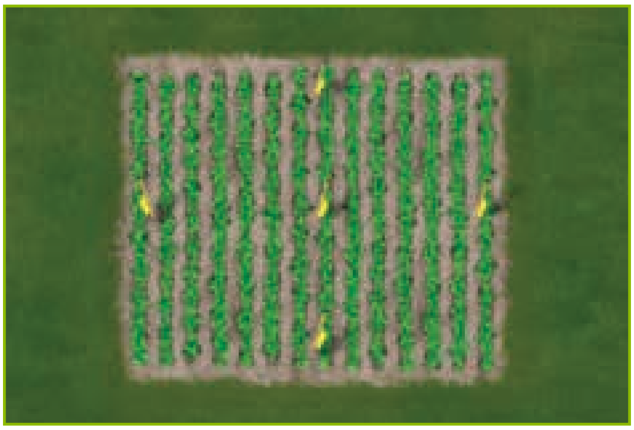


Figure 3. Trap placement.

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

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For further information

Contact Jessica Dohmen-Vereijssen,
Jessica.dohmen-vereijssen@plantandfood.co.nz

July 2014

Potato Update

Issue 2

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.

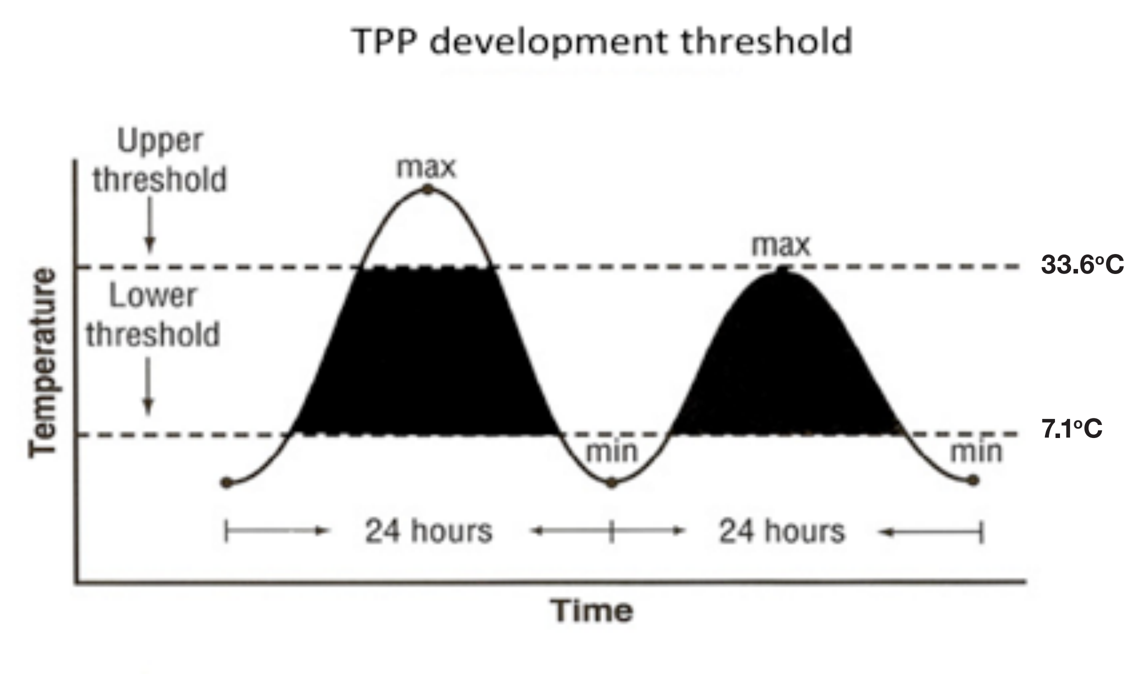

Figure 1. TPP development threshold.

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.

For further information

Contact Jessica Dohmen-Vereijssen,
Jessica.dohmen-vereijssen@plantandfood.co.nz

July 2014

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.

July 2014

Potato Update

Issue 4

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.

