Final Report

National Tomato Potato Psyllid (TPP) Program Coordinator

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AUSVEG Ltd

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National Tomato Potato Psyllid (TPP) Program Coordinator (MT16018)

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Summary

The Hort Innovation funded project MT16018 *Tomato potato psyllid (TPP) National Program Coordinator* was developed in recognition of the extensive impact the detection of tomato potato psyllid (TPP) in Western Australia in February 2017. TPP was listed on the Australian top 40 exotic pest as part of a complex with *Candidatus* Liberibacter Solanacearum (CLso).

TPP is the only own known vector for *Candidatus* Liberibacter solanacearum (CLso). This a phloem-limited, gram-negative, unculturable bacterium with five known haplotypes (A-E). CLso types A and B are associated with Solanaceae in Canada, USA, Mexico, Central America, New Zealand and Norfolk Island, while haplotypes C, D and E are associated with Apiaceae in Europe and wider Mediterranean region. The association of TPP with CLso was unknown until 2008.

The project worked extensively with stakeholders across the potato, vegetable and processing tomato industries. Within the potato industry, the project worked with all sectors of the supply chain – seed, ware and processing from tissue culture, seed, tuber production and product to consumers. Importantly, government biosecurity agencies were an important stakeholder, especially regarding the economic impact of restricting the movement of product across state borders.

The project has successfully delivered:

- Increased knowledge of TPP and CLso amongst all key stakeholder groups.
- Enterprise Management Plans for respective stakeholders.
- National Management Plan for both industry and government stakeholders.
- Industry Communique from Plant Health Committee to the Potato Industry re the movement of potato tubers.
- A Research and Development Plan for TPP and CLso.

Extension efforts were wide-ranging. The Coordinator engaged with potato, vegetable and processing and fresh tomato growers; potato processors; seed potato producers; potato tuber merchants; and respective industry bodies. This was achieved through 22 grower meetings total of 455 growers attended, nine presentations at industry meetings and conferences – of which approximately 400 participants attended – as well as three workshops conducted with industry and Plant Health Committee members. These were specifically on the movement of potato tubers.

Information resources have been produced and a TPP Portal was established where all resources are available. A TPP article was published in each issue of *Potatoes Australia* and *Vegetables Australia* for the life of the project from October 2017 to May 2021. These publications can be found at https://ausveg.com.au/news-media/publications/

The project was put on hold from March 2020 to February 2021 due to the COVID-19 pandemic and subsequently reinstated from March 2021.

Keywords

Tomato Potato Psyllid (TPP);

Candidatus Liberibacter Solanacearum (CLso);

Plant Health committee (PHC), Jurisdictions (Australian States);

Wares, potato tubers for the fresh market;

Processing, potato tubers for the processing or food manufacturers;

Seed potato for the basis of potato tuber production.

Introduction

In February 2017, tomato potato psyllid (TPP) was detected in the Perth metropolitan area.

Internationally, TPP is linked with the spread of *Candidatus* Liberibacter Solanacearum (CLso) or zebra chip as commonly known.

As TPP was listed as one of the top 40 exotic pests of concern for Australia, the Emergency Plant Pest Response Deed (EPPRD) was initiated. Within a month, the extent of the spread of TPP was determined and it was resolved by the Consultative Committee for the Emergency Plant Pests (CCEPP) to establish and implement a Transition to Management Plan (T2M Plan). The T2M plan commenced in September 2017 (just before the National TPP Coordinator role).

The National TPP Coordinator role was funded by grower levies from the vegetable and potato industries through Hort Innovation. The role was to provide a central point for all matters related to TPP. It included monitoring the TPP situation nationally, in particular the surveillance programs for TPP, and report on the outcomes to stakeholders. The Coordinator worked closely with industry stakeholders to undertake appropriate engagement and extension strategies as required. The role also involved working in collaboration of existing TPP programs, especially the Transition to Management Plan (T2M), developing a national R&D program and establishing a National Management Plan for TPP, in collaboration with government and industry bodies.

Project efforts were initially directed toward Western Australia – the uninfected regions, in particular – to ensure that growers had the tools to detect TPP (monitoring) and, if detected, the tools and knowledge to manage the ongoing presence of TPP. Finally, an important aspect for Western Australia was to re-establish trade with the other jurisdictions. This required high level negotiation to identify the other jurisdictions expectations and what processes (monitoring and testing) were required to build confidence, so that trade could be resumed.

At a national level, the project's activities aimed to raise awareness of TPP – how to identify it and importantly, how to manage it. What became clear at the commencement of the project was the reluctance of growers to actively engage in reporting TPP if it was found. This was due to the potential for economic loss through biosecurity quarantine. Secondly, industry stakeholders in the eastern states expressed concern that the 'just in time' nature of their business potato tubers was under threat from current quarantine practices if TPP was detected – whether they be wares, processing or seed or moved cross state borders on a daily basis. The largest risk to their business was the imposition of state quarantine regulation stopping the movement of potato tubers. The experience of stopping trade from Western Australia to the other states heightened this industry concern. These issues required to be addressed promptly to ensure that business continuity was maintained.

Methodology

This project required extensive networking within industry and between the different industry sectors, along with government agencies (in particular members of the Plant Health Committee), and with grower groups.

The main industry sectors involved were the potato industry, the nursery industry, vegetable industry and the processing tomato industry. We also maintained a link with the fresh tomato growing industry, even though they were not a levy-paying industry.

The potato industry

This project got underway just as the transition to management plan (T2M), led by the Department of Primary Industries and Regional Development (DPIRD), commenced in Western Australia. As a member of the steering committee, I had a leadership role in the production of the Enterprise Management Plan (EMP) for nurseries, processing tomatoes, potatoes and vegetables. These plans are available on the TPP Portal (https://ausveg.com.au/tpp/) and some Department of Agriculture websites.

A series of workshops were delivered over the life of the project to grower and industry groups. The content included the taxonomy of TPP; the potential impact of TPP and CLso; the current international experiences in managing TPP and CLso; the impact of property quarantine; and what actions were undertaking to reduce the risk of economic loss from an inclusion of TPP into other parts of Australia. Details of the location and number of participants at workshops are included in Appendix A.

Secondly, there was extensive negotiation with Plant Health Committee members about the economic impact on the 'just in time' operations across the supply chain from seed to customer, should the movement of potato tubers be stopped across state borders. Industry stakeholders and growers were reluctant to report the detection of TPP because of the legislative requirements to stop the movement of product from their respective properties. The Chief Plant Health Managers considered they were bound by the legislation, which required the quarantining and stopping the movement of product to mitigate the spread of TPP. This highlighted the need to undertake an awareness/education program with biosecurity personnel to assist them in understanding the economic impact of stopping the movement of potatoes for wares and processing. A series of industry visits were arranged, and the locations of these visits are listed in Appendix B.

This culminated in a joint industry/Plant Health Committee member workshop where the foundation was laid for the release of an Industry Communique (Appendix C). This was circulated widely to all industry stakeholders through newsletters and *Potatoes Australia* and *Vegetables Australia,* and a copy can be found on the TPP Portal.

The issue of TPP/CLso being present in Australia was discussed by industry stakeholders in respect to seed potato. The outcome is that industry does not want the movement of seed across state borders to be impacted should TPP with CLso be detected, and it would be the responsibility of industry stakeholders, growers and businesses to manage as part of their respective supply chains. This issue of certified seed versus uncertified seed was discussed; however, Industry recognizes grower's prerogative to use their seed of choice but strongly recommends traceability of all seed movement across the country.

The processing tomato industry

There is a very specific growing region in Australia on both sides of the Murray River, which provides product for the cannery in Shepparton, Victoria. The Enterprise Management Plan (available on the TPP Portal https://ausveg.com.au/tpp/) was developed in collaboration with the processing tomato industry to address their specific on-farm management practice as a preparedness approach. To date, they have not detected TPP. The movement of tomato product from one jurisdiction – mainly New South Wales to Victoria – has been resolved, with the Chief Plant Health Managers from New South Wales and Victoria agreeing to implement special powers under their respective Biosecurity Acts to ensure the ongoing movement of product.

The nursery industry (Greenlife)

The nursery industry already had a Nursery Industry Accreditation Scheme Australia (NIASA) for members. In collaboration with the industry, an Enterprise Management Plan was produced to integrate TPP knowledge and practice as part of the best practice accreditation program. A copy of the EMP is available on the TPP Portal.

The vegetable industry

In collaboration with DPIRD and vegetables WA, the Enterprise Management Plan was developed.

The project was provided with overall direction by a steering committee incorporating members of the potato and vegetable industries, and a member of the Plant Health Committee. Members of the steering committee are listed in Appendix F.

A copy is on the TPP Portal: https://ausveg.com.au/tpp/.

Outputs

1. Enterprise Management Plans for:

    a. Tomato processing industry.

    b. Potato industry.

    c. Nursery industry.

    d. Vegetable industry.

2. A Research and Development Plan (Appendix D) was prepared for the guidance of research funding by Hort Innovation. To date, the priorities remain active. The only program to receive funding is the TPP surveillance program, which is now in its third and final year. Copy in Appendix D.

3. Produced a National Management Plan (Appendix E). This was developed with input from industry stakeholders and all biosecurity jurisdictions. It remains a living document that requires reviewing annually to take into account developments in local and international research and changing environmental and political factors. Copy in Appendix E.

4. An industry Communique from the Plant Health Committee was prepared and distributed to all industry stakeholders, addressing the barriers to maintaining business continuity in the potato industry if TPP is detected in the eastern states (New South Wales, Victoria, Queensland and South Australia). Copy in Appendix C.

5. Copies of articles produced in *Potatoes Australia* and *Vegetables Australia* can be found on the TPP Portal: https://ausveg.com.au/tpp/.

6. The creation of a TPP Portal where relevant information regarding TPP and CLso is accessible on the TPP Portal.

Outcomes

The project has increased government and industry preparedness and management of TPP and CLso, while maintaining a commitment to business continuity across Australia. This has been achieved using a strategic approach for the project – incorporating preparedness, building knowledge, and promoting surveillance and management techniques. The project has increased Australia's capacity to ensure a smooth transition when new detections of TPP occur and thereby increasing the chances of successful management through the development of on-farm management plans. The strengthening and maintenance of a strong relationship between industry and government agencies has ensured business continuity throughout the supply chain. Management knowledge has been enhanced by the promotion of effective chemical and biological management strategies, effective use of surveillance tools, and ongoing community engagement and information dissemination.

It is important that these approaches be continued and industry-government relationships are maintained.

Monitoring and evaluation

Desired outcome: Industry has access to resources/tools that allow it to effectively manage TPP.

Achievement:

Three specific products were produced to provide industry with resources/tools for the management of TPP.

1. Enterprise management Plans for potato, vegetable, nursery and processing tomato growers.
2. TPP Portal: https://ausveg.com.au/tpp/.
3. Industry Communique from Plant Health Committee distributed to 4,500 potato and vegetable growers. It is also on the TPP Portal.

Desired Outcome: Targeted future RD&E efforts that comply with stakeholder needs.

Achievement:

1. The initial Research and Development Plan was produced in September 2019 and was the foundation document for the funding of the National TPP Surveillance Program MT16018. This program has run for two years and no TPP has been detected in any other jurisdictions, except Western Australia (where it was first found). The surveillance program has an additional year to gather data and has industry support for its continuation. It is important to know where TPP is and where it isn't, to aid the implementation of risk mitigation strategies.

Desired outcome: Industry more prepared for CLso management (or eradication).

Achievement:

1. Surveillance has been strongly promoted throughout the project, both on-farm and in collaboration with government agencies. While on-farm surveillance is important for farm management, it also assists in knowing where TPP is and isn't on a national level. Industry confidence is high that the supply chain will not be impacted, and stakeholders will actively engage in the management of TPP and CLso if it's detected. An example is the capsicum and chilli growers in the Gladstone region where they were provided with the tools and knowledge for surveillance of TPP, and they have maintained a monitoring program for the last two years. The capsicum and tomato growers in the Bowen region initiated their own surveillance program for TPP in 2018 and have continued to maintain it. Several potato growers in Western Australia now routinely put out traps and monitor for TPP separately to government sponsored programs. They consider it essential to their management of TPP.

Desired outcome: Effective use of overseas knowledge and reduce duplication of R&D.

Achievement:

1. Overseas information from Canada, the United States, New Zealand and the United Kingdom has been distributed across the industry in the Enterprise Management Plans and articles over the last three years. In addition, an output from this project is the R&D Plan, which was developed in consultation with the Steering Committee to identify the major areas where research dollars would deliver best value for money.

2. While only one priority has been funded to date (National Surveillance Program), the plan outlines other important areas of research. It is understood that financial constrains have led to limited application of the R&D priorities.
3. Work has continued overseas in the areas of reducing waste as a result of CLso-affected potato tubers and the management of TPP. An area that received initial low priority support from industry is the application of RNAi technology in the control of TPP. With the impact of COVID-19 and the subsequent success of mRNA technology to create a vaccine for COVID-19, the time is right for this to be revisited. RNAi technology is currently being applied to manage Asiatic Psyllid (a cousin to TPP) in Citrus Groves in the USA.
4. Undertook a study tour of New Zealand potato industry to see firsthand the impact of TPP and CLso and established links with New Zealand research and industry expertise.
5. **Desired outcome:** Scientific knowledge of TPP and CLso increased.

Achievement:

1. The initial reaction to the detection of TPP in Western Australia in 2017 resulted in delayed decision-making on management action primarily as a result of limited knowledge of TPP and CLso. The result was the restriction on the movement of not just Solanacearum produce, but other crops that were not hosts of TPP. This resulted in significant economic losses to growers and nursery businesses. By increasing awareness and discussion regarding the currency of published research and the practical application of international findings, we have been able to achieve consensus to ensure business continuity across the produce supply chain.
2. Western Australia had lost its trading status within Australia as a result of other jurisdictions applying bans to produce due to the detection of TPP. This was eventually lifted after 12 months of negotiations between industry and the various jurisdictions to deliver area freedom status for CLso for five years from December 2018. The implementation of a national surveillance program was important to secure the position for Western Australia.

Desired outcome: Government-industry research partner collaboration in TPP research and management.

Achievement:

1. Several meetings were held with government, industry and research institutions to discuss TPP R&D priorities. e.g., beneficial insects and chemical management. However, limited research funds restricted a cohesive program forward and should be investigated now that levy collections are increasing.
2. Funding for the National TPP Surveillance Project was achieved and project MT16018 contracted. Industry stakeholders were disappointed that the funding did not extend to providing on farm monitoring for TPP. However, the results from the project have provided excellent data on where TPP is, and where it isn't.

Recommendations

1. The National Management Plan be reviewed on a 12-monthly basis to take into consideration emerging research findings both nationally and internationally.
2. That funding for the priority R&D projects (Appendix D) continue to be sourced. That the application of international research into new technologies in TPP management be monitored and the R&D plan remain a living document.
3. That AUSVEG continue periodic engagement with the Plant Health Committee to ensure commitment to business continuity remains.

Intellectual property, commercialisation and confidentiality

There were no changes to intellectual property contained in this project during the life of the project.

Appendices

Appendix A: List of presentations at grower meetings during the life of the project

Date	Location	Topic	Outcome
18 July 2017	Virginia, SA	Speaking role: Advisor on TPP surveillance and training workshop. 25 growers attended.	Information on the ecology of TPP.
24 August 2017	Gatton, QLD	Speaking role: Advisor at Lockyer Valley Growers Association meeting – TPP and farm biosecurity planning workshop. 17 growers attended.	Information on the ecology of TPP.
27 October 2017	Perth, WA	Speaking role: Project Lead raised project awareness at VegetablesWA Industry Summit. 35 growers attended.	Information on T2M and on farm management.
30 October 2017	Attwood, Vic	Speaking role: Advisor TPP, CLso and farm biosecurity workshop. 15 growers attended.	Information about 'on-farm management'.
27 November 2017	Mount Gambier, SA	Met with local potato growers regarding biosecurity issues and Eastern Bloc business continuity. 12 attended.	Information on project and the impact of TPP on potato crops.
28 November 2017	Virginia, SA	Met with local potato growers regarding biosecurity issues and Eastern Bloc business continuity TPP Coordinator selection. Eight growers attended.	Information on project and the impact of TPP on potato crops.
19 December 2017	Thorpdale, VIC	Speaking role at a grower meeting in conjunction with AuSPICA and Agriculture Victoria. Approximately 60 growers attended.	Information on the impact of TPP on crop management. Growers raised their experience with potato cyst nematode (PCN). and the personal and economic impact biosecurity measures had on growers.
20 December 2017	Ballarat, VIC	Speaking role at a grower meeting in conjunction with AuSPICA and Agriculture Victoria. Approximately 50 growers attended.	Information on TPP on potato crops; however, the biggest issue was the economic impact of potential biosecurity measures.
21-23 February 2018	Various locations in Tasmania.	Speaking at grower meetings held by Simplot and McCain processors. Filed trip to inspect seed potato crops. Spoke about the National Management Plan and what TPP was. Attended by 40 growers. Spoke at two grower sessions held by McCain and Simplot with Robert Cox, a visiting agronomist from New Zealand. Approximately 70 growers and agronomists attended the two sessions.	Information on TPP. Reported on the TPP/CLso experience in New Zealand and the lessons learned; in particular, the implementation of on-farm management practices such as changing planting ting and the use of beneficial insects (IPM).
6-10 August 2018	Bowen, QLD	Visited the Bowen/Gumlu region with a survey team led by Dr Cherie Gambley and met with Carl Walker, President of the Bowen Gumlu Growers Association. Gave a presentation to 15 growers on TPP and its	Information on the progress to ensure business continuity. Provided information on trapping practice and a monitoring program for TPP

		current status. Met with Department of Agriculture and Fisheries, Queensland (DAF, QLD) biosecurity officers regarding the future TPP surveillance that they will be undertaking in the coming season. Also met with Chris Monsour, an agronomist who was involved in the past TPP surveillance program (collecting traps and forwarding them to Tasmanian Institute of Agriculture).	
15 October 2018	Manjimup, WA	Grower meeting regarding area freedom and TPP management. 16 growers attended.	Information on securing area freedom for Western Australia, so that trade could recommence to the eastern states.
12 November 2018	Virginia, SA	Attended a grower meeting arranged by VegNET and spoke with growers regarding TPP management. 27 growers attended.	Information about 'on-farm' management, progress on ensuring business continuity across the supply chain.
9 April	Geraldton, WA	Grower meeting (17 attendees, of which 10 were Vietnamese growers). Presentation was in English and Vietnamese.	Printed information was circulated; however, the issue of adequate advice in Vietnamese language available nationally needs further consideration.
11 April	Carnarvon, WA	Grower meeting (13 attended) – which included agronomists and Department of Primary Industries and Regional Development staff and private chemical suppliers – to discuss TPP surveillance and maintenance of a Carnarvon TPP-free zone.	As they are going to have traps spread across the region, this also provided an opportunity to assess the levels of beneficial insects that would assist in on-farm management.
12 June 2019	Mareeba, QLD	Grower meeting presentation on TPP and the importance of ensuring movement of potato tubers between states. Meeting attended by local DAF, QLD staff. 25 people attended.	Informed growers of the behaviour of TPP in the field. Discussed the lifecycle of TPP. Promoted the importance of ongoing monitoring of TPP.
13 June 2019	Mareeba, QLD	Field demonstration for identifying TPP in a potato field. Attended by local growers and DAF, QLD staff. Demonstration took place on David Nix's property. 30 growers and government officers attended.	Growers undertook simulated experience of identifying TPP in the field.
23 August 2019	Virginia, SA	Presentation on TPP lifecycle and ecology to 46 growers and agronomists.	Introduction of biosecurity measures, using TPP as an example.
28 August 2019	Perth, WA	Presented at the inaugural training workshop for the National TPP Surveillance Project, led by DPIRD. 13 entomologists from all jurisdictions attended.	All jurisdictions received a sound understanding as to why it was important not to put traps in commercial nurseries and commercial growing locations, but to focus on community gardens and individual backyards.
30 August 2019	Devonport, TAS	Presentation on TPP lifecycle and ecology by Callum Fletcher to 44 growers and agronomists.	Introduction of biosecurity measures, using TPP as an example.
24 September 2019	Ayr, QLD	Presentation on TPP lifecycle and ecology by Callum Fletcher to 26 vegetable growers, agronomists and industry stakeholders.	Introduction of biosecurity measures, using TPP as an example.

26 September 2019	Bowen, QLD	Presentation on TPP lifecycle and ecology by Callum Fletcher to 24 vegetable growers, agronomists and industry stakeholders.	Introduction of biosecurity measures, using TPP as an example.
25 October 2019	Richmond, NSW	Presentation on TPP lifecycle and ecology by Callum Fletcher to 30 vegetable growers, agronomists and industry stakeholders.	Introduction of biosecurity measures, using TPP as an example.
11 November 2019	Carnarvon, WA	Grower meeting (13 attended) which included agronomists and DPIRD staff and private chemical suppliers to discuss TPP surveillance and maintenance of a Carnarvon TPP-free zone.	As they are going to have traps spread across the region, this also provided an opportunity to assess the levels of beneficial insects that would assist in on- farm management.

Appendix B: Location of visits by government biosecurity staff to industry locations

The purpose of these visits was to demonstrate to government officers the nature of the 'just in time' operations of processing and ware production. The visits also identified the extensive movement of potato tubers across the four states of Queensland, New South Wales, Victoria and South Australia.

PEPSICO – Wynnum West, Queensland.

Zerella Fresh – Virginia, South Australia.

McCain Foods – Ballarat, Victoria.

Snack Brands – Smithfield, New South Wales.

Appendix C: COMMUNIQUE TO POTATO INDUSTRY STAKEHOLDERS from PHC

COMMUNIQUE TO POTATO INDUSTRY STAKEHOLDERS

Tomato Potato Psyllid (TPP)/*Candididatus liberibacter solanacearum* (CLso) Business Continuity Arrangements in NSW, Qld, SA and Vic.

Since the 2017 detection of TPP (tomato potato psyllid) in Western Australia (WA), industry stakeholders in New South Wales (NSW), Queensland (Qld), South Australia (SA) and Victoria (Vic) have been concerned about the impact of regulatory movement conditions on produce that may spread the pest and disease, if detected, across the respective jurisdictions.

In October 2017, a request was made by industry stakeholders for Plant Health Committee (PHC) to take into account the economic impact of imposing regulated risk mitigation measures on the movement of potato tubers between jurisdictions if TPP was found in the eastern states and territories.

Plant Health Committee acknowledged that TPP detections in the eastern jurisdictions will be dealt through the Emergency Plant Pest Response Deed. PHC agreed it is critical that business continuity is maintained whilst measures are put in to slow the spread of TPP. PHC held a number of scenario workshops on key pathways of TPP spread that also involved representatives of key affected industries. A draft protocol for all pathways including potato tubers was prepared in early 2018 and circulated by PHC to key industry stakeholders for comment and feedback. The protocol was revised and considered at a PHC meeting in early October 2018.

At this meeting, PHC confirmed that it is:

1. Committed to a harmonised approach to ensuring the movement of potato tubers between Qld, NSW, Vic and SA, if TPP arrives from WA in any of the respective jurisdictions.
2. Committed to ensuring business continuity, is maintained whilst minimising the spread of TPP.
3. Supports the development of an ongoing national TPP monitoring program in collaboration with all jurisdictions, Plant Health Australia (PHA), the Federal Department of Agriculture and Water Resources, and industry stakeholders.

Specifically for potato tubers, PHC took into consideration the following:

1. Tubers are not traded with green leafy material.
2. Potato tubers were not a vector for TPP.
3. Western Australia had demonstrated CLso freedom through nationally endorsed surveillance and testing protocols.
4. All jurisdictions will collaborate in an ongoing TPP monitoring program.
5. International experience has shown that despite the presence of TPP and CLso, potato production is still able to continue and grow.
6. A CLso preparedness plan is to be developed taking into consideration the unique situation Australia finds itself of having TPP but no evidence of CLso.

As indicated above, at that point it was considered the requirements of the proposed protocol would only take effect when TPP is detected in NSW, Qld, SA or Vic. and was confirmed to have come from WA, i.e. could be considered free from CLso.

The latter pre-requisite caused some industry concern due to delays likely to be encountered in confirming source of the TPP. To address these concerns PHC, in conjunction with the national TPP Coordinator, met with representatives of the ware and processing potato industries in a November 2019 workshop to investigate the 'worse-case scenario' of TPP carrying CLso being detected in eastern states of mainland Australia and determine what likely conditions and risk mitigation measures could be put in place to ensure business continuity and produce movement through the initial incident definition phase of a biosecurity response.

The workshop was successful in preparing industry and government in the event of the detection of TPP and CLso in the eastern mainland states. Workshop participants developed high-level risk mitigation frameworks for the movement of both processing and ware potatoes across regions and borders in the event of TPP carrying CLso being detected in the eastern states. For these two pathways, hazard points were identified and for each point, meeting attendees considered the associated risk and likely approaches to mitigating this that would enable business continuity. Workshop participants agreed that as a next step, detailed movement conditions based on a formal risk analysis of the scenarios were required that would provide the detail to underpin the overarching plans developed in the workshop.

At its December 2019 meeting, Plant Health Committee took account of workshop outcomes, endorsing them, and recognising the importance of continued movement of ware and processing potatoes during the incident definition phase following detection of TPP/CLso in the eastern states, and that the risk frameworks developed at the TPP Business Continuity Workshop (November, 2019) provided a way forward to achieve this. Plant Health Committee tasked a working group with formalising the risk assessment to underpin this, to be provided to the Subcommittee on Domestic Quarantine and Market Access to develop and agree on appropriate movement conditions through 2019/20. While this process is underway, it is expected that the risk frameworks developed at the workshop would guide actions to maintain business continuity in the event TPP were detected in NSW, Qld, SA or Victoria.

For further information please contact your respective state jurisdiction.

Andrew Bishop, Chair (Plant Health Committee)
18 January 2020

Appendix D: Tomato Potato Psyllid R&D Research Priorities

Tomato Potato Psyllid (TPP) Research and Development Priorities

May 2021

Version 3.0

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Project MT16018 has been funded by Hort Innovation using the vegetable, fresh potato and potato processing research and development levies and contributions from the Australian Government.