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

Contact Jessica Dohmen-Vereijssen & Robin Gardner-Gee, Jessica.dohmen-vereijssen@plantandfood.co.nz & Robin.Gardner-Gee@plantandfood.co.nz

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.

Contact Jessica Dohmen-Vereijssen,
Jessica.dohmen-vereijssen@plantandfood.co.nz

July 2014

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.

Plant & Food RESEARCH
RANGAHAU AHUMĀRA KAI

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

For further information

Contact Robin Gardner-Gee, Robin.Gardner-Gee@plantandfood.co.nz

December 2015

Potato Update

Issue 7

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.

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.

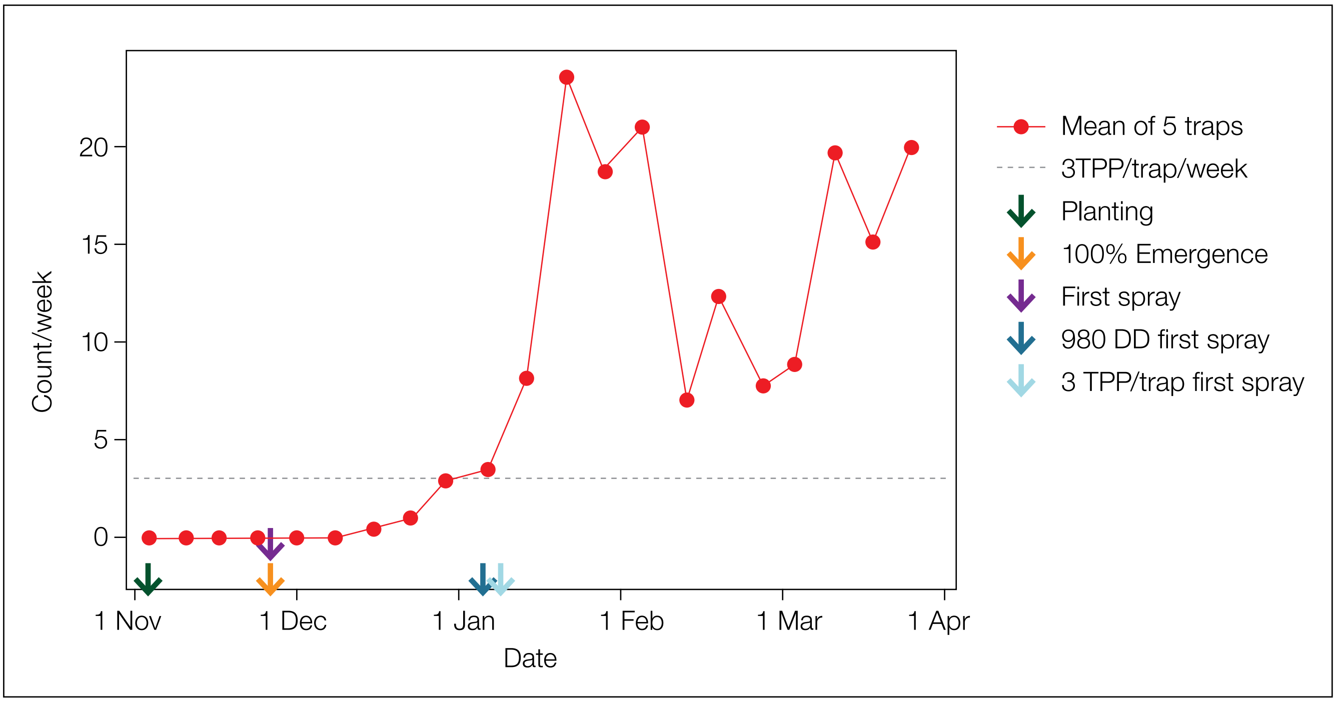

Figure 1. Mean number of TPP caught on yellow sticky traps in Pukekohe. There were 5 sticky traps in the crop.

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.