Introduction

This document gives an overview of research and development strategies for the management of TPP as a vector for *Candidatus* Liberibacter solanacearum (CLso). It remains a living document where new opportunities arise through the application of new technologies and strategies.

Tomato-potato psyllid (TPP) was detected in Western Australis in February 2017. An emergency response was enacted which included surveillance by sticky traps. The evidence gathered by the end of March 2017 indicated that TPP was not eradicable. The Consultative Committee for Emergency Plant Pests (CCEPP) members put in place a Transition to Management (T2M) program with the following themes:

- Surveillance for TPP.
- Development of Enterprise Management Plans.
- Market access.
- Research into chemicals, biologicals and post-harvest fumigants.
- Stakeholder engagement.

The Transition to Management report was completed by June 2018 and the outcomes were accepted by the National Management Group in July 2018. The significant outcome of this work is that Western Australia, and therefore Australia, have been declared *Candidatus* Liberibacter solanacearum (CLso) free.

TPP was considered a top 40 exotic pest for Australia, but CLso is not listed. Plant Health Australia (PHA) and the Department of Agriculture and Water Resource (DAWR) will undertake a review of the categorisation list later in 2018 and consider its inclusion.

Research and Development projects

Development and research projects formulated from the Transition to Management Program, the T2P Workshop (September 2017) and discussion with stakeholders, are listed below in order of priority:

1. National surveillance and monitoring.
2. In-field testing of chemicals for the management of TPP.
3. In-field testing of Biological Control Agents (BCAs).
4. Identification of native Psyllids, native hosts and native BCAs.
5. Diagnostic protocols for testing plant material for CLso.

6. Cultivar resistance to TPP and CLso.
7. CLso management at the factory (processing) door.

1. National surveillance and monitoring

Actioned

Research question

<u>*What is the geographical range and boundaries for TPP?*</u>

Industry Stakeholder Needs

TPP was found to be endemic in the Perth metropolitan area and sparsely spread through Western Australian commercial regions during the T2M period. A total of 27,311 TPP were trapped during the 2017-18 growing season. A total of 10,136 TPP were tested for *Candidatus* Liberibacter solanacearum (CLso), with no CLso detected. The extent and range of TPP in Western Australia has yet to be completed, and the Western Australian Department of Primary Industries and Regional Development (DRIRD) is undertaking further surveillance in the coming growing season to ascertain the range. During the T2M, other jurisdictions undertook surveillance primarily in commercial crops and no TPP was found.

With the expectation that TPP will spread, there is a need for ongoing monitoring for range and boundaries of TPP in the first instance. This will enable sentinel (or early warning) advice to growers to prepare to manage TPP, enable ongoing testing for CLso.

Current international practice

In New Zealand, monitoring for TPP has become routine on Solanaceous crops (e.g., potatoes) to assist growers with their Integrated Pest Management programs (IPM). New Zealand did not have a coordinated national monitoring program in place prior to TPP spreading across New Zealand.

In 2013, the Canada's potato growers, in collaboration with the Canadian Government, established the Potato Psyllid and Zebra Chip Monitoring Network across all potato growing regions in Canada. The network of growers have been monitoring TPP during this time and in 2017, Alberta's potato growers detected identified low levels of CLso in trapped TPP; however, CLso has yet to manifest in potato plants.

Impact

The data gathered will improve knowledge and confidence to manage TPP and ensure business continuity. The evidence will assist in maintaining industry and government agencies' confidence for CLso freedom or otherwise.

What has been done?

A national TPP monitoring program was established by industry with government agency collaboration. Its focus was on urban and peri-urban sites, which complimented existing TPP surveillance undertaken by the respective jurisdictions. The lead agency was DPIRD. All other jurisdictions participated in the program and it commenced in the summer of 2019. Trapping during the last two season didn’t detected TPP in any other jurisdiction, apart from WA. Further testing of TPP trapped in WA has not detected CLso. At the time of writing, this project has a further year to complete. Industry supports the need for ongoing surveillance to know where TPP is and where it isn’t as an aid to TPP/CLso management.

2. In field testing of chemicals for the management of TPP

Very High Priority

Research question

<u>What is the efficacy and effectiveness of chemical spray on TPP?</u>

Industry stakeholder needs

The dominant industry practice is to use chemicals for the management of sucking insects. To action Integrated Pest Management (IPM) effectively, the impact of chemical sprays needs to be fully tested and understood. With the introduction of TPP to the Australian environment, the application of chemical sprays in the Australian setting requires further work and testing. There is an increasing interest in implementing IPM programs utilising biological controls in conjunction with chemical spray management.

Tomato potato psyllid (TPP; *Bactericera cockerelli*) is a serious pest of commercially grown Solanaceous crops including potato, tomato, eggplant, capsicum, chilli and tamarillo. Currently, no chemicals are registered in Australia for use by commercial growers against TPP.

Evidence of the efficacy and effectiveness of chemicals across the TPP lifecycle in a field environment is required. Additionally, the impact of these chemicals on biological agents (BCAs) in a field environment is also required.

Current research

As part of the T2M, 15 chemicals (conventional and bio rational; 14 foliar bioassay, 1 soil drench) with various modes of action (MoA) were screened against all TPP life stages in capsicum, tomato and potato. The results of laboratory and glasshouse testing available in Note 1.

Impact

The knowledge will provide growers with confidence regarding the application of chemicals they can apply in their respective IPM programs. It will assist in reducing the impact on biological controls and reducing waste and cost of unnecessary chemical applications.

What to do

- Evaluate the efficacy of insecticides using both foliar and soil drench applications in a large-scale whole plants bioassay is required as required to attain AVPMA registration.
- Evaluate the potential of repellency (feeding, oviposition) in addition to mortality effects.
- Evaluate potential insecticides' direct and residual toxicity on biological control agents (BCAs) to determine reduced - risk insecticides that can be used in conjunction of BCAs. Some of this information may already be available overseas, but some species present in Australia are not tested elsewhere for biological control.

3. In field testing of Biological Control Agents (BCA's)

Very High Priority

Research question

<u>Which BCAs are available and effective in the field?</u>

TPP attacks a range of economically important crops in the Solanaceae family and was reported in Western Australia in February 2017. A range of biological controls agents were tested in the laboratory and glass house and in-field testing will provide the evidence to inform best practice.

Industry stakeholder needs

To implement an IPM program with confidence, growers need to know the effectiveness and how best to manage BCA's. Knowing the toxicity of widely used chemicals against TPP on BCAs is critical. There is international information available on biological controls impact on TPP; however, there are unique Australian species of BCA's that have not been tested.

Evidence suggests that as temperatures increase, the rate of growth of the pest population outstrips the capacity of the beneficial species to suppress it and chemical intervention becomes necessary. Chemical intervention has a major impact on populations of beneficial insects.

International and national research

With the introduction of TPP in Western Australia, laboratory testing of the performance of nine BCAs against egg 1^{st}-5^{th} instar nymphs, and adult, was undertaken. The details of laboratory and glasshouse testing is available in Note 2.

In New Zealand, research has shown that predators and parasitoids are able to suppress the development of TPP populations early in the season when temperatures are relatively low and the psyllid reproduction rate is moderate.

There are several species of generalist BCAs commercially available in Australia for use against various insect pests in a range of crops. However, their effectiveness against TPP is not known.

Impact

Research on biological controls will provide growers with confidence regarding the BCAs they can incorporate (both introduced and native) into their respective IPM programs. The overall impact is to reduce cost in chemicals and impact on the environment.

What to do

Further in-depth research evaluating the efficacy of green lacewing, *M. signata* and the lady beetle species, *C. circumdatus, C. montrouzieri, H. conformis, H. octomaculata and H. variegata* against TPP on various host plants in whole plant bioassay and glasshouse trial. This would be followed by field trials to verify the whole plant glasshouse trials outcomes.

In-depth field study to identify other potential naturally occurring BCAs of TPP.

To include the potential BCAs in an IPM program, evaluation of direct and residual toxicity of widely used chemicals against TPP on the BCAs are critical.

4. Identification of native Psyllids, and native hosts *High Priority*

Research question

What are the range of native hosts and psyllids?

The incursion of TPP into mainland Australia creates a need for timely and focused research on the species: work for immediate application as well as work to provide the fundamental understanding to develop durable solutions for the future. Due to its recent arrival, virtually nothing is known of TPP's behaviour or population dynamics in Australia; extrapolations can only be made from findings in other countries. This has a direct impact on our ability to develop effective and long-lasting pest management approaches for TPP.

There are three broad areas of particular concern that are closely inter-linked:

- The mild winters (warmer Australian conditions) experienced in many vegetable growing areas are expected to allow psyllid populations to survive in significant numbers.
- The high diversity of Solanaceous species in the Australian native and naturalised flora (over 200 species) may include hosts for the psyllid.
- There is limited information about potential predators or parasitoids of TPP, resident in the Australian ecosystems and the value of conserving these species.

Industry Stakeholder Needs

Chemical intervention has a major impact on populations of beneficial insects. Once these are lost from the crop system, the grower is locked into repeated chemical applications. If native BCAs can be harnessed, then the cost associated with introduced BCAs could be reduced.

Current research

Apart from the trials conducted as part of the T2M, there has been no information gathered on what could be an extensive population of predators and parasitoids to match the extensive population of native psyllids.

Impact

Several potential outcomes of benefit to growers include:

- Improved management of native BCAs.
- Reduced cost of having to introduce BCAs.
- An increase in knowledge of native psyllids and their potential adaptability.

What to do

- Research into population dynamics and population movement of TPP in Australian environments.
- Identify alternate hosts for TPP among the native and naturalised Solanaceae.
- Determine the presence and impact of resident predators and parasitoids, which

will provide fundamental information necessary for the development of robust crop protection practices, whether based on synthetic chemistry or an integrated pest management approach.

5. Diagnostic protocols for testing plant material for CLso *Low Priority*

Research question

<u>What is the most reliable and cost-effective diagnostic protocol for detecting CLso in plants and tubers?</u>

There is no cost effective and efficient diagnostic protocol for the detecting CLso in plants and particular in potato plants and tubers (especially for seed). Current diagnostics are expensive to implement.

Industry Stakeholder Needs

As Australia is declared CLso free, the immediacy of plant and tuber testing is not urgent. We have an opportunity to research and develop cost effective plant testing for CLso.

Current research

Research undertaken by AgriBio and SARDI that assessed different methods of CLso detection is now complete and reports are available. While progress has been made on the diagnostic tools, the gathering of samples is still problematic and expensive.

Impact

A cost-effective plant diagnostic would be a valuable addition to testing plant material (tubers) for the presence of CLso is detected in the future.

An effective method of detecting CLso in potato tubers will add to the confidence for seed growers and their customers (potato growers) that potato tubers for planting are free of CLso.

What to do

Review the findings from the current research and discuss. Explore further collaboration with international researchers on the refinement of existing diagnostic tools.

6. Cultivar resistance to TPP and CLso

Low Priority

Research question

What are TPP and CLso resistant varieties are currently available?

Potato tubers are adversely affected by CLso, which causes zebra chip in processing potato tubers. If TPP- and CLso-resistant varieties can be identified and are economically viable, then they will significantly reduce the waste of tubers and TPP management costs.

Industry Stakeholder Needs

A range of potato varieties are used in processing and fresh production. International evidence has shown that some varieties are significantly adversely affected by TPP and CLso. If resistant varieties are identified that also display high quality performance, this will provide a level of risk mitigation for future management of TPP and CLso.

Current research

New Zealand's Plant & Food Research has conducted potato variety trials at its Pukehoke site, to determine if any are resistant or tolerant to TPP incursion. Reports on the findings are yet to be available.

Impact

If resistant varieties are identified and meet other yield and management criteria, then the reduction in TPP and CLso management costs at farm gate and factory would be significant.

What to do

Australia does not have a potato breeding program; however, Australia could collaborate with other countries such as New Zealand to identify resistant varieties and/or develop new ones. It can also monitor existing in varietal resistance research that is being undertaken in New Zealand.

7. CLso management at the factory (processing) level

Low Priority

Research question

To identify and test technologies to reduce tuber loos at the commencement of the manufacturing process.

Are there technological methods that drive down wastage and hence reduce economic losses? The New Zealand potato industry has been exploring this issue for some time.

Industry stakeholder needs

Australian processors experience limited economic margins. To remain internationally competitive, they are continually seeking to reduce losses at all parts of the supply and manufacturing chain in delivering a quality product to customers. Evidence from New Zealand processors is that tubers infected by CLso account for approximately 3-5 per cent of waste, and therefore economic loss before processing commences.

Current research

There is no published international research on this topic. Potatoes NZ has expressed interest in collaborating with Australia in a trial of adapting existing in factory technologies.

Impact

The development of such methodologies would enable processors to reduce waste (losses) during production.

What to do?

Have further discussions with Potatoes NZ and processors to scope out a research project.

8. RNAi interference as a control for Tomato Potato Psyllid (TPP)

Low Priority

Research question

To establish a RNAi approach to the infield management of TPP.

Current management of TPP – infield in Western Australia and internationally – has used two technologies, Biological Control Agents (BCAs) and chemical sprays. With improved on-farm management strategies and the growing knowledge of Integrated Pest Management (IPM), these approaches are proving to be effective in management of TPP. However, as customer expectations for 'clean and green' chemical-free farm approaches continue to increase, it is important to explore other alternatives such as engineering approaches as RNAi, which are insect-specific.