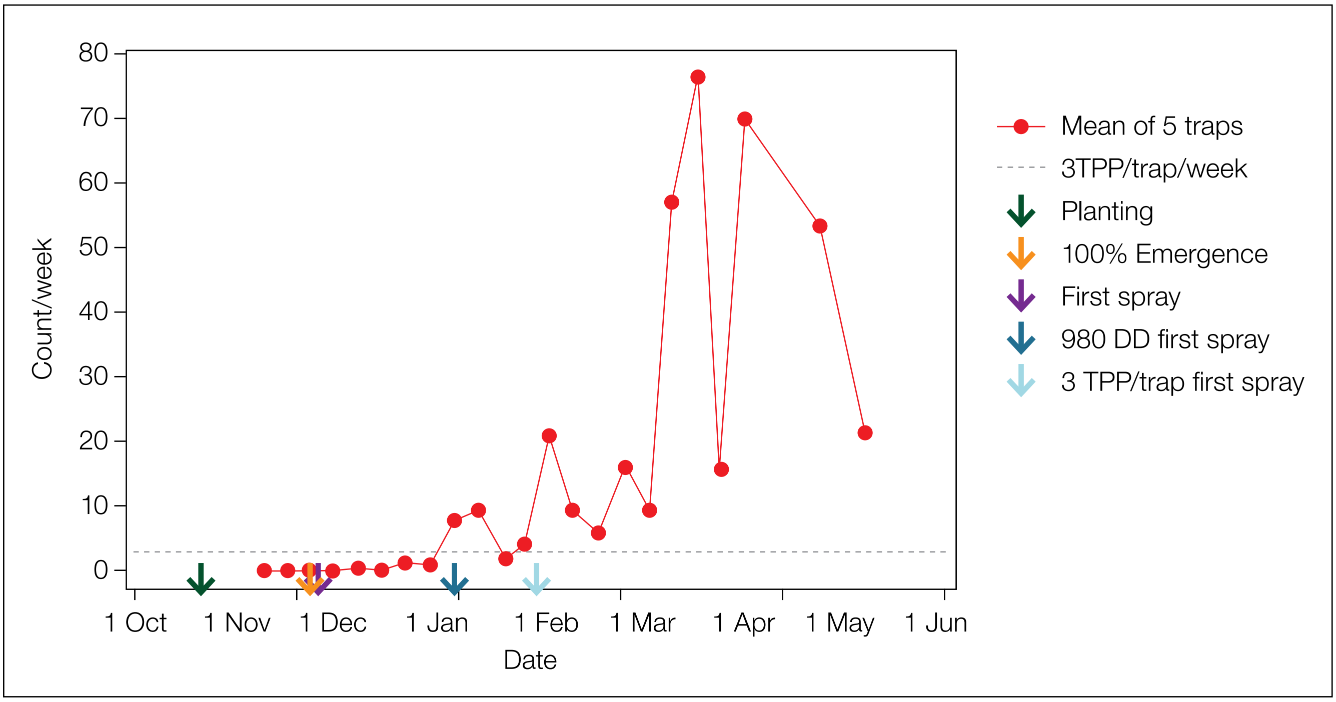

Figure 2. Average number of TPP caught on yellow sticky traps in Canterbury. There were 5 sticky traps in the crop.

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

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CROP 39

Cross:
CROP 17 x Coliban = 4353-3

Market niche:
Maincrop fresh, suitable for washing

Maturity

- mid season maturity, similar to Desiree

Tubers

- slightly flattened oval-round
- shallow eyes
- white flesh
- bright attractive skin that can wash up well even from later dug crops
- physiological disorders rare
- slightly susceptible to bruising so may need extra handling care
- medium-long dormancy, slightly earlier than Moonlight

Disease and pest resistance

- susceptible to both cyst nematode species
- slightly susceptible to powdery scab (score 5.5 where 9 is very resistant)
- susceptible to late blight slightly better than Ilam Hardy
- in one years soft rot testing scored about the midpoint of the lines tested. Better than Nadine in early trial soft rot scores.

Cooking quality

- suitable mainly as a fresh market potato
- holds together (some sloughing) on boiling with little after-cooking darkening
- dry matter content from mid-season on digging around 18–20%
- sugar levels are low unless the crop is exposed to low temperatures before harvest

Yield and agronomy

- consistent high yields from mid-season onwards from a range of sites
- tuber size tends to be medium-large from 30 cm spacing, mostly uniform (≈ 84%)
- released in New Zealand as a washing potato

CROP 78

Cross:
Bondi x CROP 20 = 1417/13

Market niche:
A main crop french fry potato with potential for long term storage, either in the ground or in cool storage at 7°C for over 6 months. A potato with exciting potential.