Current research

The technically capabilities for the use of RNAi technologies to control of Diaphorina citri Kuwayama (Hemiptera: Lividae), known as Asian Citrus Psyllids (ACP) has been successfully tested in the US. This includes the use of a kaolin medium for application to citrus trees.

The major research into RNAi control of Asian Citrus Psyllid has been carried out by the Florida University in collaboration with the Florida Citrus industry to reduce the spread of 'Citrus Greening' disease or Huanglongbing (HLB) through ACP, which is the only vector. This is a very similar situation to TPP and CLso.

The current research into the application of RNAi technologies in Australia has been focused on medical interventions, particularly some forms of cancer and viruses in plants.

Impact

Establishing a successful RNAi approach to the management of TPP would provide an additional management tool for growers. However, there remains a strong reluctance within the horticulture community regarding the use of such technologies due to the public perception that DNA engineering could have deleterious impact on human wellbeing.

What to do?

Continue to monitor public attitudes toward DNA engineered approaches to pest control. Continue to monitor progress with Asiatic Psyllid RNAi.

With the COVID-19 pandemic occurring in 2020, the challenge has been to find a vaccine to inoculate the world's population against the impact. To date, the most effective vaccines employ mRNA technology, which is the same as RNAi technologies. Initially, industry was resistant to exploring the RNAi approach because of the perception that it would shatter public confidence due to the manipulation of the genes. However, two years on, this approach is definitely worthy of research investigation for the management of TPP, especially as RNAi is proving to have strong management benefits in the management of Asiatic Psyllids (a relative of TPP).

Notes:

Note 1 – Results of initial efficacy and effectiveness of chemicals tested during the T2M

Irrespective of the crop, abamectin, spinetoram, methidathion, methomyl, chlorpyrifos, cyantraniliprole, DC-164 and sulfoxaflor caused 100 per cent mortality to the TPP life stages when tested between 24 to 72 hours post-exposure.

Spirotetramat was the slowest of all chemicals tested after 24 hours to all TPP life stages. With 1^{st}-2^{nd} instar nymphs, cyantraniliprole and flonicamid had significantly less mortality (65%) as compared to other insecticides (100%) in capsicum only.

All plant-based derivatives (azadirachtin, eco-oil, agri-50 and paraffinic oil) were the least toxic to 3^{rd}-5^{th} instar stage irrespective of plant type. At adult stage, < 50% mortality was observed with spirotetramat, flonicamid, paraffinic oil, agri-50 and eco-oil in potato and capsicum after 72 h post exposure. Egg laying was observed with agi-50, eco-Oil, paraffinic oil, flonicamid and spirotetramaid in all plant types but none hatched after 7 days.

Azadirachtin showed significant toxicity to adults TPP in all plant types. Of 13 chemicals tested against eggs, hatching was observed with spirotetramat, abamectin, methomyl, chlorpyrifos, eco-oil, paraffinic oil and azadirachtin, but only in spinetoram and sulfoxaflor treatments in capsicum and potato, second instar nymphs developed. However, the second instar nymphs did not survive after five days. Significant mortality occurred after three, seven and 10 days after soil drenching with imidacloprid to nymphs and to adults at seven days only. (DPIRD 2018i)

Note 2 – Findings of initial efficacy and effectiveness of BCA's during TTM

The BCAs included in the study were adults of lady beetles *Cyrptolaemus montrouzieri*, *Coccinella transversalis*, *Chilocorus cirumdatus*, *Harmonia conformis, H. octomaculata*, *Hippodamia variegate* (Coleoptera: Coccinellidae), late instar and adult of green lacewing *Mallada signata* (Neuroptera: Chrysopidae), and fifth instar and adult of the two plant bugs, *Nesidiocoris tenuis* (Hemiptera: Miridae) and *Orius tantillus* (Hemiptera: Anthocoridae). Both choice and no-choice tests indicated that all BCAs successfully consumed TPP with lady beetle species and juvenile of green lacewing showed greater voracity than the two plant bugs with some differences observed in mean consumption, depending on the host tested. Among all the BCAs tested, *H. conformis*, *C. montrouzieri* and the larval stage of *M. signata* were most efficient consumers of TPP. In addition to *H. conformis* and *C. montrouzieri*, on capsicum lady beetle species *H. variegata*, *H. octomaculata* and *C. circumdatus* were found to be effective predators of TPP. (DPIRD 2018j)

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The Citrus Industry This Week, various articles on progress at the Florida Research and Education Center (CREC)

Appendix E: National Management Plan May 2021

Also available at the TPP Portal at **https://ausveg.com.au/tpp/**

Tomato Potato Psyllid (TPP) National Management Plan

May 2021

Version 4.0

Tomato Potato Psyllid (TPP) National Management Plan

Version Control		
Version	**Revision Date**	**Comment**
1.0	1/5/19	Completed by NTTP
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Acknowledgements

The National Management Plan was established through the National TPP Coordination project which is supported by a steering committee including representatives from the processors, wares and seed mini tubers sectors of the potato industry. It also includes representation from Plant Health Committee through Biosecurity SA. A special thanks to the potato growers and processors who provided frank and fearless feedback, and the robustness of this document is built on their experience and advice.

This National Management Plan was informed with the outcomes of the Transition to Management final report released in December 2018 by the Department of Primary Industries and Regional Development Western Australia. This included the finding of a literature review, results of surveillance monitoring, research into field trials for spray efficacy and biological controls.

The Plan was correct at the time of writing. Information should be checked with the relevant jurisdiction that regulations are unchanged from those described in the plan.

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1 Introduction to the Management Plan

Tomato Potato Psyllid (*Bactericera cockerelli*) (TPP) was detected in Western Australia on 3rd February 2017. On the 20th April 2017 the Consultative Committee on Emergency Plant Pests (CCEPP) agreed that it was not technically feasible to eradicate TPP and on the 20th April the National Management Group (NMG) initiated the move to a Transition to Management (T2M) phase, under the Emergency Plant Pest Response Deed (EPPRD).

The objectives of the T2M plan were:

1. Further determine the status of *Candidatus* Liberibacter Solanacearum (CLso)
2. Establish arrangements to mitigate the impact of TPP in Australia in relation to market access and trade.
3. Preparing the nation for a detection of CLso.

The Transition to Management plan commenced in September 2017 and completed in mid-May 2018.

This TPP National Management Plan (Management Plan) provides an overarching framework upon which jurisdictional operational plans are developed to mitigate against the commercial spread of TPP and ensure trade of produce continues between the jurisdictions. The Management Plan is underpinned by scientific evidence and risk based assessment developed by the National TPP Coordination Steering Committee (Appendix 1).

The Management Plan describes symptoms, identification and testing for the pest (TPP) and *Candidatus* Liberibacter solanacearum (CLso), for which TPP is the only known vector, and precautionary measures and disinfection procedures to prevent pest and Liberibacter spread. The Management Plan also outlines best practice approaches to farm biosecurity and provides a decision making tree to guide growers on best approaches should their crops become infested by TPP. Surveillance procedures to check for presence of TPP are also outlined.

Importantly, the Management Plan articulates agreed roles and responsibilities of governments, industry and other stakeholders to manage TPP in Australia. Finally the Management Plan highlights future research opportunities.

1.1 Purpose

The purpose of the Management Plan is to minimise the impact of TPP by:

(1) Preventing the spread of TPP to new regions;
(2) Reducing the impact of TPP on currently affected regions; and
(3) Minimising the impact of TPP on domestic and international trade.

1.2 Benefits

The Management Plan has benefits to individual growers and to the Solanaceae industry, including:

a. Containment of TPP to current areas of infestation;
b. Reduced production losses from TPP if the best practice measures are applied;
c. Limiting the spread of other pests and diseases through application of the best practice hygiene measures;
d. Support for continued access to markets, including international markets.

1.3 Elements

The key focus areas of the National Management Plan are:

- Early detection through monitoring for TPP;
- Identifying the scope of infestation ie. know where it is and where it isn't;
- Measures to prevent spread of TPP;
- Reducing the risk of overwintering between crops.
- Provide effective TPP management across the supply chain to ensure business continuity.

Growers need to consider the actions they need to undertake to mitigate against the infestation of TPP in a cost effective manner. Ideally, the requirements will fit in with existing hygiene practices and will not add significant cost or inconvenience to growers.

Growers need to document a "on farm" management plan on how they will meet the requirements, so that all their staff can be aware of their role in TPP management. The operational procedures need to identify what actions are taken, who is responsible for the action, when it will be done and how it will be done. For development of a farm management plan, growers can adopt or modify the guiding documents provided in Appendices 6-9.

1.4 Constraints

The management of TPP is similar to other sap sucking insects that can be managed provided:

a) Growers are monitoring for TPP and records kept for customer confidence
b) Growers undertake an audit of host plant and remove them around their properties to reduce overwintering opportunities;
c) Overseas evidence has shown that where TPP is then CLso will follow. However current evidence (report from DPIRD) is that the TPP in Western Australia does not have CLso. This is unique in the world.
d) Australia could have another detection for TPP in another location away from Western Australia which is not directly related to the Western Australian detection. The detection will need to be treated with the same care as the Western Australian detection. Hence the importance of all jurisdictions maintaining ongoing monitoring
e) A mandatory program for the management of TPP involving all Australian solanaceous crop growers is not feasible.

1.5 Endorsement and Implementation

The Management Plan will be endorsed by: the Australian Government, state and territory governments, Nursery & Garden Industries Australia (NGIA), AUSVEG Ltd, and the Australian Processing Tomato Research Council Inc.

All partners (in managing TPP) have a role and responsibility in building capacity to manage TPP. These partners include federal and state governments, as well as the 'at risk' industries. The "at risk" industries include, commercial growers of solanaceous crops and nurseries.

2 Context

The known global distribution of TPP includes Canada, USA, Mexico, Central America, New Zealand and Norfolk Island. Prior to its detection in Western Australia in February 2017, TPP had not been previously detected anywhere on mainland Australia and Tasmania.

TPP was first detected in Perth, Western Australia (WA), on 3rd February 2017. The Department of Agriculture and Food, Western Australia (DAFWA, now Department of Primary Industries and Regional Development DPIRD), implemented property quarantine measures to contain and manage TPP.

The EPPRD was actioned and other jurisdictions implemented trade bans on produce moving from Western Australia on all host material including “hitch hiker” plants, because there had been no monitoring for TPP prior to its detection. During the T2M phase other jurisdictions have also implemented monitoring programs for TPP, and to date, TPP has not been found in any other jurisdictions.

In the months that followed the decision to move from eradication to management, several jurisdictions implemented special movement arrangements on tomato seedlings and nursery stock to ensure the supply chain was maintained for nurseries and tomato producers.

Since the completion of the Transition to Management phase, and WA demonstrating freedom from CLso, market access for potato tubers from Western Australia to the eastern states has been granted. Based on best available scientific advice, the likelihood of TPP being transmitted from an infested commercial production facility in Western Australia to commercial properties in other states or territories is minimal. All potatoes are sold directly to domestic markets for fresh or processing consumption. Seed potatoes (mini tubers) produced in regions that are affected by TPP are taken from properties that undertake TPP monitoring and are treated with a pyrethrum dust to kill all insects that may be “hitch hiking” on seed potatoes.

On 20th April 2017, the National Management Group (NMG), under the EPPRD for TPP, agreed that it was not technically feasible to eradicate TPP from Western Australia. This was due to the identification of a large geographical area where TPP was found during the initial monitoring program using sticky traps. Interestingly the number of TPP found on commercial Solanaceous crops was very low. Most detections found were in metropolitan Perth, in individual back yards and public lands such as parks and road sides.

In September 2017 the T2M program, managed by the Department of Primary Industries and Regional Development (DPIRD) commenced, with the following themes:

a. Surveillance and Operations
b. Managing TPP
c. Market Access and Trade
d. Research
e. Stakeholder Engagement.

a. Surveillance and Operations

All jurisdictions developed surveillance plans based on advice from the National Plant Health Surveillance committee. This is the ensure consistency, alignment with national and international standards to provide a level of confidence for claiming pest free status, especially if this becomes necessary for international trade.
All jurisdictions have undertaken monitoring programs in their respective areas especially during the spring, summer and autumn period. No TPP has been identified in any other jurisdictions. Western Australia has undertaken specifically targeted monitoring and collection of TPP to test for the existence of CLso in the trapped TPP. All monitoring has included a spring, summer and autumn trapping program. Even though large numbers of TPP have been tested in Western Australian and an independent interstate laboratory no CLso has been detected. The T2M program is due for completion in May 2018. The NMG will then consider what further actions need to be taken once a T2M report is delivered.

b. Managing TPP

A key outcome of the Transition to Management (T2M) phase will be a national management plan, which will provide an overarching framework on which jurisdictional plans can be managed.
Additionally Enterprise Management Plans for potatoes, tomatoes and the nursery industry will be developed and will be incorporated into the national management plan in Appendix 9.

c. Market Access and Trade

As Western Australia is the only jurisdiction currently affected, they have undertaken responsibility to minimise the impact of TPP on trade and harmonise national phytosanitary measures to provide an Appropriate Level of Protection (ALOP) for other jurisdictions in relation to moving host and non-host produce and nursery stock. Eastern jurisdictions, including Queensland, New South Wales, Victoria and South Australia.

d. Research

The research currently undertaken through the T2M includes:

1. To clearly identify native psyllid species from TPP
2. A literature review to contain the best available information from overseas, glass house/field Integrated Pest Management (IPM) practices, considerations of different crops and climates and spray management. Establish a list of effective chemicals
3. To evaluate the effectiveness of currently registered pesticides in the laboratory and the glasshouse against all life stages of TPP and submit data to APVMA for approval
4. Establish a TPP colony for ongoing research of management aids
5. Conduct trials for the use of Ethyl Formate as an effective post-harvest treatment for hosts of TPP
6. Establish a list of biological control agents for TPP with trials conducted in the laboratory and glasshouse.

e. Stakeholder engagement

Stakeholder engagement plans were developed for each jurisdiction and focus on raising awareness of TPP using agreed national themes and talking points. Key messages were updated during the T2M phase. All national stakeholders including, Plant Health Committee (PHC), state jurisdictions and industry bodies agreed that TPP was a pest of national significance in May 2017 and requiring the development of a national management plan for TPP. The National Management Plan is to be informed by the work carried out through the Transition to Management phase which was completed by May 2018.