Maturity

- medium maturity similar to Moonlight (score 3.5 where Moonlight Is 3.8)
- moderate dormancy similar to Moonlight (score 7.0 where 9 is long)

Tubers

- oval-long shape, sometimes slightly flat - uniformity of tubers 4 (5 average on a 1–9 scale) and consistent shape
- light red skin
- shallow eyes, better eye distribution for cutting seed than Bondi
- white flesh
- physiological disorders rarely occur except for occasional surface cracking and rare hollow heart
- Bruising 2.0 (Innovator 1.6) (0=nil; 5=severe)

Disease and pest resistance

- moderate resistance to late blight, similar to or slightly better than Bondi. Significantly better than Russet Burbank or Ranger
- has resistance to *pallida* PCN but susceptible to *rostochiensis*. Susceptible to RO1
- has reduced susceptibility to Zebra Chip compared to widely used cultivars French fry varieties
- moderately susceptible to powdery scab - average 6.2 (0=VS; 9=VR – Bondi 5.8). If powdery scab levels are high it can affect roots
- Moderately susceptible to potato viurus Y

Cooking quality

- excellent consistently high french fry processing quality
- dry matter moderately high 0.5–1.0% above Bondi
- will process from long term ground storage or from cool storage to below 7°C
- excellent overall flavour

Yield and agronomy

- has a reasonably high yield potential across a wide range of growing conditions, higher on average and more consistent than Bondi. Medium tuber number, consistently higher than Bondi
- should perform well with lower than average fertiliser applications for Russet Burbank but needs more fertilizer than Bondi or Moonlight for high yield

CROP 80

Cross:
Summer Delight (CROP 17) x CROP 20 = 1413/3

Market niche:
An attractive yellow fleshed potato suitable for fresh market in both washed and brush markets across a wide range of seasonal slots.

Maturity

- medium maturity similar to Moonlight
- moderate dormancy slightly longer than Summer Delight (CROP 17)

Tubers

- oval shape
- medium/large but smaller than Summer Delight
- shallow eyes
- yellow flesh - more yellow than Summer Delight but less than Agria
- physiological disorders rarely occur
- yellow skin often moderately bright which holds its lustre
- attractive with possible washing potential

Disease and pest resistance

- moderately high resistance to late blight
- has resistance to both species of PCN
- appears to have good resistance to soft rot
- moderately susceptible to powdery scab, better than Agria (but mixed from S→R, 5.17–7.22, average 5.78)

Cooking quality

- suitable as a fresh market potato with some possible French fry potential
- holds together well on boiling with no after-cooking greying
- excellent flavour
- sugars are normally low at harvest but not suitable for long term storage. No CIS
- dry matter content similar to Moonlight, usually around 18–19%

Yield and agronomy

- a very high yield potential across a wide range of growing conditions in plantings from early July through to early December in New Zealand
- medium tuber number

CROP 100

Cross:
Kaimai x Crop 20 = 1550/6

Market niche:
An early-main to main crop processing potato, with potential for medium term storage, either in the ground or in cool storage down to 7°C for four months.

Maturity

- medium-late maturity slightly later than Moonlight
- medium dormancy, slightly shorter than Moonlight

Tubers

- generally round-oval in shape
- shallow eyes
- flesh colour yellow
- physiological problems rare
- resistant to bruising damage

Disease and pest resistance

- highly resistant to Pa PCN
- moderately susceptible to powdery scab (5.4 where 9 is very resistant)
- high resistance to late blight

Cooking quality

- dry matter consistently high
- consistently good fry colour both from field and medium-long term storage to below 7°C
- some sloughing but no greying in boiling tests

Yield and agronomy

- a line with high yield potential as a main crop potato

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FAR
P.O. Box 23133, Templeton
Christchurch 8445
Telephone: 03 345 5783