In July 2018 the National Management Group accepted Western Australia's request for area freedom from CLso and Certificates of Freedom were issued by Western Australia. By December 2018 all other jurisdictions had granted market access for tubers from Western Australia.

In December 2018 the Plant Health Committee also issued a communique stating their commitment to ensuring business continuity for the movement of potato tubers across state borders for Queensland, South Australia, Victoria and New South Wales if TPP were found. This does not include TPP which is infected with CLso when the current EPPRD process would be actioned.

Further monitoring for TPP undertaken during 2018-19 has indicated TPP spreading to the east to take in Albany and Esperance.

3 Pest Characteristics

3.1 The insect

Internationally there are currently four haplotypes of TPP the western, central, north western and south western, which correlate with specific regions of North America. The TPP detected in Western Australia was identified as the western haplotype, which was previously found in western USA, Mexico, Honduras, Guatemala, New Zealand and Norfolk Island.

3.2 Lifecycle of TPP

Female tomato-potato psyllids mate 3-4 days after emerging as adults. They can mate more than once in their lifetime of approximately 40 days. Each female can produce up to 500 eggs. Eggs hatch 3-9 days after being laid. Nymphs pass through five instars in 12-21 days depending on temperature, before becoming adults. The average lifecycle from eggs to adults takes 15-30 days.

Psyllids thrive at about 27 degrees C, while temperatures below 15 degrees C or above 32 degrees C adversely affect their development and survival. In conditions of average temperatures 4-5 generations per year could occur on outdoor host plants. In protected cropping facilities, tomato-potato psyllid development progresses rapidly between 15-32 degrees C. The lower temperature threshold for development is about 7 degrees C.

3.3 Hosts

TPP can reproduce on more than 60 Solanaceous plant species including cultivated and weedy plant species (Essig 1917; Knowlton and Thomas 1934; Pletsch 1947; Jensen 1954; Wallis 1955 & Butler & Trumble 2012). Australian native Solanaceous plant species may also be a host but remain to be tested.

Non crop plants that support TPP lifecycles include nightshades, ground cherry, African and Chinese Boxthorn. TPP can also maintain its lifecycle on some other wild and crop species from the Convolvulaceae including bindweed and sweet potato. A list of host plants for TPP can be found in Appendix 2 Table 1.

The current host list is under review following a request from industry stakeholders due to the economic impost for treatment required for non-host plants.

3.4 Hitch Hiker Plants

These are plants which TPP can move on but do not support any of the three stages of the TPP lifecycle.

3.5 *Candidatus* Liberibacter solanacearum (CLso)

TPP is the only own known vector for *Candidatus* Liberibacter solanacearum (CLso). This a phloem-limited, gram-negative, unculturable bacterium with five known haplotypes (A-E). CLso types A and B are associated with Solanaceae in Canada, USA, Mexico, Central America, New Zealand and Norfolk Island, while haplotypes C, D and E are associated with Apiaceae in Europe and wider Mediterranean region. The association of TPP with CLso was unknown until 2008 (Murphy et al 2014).

CLso is a horizontally transmitted by TPP, feeding first on an infected plant and then on healthy plants. Vertical transmission to progeny TPP does not occur. TPP nymphs and adults can only carry CLso if they feed on an infected plant.

The main economic impact of CLso is that it reduces the yield and quality of potato tubers, with fried chips processed from infected tubers exhibiting dark strips which is referred to as Zebra chip. . In addition to infecting potatoes, CLso also infects tomato, Cape gooseberry, Jerusalem cherry, tamarillo, thornapple and sweet nightshade (Vereijssen et al 2015). Visual symptoms of CLso in potatoes are available in Appendix 2.

3.6 In-crop symptoms of TPP infestations

In-crop signs of tomato-potato psyllid include:

- Insects jumping from the foliage when disturbed (adult psyllids are sometimes called jumping plant lice as they readily jump and fly when disturbed) Psyllid yellows results in yellowing or purpling of foliage on potato plants caused by tomato potato psyllids feeding.
- Severe wilting of plants caused by high numbers of psyllids feeding.
- Yellowing of leaf margins and upward curling of the leaves caused by the injection of salivary toxins (called psyllid yellows).
- Honeydew and psyllid sugar making the plants sticky and often appearing dirty.
- Shortening of stem internodes
- Stem death.

Examples of plant damage are documented in Appendix 2 and 9.

4 Managing TPP in Australia

4.1 Principles for Managing TPP

The following principles underpin the management of TPP in Australia:

a. TPP in Australia is managed in line with the principles of Australian and New Zealand Standard for Risk Management IS0 31000
b. TPP is a reportable pest in Australia
c. To whatever extent possible TPP will be managed by growers through best practice on farm biosecurity
d. Where required, government in collaboration with industry stakeholders will implement mitigation measures to reduce the risk of transmission of TPP to areas not infested with TPP

e. Industry, growers, governments and the public will work collaboratively to manage and monitor the impacts of TPP in Australia, through transparent communications and agreeing on strategies.

4.2 TPP is a Notifiable Pest

TPP is a notifiable pest in Australia. Growers are required to report any suspected detections of TPP to the Chief Plant Health Manager (CPHM) in their jurisdiction. If in an area or jurisdiction that is currently not infested with TPP, the CPHM will request the grower to provide evidence (sticky traps) and symptomatic plant material for testing. The CPHM will notify the Australian Chief Plant Protection Officer (ACPPO) and affected industries, if there is a confirmed positive diagnosis in accordance with the current jurisdictional diagnostic requirements. The period for the initial assessment is about 7 days. Reporting of new cases of TPP will be made when the detection changes area freedom or if TPP is detected on a previous unknown host.

Even though TPP has been identified in Western Australia, any incursion outside of Western Australia, in the first instance, needs to be assessed as a “new” incursion until testing has been completed to determine if it is directly linked. It will also be necessary to undertake a trace back exercise to establish the origin and pathway for future learnings.

For the Eastern Block jurisdictions (Queensland, New South Wales South Australia and Victoria) there is a commitment from the relevant CPHM from the respective jurisdictions to ensure movement of potato tubers so that business continuity is assured.

4.3 Management of Risk Pathways

The Management Plan applies a Hazard Analysis Critical Control Point (HACCP) based approach for managing TPP. High risk pathways, and the points at which regulatory or other control measures are required, have been identified. Table 1, describes the agreed points at which management controls are required to manage the risk pathways of TPP. These include soil, potato seed, nursery stock, tubers, hitch hiker plants, debris and waste from previous crops, conveyances such as bins, farm tools and machinery, transport vehicles and personnel.

A Decision Tree (Appendix 4) underpinned by the HACPP approach has been developed to assist growers to identify the risks and the steps to mitigate against them. The Decision Tree is intended as a resource for reducing the risk of TPP transmission and should be used as a component of state or territory TPP Operational Plans. The Decision Tree has been developed to be used in concert with the TPP Biosecurity Action Planner (Appendix 6) and Checklist (Appendix 7).

Table1: Points at which controls are to be applied to manage Tomato Potato Psyllid in Australia

Risk Pathway	Import into Australia	State or Territory borders	TTP Infested Region	TTP Infested Property within a Region	Non-infested Property within a non-infested region
Soil Control required: Action:	No No action is required as TPP or CLso are not known to survive in or be transmitted in soil	No No action is required as TPP or CLso are not known to survive in or be transmitted in soil	No No action is required as TPP or CLso are not known to survive in or be transmitted in soil	No No action is required as TPP or CLso are not known to survive in or be transmitted in soil	No No action is required as TPP or CLso are not known to survive in or be transmitted in soil.
Potato Seed Control required: Action:	All leafy green Solanaceous crops prohibited All imports managed by Department of Agriculture (DA)	Yes Certification preferred however decision to move seed is a commercial decision	Yes Certification preferred Grower responsibility to manage seed movements	Yes Certification preferred Grower responsibility to manage seed movements	Yes Certification preferred Grower responsibility to manage seed movements
Nursery Stock Control required: Action:	Yes Comply with current import requirements as stipulated by DA	Yes Controls on Nursery Stock of host plants from infected states. CPHM certification required via ICA	Yes Controls on Nursery Stock of host plants from infected areas. If an accredited nursery under Biosure, clear documentation of treatments required for movement. Jurisdiction to manage on a situational basis via ICA	Yes Controls on Nursery Stock of host plants from infected properties. Jurisdiction to manage on a situational basis. Support by proof of area freedom with evidence gained by sticky traps and records	No If outside of infected region. Supported by proof of area freedom with evidence of monitoring by sticky traps and records
Tubers Control required: Action:	Yes	Yes	Yes	Yes	No n/a

	Importation of tuber prohibited. Managed by DA	In accordance with jurisdictional requirements	Movement of tubers out of TTP region is prohibited	Movement of tubers is permitted within a TPP infested region	
Plant debris and waste from previous crops Control required: Action:	Yes Prohibited, managed by DA	Yes Controls on movement and destruction of solanaceous plants including debris and waste from previous crops is removed from all fresh tubers before moving across state borders. CPHM certification required to move out of infested state.	Yes Controls on movement and destruction of solanaceous plants not required all green leafy material is left in property. Jurisdiction to manage on a situational basis.	No Controls on movement and destruction of solanaceous plants not required all green leafy material is left on property Jurisdiction to manage on a situational basis.	No Supported by proof of area freedom
Hitch hiker plants Control required: Action:	n/a	Yes To be managed by the jurisdictions on a case-by-case basis.	No To be managed at the property level	No To be managed at the property level	
Conveyances (eg crates, boxes, bins, pallets) Control required: Action:	Yes Managed by DA on a situational basis	Yes Controls on Conveyances that may have come into contact with infected plants. Managed by each jurisdiction on a case by case basis	Yes Controls on Conveyances that may have come into contact with infected plants. Jurisdiction to manage on a situational basis. May be managed by via on farm biosecurity /auditable HACCP.	Yes Controls on Conveyances that may have come into contact with infected plants. Jurisdiction to manage on a situational basis. May be managed by via on farm biosecurity /auditable HACCP.	No Supported by proof of area freedom. May be managed by via on farm biosecurity /auditable HACCP.

Tools, equipment, farm machinery Control required: Action:	Yes Used machinery/equip-ment must be clean and free of green leafy material managed by DA.	Yes Controls on tools, equipment, machinery used on farm that may have come into contact with soil or may carry green leafy material CPHM certification required	Yes Controls on tools, equipment, machinery used on farm that may carry green leafy material. Jurisdiction to manage on a situational basis. May be managed by via on farm biosecurity /auditable HACCP.	Yes Controls on Tools, equipment, machinery used on farm that may carry green leafy material. Jurisdiction to manage on a situational basis. May be managed by via on farm biosecurity /auditable HACCP.	No Supported by proof of area freedom. May be managed by via on farm biosecurity /auditable HACCP.
Transport vehicles Control required: Action:	No	No To be managed at property level.	No To be managed at property level.	No To be managed at property level.	No To be managed at property level.
Personnel Control required: Action:	No	No	No	No	No

*Controls on tubers may change subject to international trading requirements.

4.4 Importation of potato varieties into Australia

TPP cannot be transmitted by mini seed tubers, however CLso can be. All potato variety imports are by tissue culture which are then subjected to quarantine requirements. Imported tissue culture are:

a) Tested for a range of viruses and include CLso. In June 2008 potato varieties imported from New Zealand were tested for CLso using Polymerase Chain Reaction (PCR). This testing was subsequently expanded to include potato imports from all countries in November 2009.

   Where tested offshore, potato varieties must be accompanied by an official government phytosanitary certificate and/or laboratory test certificate.

A national diagnostic protocol for seed potatoes continues to be under review to find a cost effective method. Until a final National Diagnostic Protocol for CLso is endorsed, an interim testing protocol is being applied by diagnostic laboratories for testing of collected leaf material, which is an expensive process.

Importation of Potato material prior to June 2008 from New Zealand and November 2009 from all other countries could have carried CLso and remained untested. The potential risk is that some of this material has been stored in germplasm for many years. Whilst the risk is low it is important that if a variety is brought out of storage which arrived before those dates is tested fort CLso before release. The location of these imports is varied and will require Federal Government notification of the importers to highlight the potential risk and measures to mitigate against it.

4.5 Moving Plant Material, and Machinery within Australia

Movement of plant material, tubers and machinery may differ between states and territories. For further information about specific requirements regarding the movement of plant material, machinery within Australia, growers are encouraged to check with local biosecurity officers or refer to the following websites:

Tasmania (Tasmanian Biosecurity Import Requirements Database) http://imports.dpipwe.tas.gov.au/ImportRx.nsf

Northern Territory (Contact NT Quarantine) https://nt.gov.au/industry/agriculture/food-crops-plants-and-quarantine/plants-and-quarantine/plant-quarantine-contacts-and-plant-inspectors

New South Wales (Plant Quarantine Manual) http://www.dpi.nsw.gov.au/content/biosecurity/plant

Queensland (Queensland Biosecurity Manual) https://www.daf.qld.gov.au/data/assets/pdf file/0004/379138/QLD_Biosecurity_Manual_2016.pdf

Victoria (Plant Quarantine Manual) http://agriculture.vic.gov.au/agriculture/horticulture/moving-plants-and-plant-products/importing-plants

Western Australia (Import Requirements Database) https://www.agric.wa.gov.au/iaquarantine/

South Australia (Plant Quarantine Standard) http://www.pir.sa.gov.au/biosecurity/plant_health

5 Surveillance

5.1 National Surveillance

Historically there was no comprehensive monitoring program for TPP in Australia. A monitoring program managed through the University of Tasmania has been maintained for 6 years and has not detected TPP during that time in Tasmania. On several occasions monitoring has occurred in other States but not on a regular basis. With the implementation if the T2M phase, all jurisdictions have undertaken monitoring for TPP during the autumn 2017, spring 2017, summer and autumn 2017-18, and summer and autumn 2018 - 2019 with no TPP detected. Indications are that most jurisdictions intend to continue with monitoring for TPP. Future surveillance programs will require ongoing national coordination.

The Department of Primary Industries and Regional Development (WA) is leading a national TPP surveillance program in collaboration with all other jurisdictions. The program is operated in peri-urban regions, the sight where TPP was first detected. The program initially is for 3 years, with 2 years completed (2021). Apart from WA no other jurisdiction has identified TPP. Testing of TPP in WAA for CLso has also not found CLso to be present. The evidence gathered will provide a level of confidence to growers and their stakeholders to assist in knowing where TPP is present or absent. The evidence gathered can underpin pest free status if this becomes necessary for the purposes of international trade. Importantly it will also provide industry stakeholders with early warning evidence to manage TPP when it arrives.

5.2 On-Farm Surveillance

During routine surveillance, growers need to record all observations, including a lack of detection, as this information may become a crucial component of supporting international market access.

For detection, an easy to use sticky trap is commercially available. This type of monitoring is the current best practice for the detection of TPP. Should growers suspect a TPP infestation, they should immediately apply strict biosecurity protocols to limit the potential spread on any infestation. If concerned, growers can submit a sticky trap for examination and/or insects collected from scouting the crop for eggs, nymphs and adults, to the biosecurity authority in the relevant state or territory. However, growers are encouraged to contact the local biosecurity office or their agronomist in the first instance. Details for state diagnostics agencies can be found in the Risk Mitigation Summary Guide found in Appendix 8.

6 On-Farm Management

If TPP is detected in a crop the risk of spread throughout the crop is likely to be high however it can be managed with the use of biological controls and a spray regime. Crop infection should be carefully managed to prevent spread of the TPP and CLso. Growers can implement simple procedures to prevent the movement of TPP onto or off their properties:

a) Use seed potatoes from a reputable producer that can provide evidence that TPP is not present on their property. If TPP is present demonstrate through documented evidence of the TPP management program they have in place monitoring and testing of TPP found on traps;
b) If new varieties of potatoes are imported then documentation should indicate if they come from a TPP infested region and the steps taken to mitigate against the presence of TPP eg spray and IPM programs as well as PCR testing for CLso to ensure confidence to the customer;
c) Follow best practice sanitation and cultural practices including controlling non-crop hosts, especially solanaceous species that border fields, and manage TPP along with other plant pests as a precaution;
d) Scout fields for symptoms at regular intervals;
e) Take plant tissue samples and have a diagnostic analysis for CLso completed on suspect plants;
f) Restrict farm visitor access;
g) Clean and disinfect tools, clothing and machinery to ensure they are free of all insects including TPP before these leave the property.

When managing a new TPP detection:

a) Wear gloves and protective clothing and place in bags for disposal;
b) Dispose of protective clothing by burning or deep burial;
c) Sanitise equipment used in conjunction with detection;
d) Restrict contractors and visitors entering the farm.

A decision tree is provided in Appendix 4 to assist growers to determine the risk of TPP on their property and how to manage the risk. A simple On-Farm Risk Mitigation Summary Guide can be found in Appendix 7.

7 Roles and Responsibilities

To manage TPP effectively, each section of the management hierarchy has roles and responsibilities. The management hierarchy includes partners at the national, state/territory, industry and individual grower level. These roles and responsibilities cover areas such as monitoring, surveillance and diagnostics, reporting, TPP farm management and TPP / CLso import risk management. These are outlined in Table 2.

Table 2: Roles and responsibilities for Management of TPP

Activity	Grower Responsibility	Peak Industry Body Responsibility	State and Territory Government Responsibility	Australian Government Responsibility
Monitoring, surveillance and diagnostics	Understanding of signs and symptoms of TPP Monitoring crops for TPP Collecting and submitting samples for testing where there is concern that a crop may be infested with TPP. Be aware of TPP habitat and lifecycle and know what to look for. Provide feedback on effectiveness and currency of awareness material. Be aware of procedures for appropriate monitoring, best practice placement, collection and inspection of traps	Development of National TPP Surveillance Protocol Development of TPP awareness material for growers. Encouraging grower support for the Plan. Coordinating and facilitating grower involvement in applicable surveillance programs. Identify and contribute to RD&E that would improve diagnostic methods. Contribute to development of national protocols for diagnostics for CLso.	Development of National TPP Surveillance Protocol Providing guidance on development of awareness material for growers. Provide diagnostic services to growers. Contribute to a National CLso Diagnostic Protocol. Identify and contribute to RD&E that would facilitate continued development of diagnostic and management methods for TPP and CLso.	Development of National TPP Surveillance Protocol Providing guidance on development of awareness material for growers. Lead the process for the finalisation of an effective National CLso Diagnostic Protocol. Identify and contribute to RD&E that would facilitate continued development of diagnostic and management methods for TPP and CLso
Reporting	Report suspect detection to biosecurity agency in the state/ territory where it occurs via the Exotic Plant Pest Hotline 1800 084 881.	Report suspect detection to Chief Plant Health Manager in the affected jurisdiction.	Reporting of new infestations of TPP beyond existing areas of infestation.	Report national and regional TPP and CLso status to international community.

TPP Farm management	Implementing appropriate on- farm biosecurity procedures for control of the pest in accordance with enterprise management plans in the Plan.	Continued management of TPP in accordance the nationally agreed measures led by the Plant Health Committee in collaboration with industry bodies. Develop and coordinate awareness and general on farm biosecurity best practice training. Contributing development and ongoing review/maintenance of the Plan. Ensuring the Plan is published, publicised and accessible to growers. Promotion of farm biosecurity practices, in accordance with the Plan.	n/a?
TPP and CLso import risk management	n/a	n/a	Advise on risk requirements to support market access. Maintain measures to minimise TPP and CLso risk on imports as appropriate. Maintain and communicate Australia's plant pest status with respect to TPP and CLso Advise on minimum requirements to support export market access.

8 Research Opportunities

The management plan is a living document and during its preparation several areas of research have been identified, especially through the T2M phase which will assist stakeholders to better prepare for managing TPP.

These are as follows:

- To give high priority to field trials of:
    - spray rates and frequencies of suitable chemicals for TPP management which will lead to Australian Pesticides and Veterinary Medicines Authority (APVMA) registration.
    - biological controls to assist in the management of TPP with IPM programs.
- To identify all native psyllids found in commercial production regions and the potential of native psyllids as vectors for CLso.
- To maintain a TPP colony established in Western Australia to monitor and test the hypothesis that TPP become infected with CLso ("hot") over generations of feeding on specific solanaceous crops. DPIRD (WA) has maintained a TPP colony for 4 years where multiple generations have occurred. No CLso has emerged to date.
- To determine the ways TPP "hitch hike" on other plants, produce, machinery and personnel. There is a need to revisit non-host plants and their role as "hitch hiker" plants. Historical publications indicate TPP can "hitch hike" on non-host plants, however there are no recent publications where the introduction of current "on farm" best practice management are implemented.
- To verify the status of known (or suspected) non-hosts that occur in Australia, including weeds that can sustain TPP populations.

At present, there is no known potato variety that is resistant to attack by TPP or infection by CLso. There is a research project underway in New Zealand to assess resistance to TPP of a range of varieties.

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https://ausveg.com.au/tpp/. For access to all Enterprise Management Plans and all DPIRD reports from the Transition To Management Phase.

10 Appendices

Appendix 1 – National TPP Steering Committee

The National TPP Steering Committee provides direction and **advice** on TPP and CLso. Additionally the steering committee seeks to establish national agreement on hosts, risk material and risk pathways that support the development of the national TPP management plan. Members are selected for their expertise and are not representing their respective organisations.

Mr Tony Cukrov, SupaFresh
Dr Nigel Crump, VICSPA
Mr. Callum Fletcher, AUSVEG
Mr Michael Hicks, Snackfoods
Ms Zarmeen Hassan, AUSVEG
Dr Penny Measham, Hort. Innovations
Mr Simon Moltoni, Potatoes WA
Mr Andrew Bishop, CPHM Tasmania

Appendix 2 – Symptoms of TPP lifecycle and CLso Infection in Potatoes

TPP eggs on Boxthorn with a pen to indicate size.

TPP Nymphs on Potato

Adult TPP on *Lycium* ferocissimum (Boxthorn)

Potato plant infected with CLso

Appendix 3 – Hosts of TTP

It is essential that hosts, non-hosts and hitcher pathways for TPP be identified and regularly reviewed in accordance with the best up to date evidence as they provide the foundation for any trade restrictions, movement controls and biosecurity risk management practices.

1. Hosts for TPP

TPP has a specific known host range mainly within the Solanaceous family. The family Solanaceae contains tomatoes, potatoes, capsicums, chillies, and tamarillo including non-commercial plants and weeds such as nightshades. CLso is plant borne in known hosts. TPP is the only known vector for the transition of CLso from infected plants to non-infected plants. When considering TPP, the current international evidence is that CLso will also be present. The manifestation of CLso as Zebra Chip Complex is of particular concern to the potato industry.

The following list of hosts is used as the basis for this paper and is supported by scientific literature as at April 2018. The table below lists the natural hosts of TPP.

Table 1: Known hosts of the tomato potato psyllid

Host Scientific Name	Common name (s)
Nicandra physalodes (L.) Gaertn.	Apple of Peru
Solanum carolinense L.	Ball nightshade, Bull nettle, Horse nettle, Devil's tomato
Solanum aviculare G. Forst.	Bullibulli
Physalis peruviana L	Cape gooseberry
Physalis franchetti Mast.	
Physalis heterophylla Nees	Chinese lantern
Nierembergia hippomanica Miers	Clammy ground-cherry
Lycopersicon pimpinellifolium (L.)	
Physalis angulata L.	Cup flower
Solanum melongena L.	Mill Currant tomato
Nicotiana affinis Moore	Cut leaf ground-cherry
Solanum villosum Mill.	Eggplants, Aubergine
Hyoscyamus niger L.	Flowering Tobacco
Physalis pruinosa L.	Hair nightshade
Solanum capsicastrum Link ex Schauer	Henbane
Datura stramonium L.	Husk tomato
Physalis longifolia Nutt.	Jerusalem cherry
	Jimsonweed, Thornapple
Physalis mollis Nutt.	Longleaf ground-cherry
Physalis rotundata Rydb.	Longleaf ground-cherry
Lycium halimifolium Mill.	Longleaf ground-cherry
Solanum pyracanthum Jacq.	Matrimony vine
Solanum tuberosum L	Porcupine tomato
Physalis lobata Torr	Potato
Solanum betaceum Cav. [synonym: Cyphomandra betacea (Cav.) Sendtn.]	Purple ground- berry
Nicotiana tabacum L.	Tamarillo
Physalis ixocarpa Brot. ex Hornem. [synonym: Physalis philadelphica Lam.]	
	Tobacco

Lycopersicon esculentum Mill [synonyms: Solanum lycopersicum L., Lycopersicon lycopersicum (L.) H. Karst.]	Tomatillo
Solanum gracile Sendtn.	Tomato
	Velvety nightshade
Solanum sisymbriifolium Lam.	Viscid nightshade, Sticky nightshade
Solanum elaeagnifolium Cav.	White horse- nettle, Silver- leaf nightshade
Physalis comata Rydb.	Wild ground- cherry
	Wild potato
Solanum jamesii Torr.	Wild tomato
Solanum triflorum Nutt.	Wonderberry, Black nightshade, Blackberry nightshade, Garden huckleberry
Solanum nigrum	
Datura meteloides Dunal	
Hyoscyamus albus L.	
Lycium andersonii A. Gray Lycium exsertum A. Gray	
Lycium fremontii A. Gray	
Lycium macrodon A. Gray Lycium pallidum Miers	
Lycium parishii A. Gray	
Lycium quadrifidum	
Moc. & Sessé ex Dunal	
Lycium torreyi A. Gray	
Nicotiana glutinosa L.	
Nicotiana texana Maxim. Physalis lanceolata Michx. Solanum baylisii Geras.	
Solanum citrullifolium A. Braun Solanum mexicanum Moc. & Sessé ex Dunal	
Solanum racemigerum Zodda	
Solanum sanitwongsei Craib	

2. Issues with Host List

The specific plant host range of TPP is not clear due to the definition of “hosts”, “non-hosts” and “hitch hiker” plants:

- TPP can colonize on plants that are not from the Solanaceous family such as sweet potato, African Boxthorns.
- Insufficient research work has been undertaken to determine exactly how CLso moves around a plant.
- It remains unclear whether Australian native psyllids can act as a vector for CLso.
- Internationally where the western haplotype is detected CLso has also been discovered in the TPP population and confirmed through plant testing. The testing of TPP in Western Australia has not found CLso to be present.
- There has been no testing of the Western Australian TPP research colony which was established for the T2M phase for CLso as it was out of scope.

3. The risk of unknown host plants

The risk of unknown host plants in the establishment and spread of CLso is low. International evidence has shown that CLso can be found in seed such as tomatoes and carrots. To date the tomato seed CLso does not appear to become active in a growing plant. The CLso associated with carrots is of the Haplotype C and D and not vectored by TPP. There may well be native psyllids that can act as vectors but they are unknown hence further work on understanding the native population.

4. The risk of potato tubers carrying CLso

Published international evidence demonstrates that potato tubers can carry CLso. To date no tubers in Australia have tested positive to CLso either in TPP infested regions or non-infested regions. The current known facts are:

- Infected tubers are likely to be symptomatic, and therefore unsaleable. Unsaleable tubers would be removed from the pathway at the farm, wholesale or processing stages of the supply chain.
- Unsaleable tubers that leave the farm will be managed as waste at the factory.
- Mini tubers as seed from a CLso infected solanaceous host may be a carrier. Current evidence shows that CLso does not spread evenly throughout the plant or tuber. TPP that feeds on infected plants may or may not become "hot". Evidence shows that the incidence rate for "hot" TPP is about 3-5%
- Potato varieties that were imported prior to 2008 and held in germplasm remain a possible source of CLso; which will diminish as stocks are used. Note. Mandatory PCR testing of all imported potato tissue culture came into effect on 4 November 2008
- Mini tubers domestically produced are a potential source of CLso if infected TPP are present. Future testing could be implemented however this needs to be cost effective. Fortunately at this stage the only known seed potato production site where TPP is present is in Western Australia. Seed growers have maintained a monitoring program for TPP and only a few TPP have been detected.
- There are currently no known varieties of potatoes resistant or tolerant to TPP or CLso.

Australia's import conditions require potato tissue culture be tested for CLso. All host species (Solanaceous family members and Apiaceous family, in particular carrot seed) have an ability to carry CLso. It is only the solanaceous family that is known for maintaining the TPP lifecycle and there is scientific evidence that CLso is associated with tomato seed however CLso does not manifest itself in the plant.

Australia is a member of the World Trade Organisation (WTO) and must follow internationally agreed plant health standards and guidelines when developing import conditions. These standards require that import conditions are justified by scientific evidence, and are applied at the species level, unless there is sound scientific justification to regulate at a higher or lower taxonomic level. If Australia does not follow its international obligations, other countries have the right to bring the case to the WTO for dispute settlement.

5. The level of risk associated with backyard and non-commercial plantings

The Western Australian experience has found TPP mainly in backyards and community gardens and parks, with smaller numbers in some commercial crops. The round of testing of TPP under the T2M program focused on high numbers trapped on non-commercial sites and in particular individual backyards. Subsequent TPP trapping programs in Western Australia has focused on locations where high numbers of TPP were identified during the previous trapping program.

Issues:

- Backyards and community gardens may become infected from TPP that remain unmanaged and "overwinter".
- They can spread from backyard to backyard especially on non-commercial tomatoes, chillies,

eggplants etc.

- TPP movement as a result of human activity, where TPP "hitch hike" on machinery or by "sharing" of infested plants/fruit. Generally adult TPP are not attracted to humans and would prefer to stay located in or near their respective colonies.
- TPP can be dispersed by wind similar to other sap sucking insects such as aphids and white fly.
- TPP eggs and nymphs are readily transported on leafy green parts of host varieties, more so than adults which will tend to fly away.
- The persistence of TPP in backyards will vary between regions and the management by owners. Community gardens have the potential for TPP infestations along with backyards, and hence have an increased risk of further spread.

6. Other potential pathways for the movement of TPP (e.g. , bins, transport etc)

For the following pathways, what is the likelihood that TPP will enter a production environment if no mitigation methods are applied?

Pathway	**Likelihood**
Mini tuber seed direct pathway to production system	Low
Seed potatoes, G1-G5 plus farm save and unspecified generation.	Low
Green plant debris and waste from previous infected crop	High
The movement of potato tubers for processing and ware	Low
TPP lifecycle does not occur on tubers, tools, equipment, machinery used on farm	Low to medium
Adult TPP can "hitchhike" on non-host pathways but it is not preferred by TPP and clothes of farm personnel and visiting agronomists	low-medium
Transport vehicles	Low - not a direct pathway
Hands and clothes of personnel in the supply chain	Low - not a direct pathway
Domestic livestock, pest animals	Low - TPP could "hitch hike" on animals but is highly unlikely

Factors that need to be considered for trade (both interstate and international)

a) Industry and Regulatory stakeholders consider:

- The factors that need to be considered for trade include:
  - The establishment and maintenance of a national monitoring program for the presence of TPP. Know where it is and where it isn't.
  - Develop a cost effective diagnostic tool for testing plants and tubers for CLso.
  - Maintain TPP free places of production.

Appendix 4 – Decision Tree for Management of CLso in a TPP infested region

	Assessing Risk	Answer	Action	Comments
1	Am I in a State with TPP?	Yes	Go to 3	
		No	Go to 2	
2	Have I received any leafy green material, used packaging on my farm or received vehicles or people from an infected property or state?	Yes	Go to 3	
		No	Go to 5	see Note 1 - Transmission
3	Have I been monitoring for TPP?	Yes	Go to 4	
		No	Go to 5	see Note 2 - Testing agencies
4	Was TPP detected?	Yes	Go to 6	
		No	Liaise with State Biosecurity or PIB for Quarantine status	see Note 3 - Replanting
		No result yet	Assume infected until result known	
5	Did the potato seed I am using come from an accredited seed grower?	Yes	Do not plant seed unless tested	see Note 1 - Transmission
		No	Go to 6	
		Unsure	Contact supplier	
6	Have I planted untested seed of the varieties or observed any symptoms in crops in the last three years consistent with CLso infection?	Yes	There is potential for infection to exist. Check susceptible weed see page 22 for example species around planted area. . Go to 8	
		No	Go to 7	See Note 4 Indicator Species
		Unsure	Go to 8	
7	Unlikely to have TPP on farm – maintain a good On Farm Biosecurity Program	Go to 9		see note 5 TPP lifespan
8	Was TPP present on traps and /or in the field?	Yes	Liaise with State Biosecurity or PIB for Quarantine status	see Note 3 – Re-sowing
		No	Go to 7	
9	Do I have an on-farm Biosecurity Program?	Yes	Go to 10	
		No	Go to 11	See Note 6 On Farm Biosecurity
10	Is it up to date for TPP?	Yes	Ensure it is being implemented	
		No	Go to 11	

11	Develop an on-farm Biosecurity Program based upon TPP management template			See Note 6 - On Farm Biosecurity

Decision Tree Notes	
1	**Transmission Methods** TPP can be introduced into a crop from host weed and plants that surround the crop. CLso can be introduced to a crop through seed potatoes and carried by TPP that can be moved in or fly in from CLso infected areas. • Infection of new plants with CLso occurs through the transition by "hot TPP" that feed on an infected plant and then move onto a non-infected plant. Direct infection can only occur by "hot TPP" feeding on a non-infected plant. There is no transmission of CLso from plant directly to another plant through touching each other or by the roots. • CLso cannot be transmitted by water or in nutrient solutions. • TPP can "hitch hike" on machinery, equipment, clothing, or even humans but is unlikely. Best practice on farm biosecurity will mitigate against this. • TPP can spread in the field where there is no IPM and spray management practices deployed. • Using seed potato harvested from CLso infected host plants.
2	**Testing Agencies** Information on testing laboratories for TPP Taxa and CLso infection is available from the Exotic Plant Hotline 1800 084 881. Australia's import conditions require seed testing for all host species for which there is scientific evidence that CLso is associated with the seed eg carrots and tomatoes. Potato tissue culture is also tested for CLso.
3	**Re-sowing** There is nothing to stop growers from re-sowing in previously infected areas. However proving TPP absence requires ongoing monitoring which growers need to consider. (1) Current scientific information from overseas suggests that TPP is the only known vector for CLso in solanaceous crops. Further research is required in Australia to test native psyllids adaptability to become a vector for CLso. (2) If TPP is found then on farm management practices including IPM and spray regimes will mitigate against the impact on TPP. Planting is a business decision and is done at one's own risk.
4	**Host Species*** **See Appendix 1 Table 1 on Host list**
5	**TPP Lifespan*** **Refer to Appendix 9 Enterprise Management Plans**
6	**On Farm Biosecurity** Refer to the Farm Biosecurity Action Planner and Checklist for Management of TPP. Appendix 6
Considerations	
What Do I Need to Know? ○ Where TPP is and where it isn't? ○ All mini tubers held in germplasm that arrived before 2008 will require CLso testing before release. ○ Currently there are no known resistant Cultivars. ○ There is no cure for CLso. ○ Familiarise yourself with the Taxa of TPP and the symptoms CLso. ○ Some varieties appear to be more impacted than others by CLso. ○ CLso infected plants located in the field need to removed and destroyed (Rogueing). ○ Vehicle and people movements need to be controlled in TPP infected areas and between properties to mitigate against spread of TPP. ○ Do a thorough check to see if there are any potential linkages between your property and those that are or may be infected, include all potential forms of movement and materials.	

*Accompanying notes will be updated in line with advances in R&D.

Appendix 5 – Major Risk Pathways for Movement

Risk	Action
Vehicles and equipment TPP cannot remain viable on • Organic material (decaying) • Vehicle surfaces CLso only remains viable in the green parts of solanaceous plants and in infected tubers	Best practice on farm biosecurity promotes the cleaning of vehicles and machinery which are stored at dedicated facilities on site away from growing areas. Equipment and dedicated farm vehicles do not move off the property and are cleaned (particularly of green leafy material) between use in different growing areas. Visitor vehicles park at designated areas and on site vehicles travel on designated pathways between growing areas to minimise interaction with farm equipment. Gate signs direct traffic and inform visitors about property access points, and who to contact for queries.
Boxes and packaging TPP is not viable on • Organic material • Conveyance surfaces	Boxes and bins need to be free of all green leafy material. Unused boxes and bins are stored on clean hard floors in a covered area away from growing areas.
Staff and Farm Visitors TPP is not viable on • Hands • Clothes, especially footwear • Vehicles including tyres	Best Practice on farm biosecurity promotes that visitor clothing, footwear and tools are checked for adult TPP and any leafy green material and removed before entering the farm. Cleaning facilities including footbaths and brushes are maintained and accessible for visitors and staff. Staff are trained about on-farm biosecurity practices and visitors inducted in biosecurity expectations prior to moving past the farm office. All visitors report to management, sign a visitor register and report previous movements in other growing regions upon entering the property. Gate signs direct traffic and inform visitors about property access points, designated visitor parking and restricted areas (growing areas).
Waste and weeds TPP can remain viable for periods on • Host based green leafy waste • And live host weeds	Waste is disposed of as soon as possible and stored away from growing areas. Growing areas are surrounded by host-free buffer zones.
Planting materials TPP lifecycle is not sustained on • tubers However CLso is viable in tubers	Planting material is sourced from reputable suppliers. Ensure that seed potato growers are monitoring for TPP by providing records and results from ongoing trapping. . Seek to be provided with any tests for CLso

Appendix 6 – Farm Biosecurity Action Planner

Farm Biosecurity Action Planner **This Action Planner is a template with which you can address the risk factors in Appendix 10.4. It is designed such that you can put in your individual management action in the blank column.**			
Risk	**Estimated risk rating*** **(0 = no risk, 10 = high risk)**	**Mitigation practices**	**Action**
Vehicle movement With multiple entry sites, vehicle access cannot be controlled, making it difficult to stop visitors moving into growing regions. These risks are increased when the vehicles have been exposed to different growingareas.		Visitor vehicles are restricted to parking only at designated areas and on site vehicles travel on designated pathways between growing areas. Gate signs direct traffic and inform visitors about property access points, and who to contact for queries.	
Vehicle hygiene Areas where organic matter can become lodged, such as tyre treads and grilles, can sustain TPP eggs and nymphs Runoff from clean down areas can carry TPP eggs and nymphs		Clean vehicles and equipment dedicated on site Facilities that are well maintained and away from growing areas. Keep dedicated equipment and vehicles for on farm use.	
Staff and Farm Visitors on farm TPP have the potential to “hitch hike” on visitors and staff from other areas on the farm or other growing regions. Staff that are untrained in good biosecurity practices can spread diseases, pests and degrade biosecurity systems in place.		Visitor clothing, footwear and tools are checked for leafy green material and insects, and are removed before entering the farm. Cleaning facilities including footbaths and brushes are maintained and accessible for visitors and staff. Staff are inducted in on farm biosecurity practices and visitors are made aware of biosecurity expectations prior to moving around the farm. All visitors report to the farm office and sign a visitor register upon entering the property.	

Risk	Estimated risk rating* (0 = no risk, 10 = high risk)	Mitigation practices	Action
Waste Leafy green farm waste can be repository for TPP eggs and nymphs.		Waste is disposed of as soon as possible, stored away from growing areas and water sources.	
Planting and packaging materials Seed potatoes are not a source for TPP however tubers can carry CLso.		Planting material is sourced from reputable suppliers and treated for pests as required, especially those which undertake TPP monitoring and keep records of trap catches. Seek to be provided with any tests for CLso Unused boxes and bins are stored on clean hard floors in a covered area.	
Monitoring Lack of monitoring can lead to TPP incursions going unnoticed, this can increase the risk of CLso been spread throughout the crop if initially present. .Allowing TPP to go unmanaged, during which time they may establish in growing regions and spread to other properties. Recording a *lack of observation* during regular monitoring is essential for proving property freedom.		Regular monitoring is carried out in crops and surrounding vegetation. Staff are trained to be aware of TPP lifecycle and impact of TPP on plants. Posters, information pages and fact sheets are available on property to help staff identify symptoms. Monitoring results are documented.	

Growing Area regulation Unnecessary movement in growing areas can increase the risk of spreading TPP establishment. Neighbouring properties could harbour TPP. Weeds as hosts can be a source for sustaining the TPP lifecycle. Animals have the potential to spread TPP as a hitch hiker.		Gate signs direct traffic and inform visitors about property access points. There is a designated visitor parking area. Regular communication is maintained with neighbours regarding biosecurity procedures. Feral animal and weed populations are controlled.	
Biosecurity planning Not implementing biosecurity strategies can increase the risk of TPP establishment, will lead to higher long-term costs for managing TPP and place market access at risk.		A biosecurity plan with prioritised actions is maintained for each growing area on your property. This plan is updated as goals are achieved and is integrated into the overall Farm Management Plan.	
Extra risk:			
Extra risk:			

***Estimated risk rating**

The risk rating is a qualitative estimate that aims to indicate high priority areas of farm biosecurity for TPP. It is important to note that individual properties may face different levels of risk for each aspect of biosecurity. For this reason farm biosecurity plans should be tailored accordingly to be most effective. Attributing a value to the risk rating should be based on current knowledge of farm traffic, farm management practices, and professional advice.

Appendix 7 – Farm Biosecurity Checklist

Farm Biosecurity Checklist				
Biosecurity Practice	**In place**	**In progress**	**No**	**N/A**
Vehicle Cleaning				
Wash down facilities are provided on site for machinery, equipment and vehicles				
Run-off water from wash down facilities is collected for disposal				
Clean down facilities are located near farm entrances and away from growing areas				
A hard pad is provided in vehicle wash down area				
High pressure water and air hoses are available for removal of plant material and soil from machinery, equipment and vehicles				
Wash-down facility and surrounds are inspected frequently for potential sources of contamination (eg. organic matter and host weeds)				
Records of wash down facility inspections are logged				
Machinery is inspected and disinfected before entering growing areas				
Vehicle Movement				
Visitor vehicle access is restricted to designated parking areas				
Only on-site vehicles are used to transport equipment and visitors around the farm				
Vehicle movement is kept to a minimum in growing areas				
Designated tracks are used to limit vehicle movement on growing areas				
Machinery and vehicles are cleaned before moving off property				
Staff and Farm Visitors				
Footbaths and brushes are easily accessible and used				
Visitor clothing, footwear and tools are checked for soil and organic matter before entering the farm				
Staff are trained in biosecurity and farm hygiene practices				
Visitors are inducted in biosecurity expectations prior to moving around the farm				
Visitors sign a register to monitor movements between farms				

Appropriate hygiene supplies are available to staff and visitors (hand sanitiser, gloves, foot baths)				

Contractor entry is conditional to a biosecurity induction and hygiene protocols				
Growing Areas and Controlled Access				
Signs requesting phone check in and providing farm contacts are visible at main entrances				
Farm is divided into 'zones' with restricted/ minimised people, machinery and equipment movement between zones				
A sanitation procedure is in place where there is regular movement of people, machinery or equipment between zones				
There is regular communication with neighbours regarding minimising TPP transmission				
Boundary fences are regularly inspected and maintained				
Vermin, feral animal, weed and wildlife populations are managed in line with regulations				
Plants and Materials				
Records of planting material are maintained				
Planting material are sourced from reputable suppliers				
Imported tomato seed has been tested for CLso presence.				
Potato cultivars imported before 2008 and held in storage are PCR tested for CLso prior to planting				
Records of seed or seedling tests are logged				
Monitoring				
Symptom monitoring is regularly conducted in crops				
Symptom monitoring is regularly conducted in neighbouring vegetation				
Staff are trained to recognise TPP and visual symptoms of CLso.				
Staff know how and where to report suspect plant disease symptoms				
Activities and results of TPP monitoring are recorded, including lack of observations				
Monitoring records are well organised and maintained				
A farm management plan is maintained for TPP				
Packaging and pallets				
Unused boxes and bins are stored on clean hard floors in a covered area.				
Boxes and pallets are clean of leafy green material.				
Dirty pallets are cleaned in the wash down area.				

Appendix 8 – On Farm Risk Mitigation Summary Guide

General Information

Use mini tubers from reputable suppliers who have maintained ongoing TPP monitoring and record keeping.
Be aware of what TPP looks like in crops that you grow. Conduct visual surveillance for these symptoms.
If you see suspect symptoms have samples of affected plants tested.
Manage your crop to minimise the impact of TPP.

General Surveillance

- Be aware of what the taxa and crop symptoms of TPP (eg psyllid yellows) are in crops that you are growing. Also familiarise yourself with the symptoms of CLso infection in a plant.
- Visually inspect your crops and maintain a sticky trap monitoring program, commencing prior to and throughout the growing period to monitor for TPP.
    a. If you observe TPP or unknown insects on the sticky traps have the insects diagnosed by a professional eg entomologist, agronomist or if you are confident with your capabilities to diagnose TPP then review yourself. Send a sample to a lab for confirmation – check with your agronomist or relevant government officers on the process for submitting samples. See the section below on sample preparation.
    b. Report TPP to your relevant jurisdictional biosecurity department or initially contact the Exotic Pest Hotline.
- If you suspect you have TPP, isolate the infected area of the crop until independent diagnostic results are known to reduce the potential movement of hitch hiker TPP.

Actions Following Detection

It is required that detections are reported to aid in delimiting the pest and for effective management of TPP. Following a positive detection the presence of the insect must be reported to the appropriate state or territory Department of Primary Industry. Call the Exotic Plant Pest Hotline (1800 084 881) to be directed to your relevant agency.

Re-sowing

There is no regulation to prevent re-sowing however growers should continue with their normal planting practices. Remember TPP adults, nymphs and eggs, cannot survive without a host. Restrict movement of people and farm vehicles on the site.
Destroy and remove any infected plants and surrounding weed hosts plants.
Continue to monitor other host plants on your property, and on linked properties.
Maintain farm zoning and biosecurity best practices. Complete the biosecurity checklist and action planner provided in this Plan to aid in developing appropriate protocols for managing TPP.

Appendix 9 – Enterprise Management Plans for Potatoes, Tomatoes and Nurseries

The final copies for these respective EMP's are available on the TPP Portal. They are subject to continuous improvement as further evidence becomes available as a result of research and international experience.

Appendix F: National TPP Coordinators Project Steering Committee

Simon Moltoni, WA Potatoes

Tony Cukrov, Supafresh

Michael Hicks, Snack Brands

Dr Nigel Crump, AuSPICA

Dr Andrew Bishop, CPHM Tasmania (replaced Geoff Raven during the project)

Dr Penny Measham, Hort Innovation

Callum Fletcher, AUSVEG

Zarmeen Hassan, AUSVEG (replaced Dr Jessica Lye during the project)

The terms of Reference for the steering Committee were:

Terms of Reference
National TPP Coordination Steering Committee

Background

In February 2017, tomato potato psyllid (TPP; *Bactericera cockerelli*) was found in mainland Australia for the first time (in Perth's metropolitan region). In April 2017, it was agreed by industry and government that TPP is no longer able to be feasibly eradicated and that a Transition to Management (T2M) program should be implemented in Western Australia.

A vital part of the successful transition into this management phase will be the coordinated and strategically focus response efforts to limit the impact of this pest. In order to facilitate this, it is important that there is a single point of contact between the various affected industries such as AUSVEG, the Australian Processing Tomato Research Council (APTRC) and Nursery and Garden Industry Australia (NGIA), government and service providers, to coordinate efforts. The APTRC and NGIA are not part of this particular project however they are industry stakeholders engaged in the Transition to Management (T2M).

As a result, APTRC and NGIA will remain engaged in the National TPP management project through ongoing communication and engagement during the T2M program and following the completion of T2M project.

A National TPP Coordinator commenced on 16 October 2017.

Membership

Nigel Crump (VicSPA, now AuSPICA), Callum Fletcher (AUSVEG), Geoff Raven (PIRSA), Michael Hicks (Snack Brands Australia), Simon Moltoni (WA Potatoes), and Troy Cukrov (SupaFresh), Alan Nankivell (AUSVEG).

Committee member's role

Steering committee members:

1. Will provide professional feedback, review and technical opinion.
2. Identify organisations and individuals integral to the project.

Governance Rules

The Steering Committee will recommend project direction and processes. AUSVEG management has the responsibility to deliver on contractual outcomes. Where there is a divergence of outcomes, AUSVEG will highlight the out-of-scope nature of the divergence to the steering committee.

Otherwise, all opportunities to deliver to all industry stakeholders sound outcomes will be encouraged in an environment of respect and openness.

Where consensus is not reached by the committee on a particular direction, then the split decision will be recorded.

Steering Committee members are required to declare all conflicts of interest where they may have a material or pecuniary interest in the direction or recommendations from the project.

Terms of Reference

1. Review proposed R&D priorities as they arise.
2. Identify further R&D priorities, potential researchers and funding opportunities.
3. Review and provide advice on the draft National Action Plan.
4. Review ongoing updates for the National Action Plan
5. Provide independent advice to the Coordinator regarding industry and governmental stakeholder, expectations and plans.
6. Review the coordinator’s annual work plan and provide feedback as required.

Appendix G: Presentations at Stakeholder workshops and Conferences

Date	Location	Topic	Outcome
3 October	Ulverstone, TAS	Presentation: Project Lead raised project awareness at a VegNET workshop. 16 participants attended.	Identified ways that VegNET and the NTTP could collaborate in getting the message out to growers through the VegNET project.
30 October - 3 November	Visit to Perth and surrounds	Various meetings, including: • Meeting with DPIRD. • Meeting with Matthew Lunn NGIA WA. • Meeting with VegetablesWA (John Shannon and team). • Meeting with Simon Moltoni from WA Potatoes. • Meeting with Troy Cukrov (Steering Committee member). • Meeting with Carole Fudge, GM Benara Nurseries. • Several meetings with Gavin Foord regarding the Enterprise Management Plans. These were meetings focused on the impact of TPP on the WA potato, vegetable and nursery sectors and – as stakeholders – what they envisage what was the best way forward for the sustainability of their respective industries.	Identified the major concerns for vegetable growers specifically regarding the need for information on infield management of TPP. Met with key stakeholders in WA to discuss impact of TPP and what actions they considered important to be taken. In particular, the reinstatement of trade with the eastern states
24 November	T2M SC Perth WA	First steering Committee meeting of T2M. Met with Gavin Foord regarding the development of Enterprise Management Plans their content and target.	Report on the extent of the infestation of TPP as a result of trapping in autumn and spring 2017. Reports on the actions were presented especially the efficacy of chemical sprays and the impact of beneficial insects.
15-16 February	Meeting	T2M Steering Committee. Met with Gavin Foord regarding Enterprise Management Plans progress. Met with Steve Blyth regarding nurseries integrating TPP management into BioSecure HACCP. Met with Simon Moltoni regarding T2M progress in WA. Met with John Shannon regarding VegetableWA's perspective on T2M.	The Steering Committee reported on the progress of its research projects and communications strategy. The finding from the steering committee were reported in the TPP column in *Potatoes Australia* and *Vegetables Australia.*
19 April	Hagley Tas.	Presentation on TPP and the Management Plan at the Tasmanian Agricultural Expo. 90 growers attended. Met with several growers and industry representatives' post- presentation to discuss their respective impact of TPP and management strategies.	Information provided to those present on the importance of business continuity and the economic impact of quarantine can have on growers and industry operations.