Hort Innovation

Final Report

An IPM extension program for the onion and potato industries

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Delivery partner:

IPM Technologies

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MT16009

Project:

An IPM extension program for the onion and potato industries (MT16009)

Disclaimer:

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Content

Summary

This project aimed to demonstrate Integrated Pest Management (IPM) in potato and onion crops in all major production regions of Australia. Presentations on IPM, what it involved and why it is of value in both potato and onion crops were made throughout the project. Those interested in seeing IPM in action were then invited to take part in field demonstrations to see how to implement IPM on-farm. A very important aspect of this project was that participants in field demonstrations did not only include or target growers, but also advisors. These advisors included field officers, seed certification officers, independent advisors and also reseller agronomists.

IPM does not necessarily mean that no insecticides are used. Instead, insecticides are selected carefully based on the impact on relevant beneficial species and not just the efficacy on pests. The change from using a pesticide-based approach to an IPM approach involves a significant shift in attitude and is often perceived as being risky. This project allowed growers and advisors to see that IPM works, is practical, cost-effective and sustainable and so the risk-factor was reduced.

Demonstrations of IPM in both potato and onion crops were held in major production areas across Australia. Each region in Australia had its own set of pest species of concern and so IPM strategies were developed in conjunction with local growers and advisors. There were usually concerns about pests such as potato moth and aphids, but then each region had varying concerns with other pests including wireworms, whitefringed weevil and African black beetle. The project also dealt with the possible arrival of tomato-potato psyllid to eastern states. The demonstrations of IPM were highly successful and over the last 5 years, this project has had a significant impact on approaches to pest management in both potato and onion production. I estimate that IPM has now become the standard means of controlling pests in potato crops, as measured by volume of production, type of production (seed or processing or ware) or number of growers. The involvement of advisors has been key to this change, and even where growers might not call their crop protection methods IPM, the advice they receive uses an IPM approach.

This project worked with the growers and advisors who were interested in changing to IPM, but now the Australian potato and onion industries have a template for others to adopt when required in the future. The template is capable of adapting to local requirements and changes in pesticide availability.

Keywords

Potatoes; onions; Integrated Pest Management; IPM; adoption; demonstration.

Introduction

Research into the control of pests of potatoes with minimal use of insecticides has been carried out in Australia, including a number of projects funded by Horticulture Australia Ltd[1]. A summary of the research work conducted can be found in Horne and Page 2008[2]. However, the basis of it is that an IPM strategy has been developed in Australia over 20 years ago that will deal with all of the invertebrate pests that an Australian potato farmer has to face. IPM means that a compatible set of biological, cultural and selective chemical methods are used to control pests. Importantly, chemical methods are not excluded but are used only as support tools. The IPM strategy has been proven to be effective in commercial crops for over two decades, so no further research is required in the current project.

IPM Technologies has also conducted trials with onion growers in Victoria and Tasmania over many years to reduce or eliminate most insecticide applications. Despite the existence of very effective methods of controlling pests of potatoes and onions that do not rely solely on insecticides, these methods have either not been used, not available or have been forgotten. With the lack of contact between growers and experts there has been a slide back to a reliance on insecticides, and also a loss in understanding of how inappropriate use of insecticides can actually induce pest problems.

Recently, IPM Technologies successfully completed a project (PT09004) to develop methods of controlling tomato potato psyllid (TPP) that were compatible with IPM. As a result of this project, if this pest arrives in Australia, potato growers will still be able to use IPM to control all pests, including tomato potato psyllid. This current project is a means of informing the potato industry of an IPM approach dealing with all pests, including TPP.

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Methodology

This project had two main components: (1) providing theory training about IPM and (2) conducting demonstrations of IPM in commercial crops and providing backup support as required.

Extension and Training events

Training in IPM was given in all regions and at all demonstration sites (as listed below). Discussions always focused on decision-making and in particular the selection and use of insecticides, and whether any was required at all. The use of cultural controls and recognition of biological control agents was always important in field demonstrations. In areas with a low starting point regarding IPM knowledge and practice, the changes that IPM Technologies supported growers and advisors to make were very significant. However, in other regions where they had already made the shift away from simply using an insecticide-based approach in potatoes, our training and support helped growers and advisors to refine their IPM programs and provided a much-needed update on insecticide compatibility. In all cases the project team were able to discuss how growers would be able to deal with TPP, if and when it arrives, without resorting to a heavy insecticide program. Unlimited phone and email support was also provided to participating farmers and agronomists throughout the project.

Workshops and Field visits by year and production regions.

[1] Relevant Horticulture Australia Ltd projects include Control of Potato Psyllid with an IPM Strategy (PT09004), Pesticide Effects on Beneficial Insects and Mites in Vegetables (VG06087), The monitoring of potato crops for insect movement on a district scale (PT02045), and National IPM Program for the Potato Industry (PT656). Paul Horne was project leader or collaborator in all of these projects.

[2] Horne, P & Page, J (2008) "Integrated Pest Management dealing with potato tuber moth and all other pests in Australian potato crops." In *Integrated Pest Management for the Potato Tuber Moth, Phthorimaea operculella Zeller – a Potato Pest of Global Importance. Tropical Agriculture 20, Advances in Crop Research 10*, edited by J. Kroschel and L. Lacey, pp. 111-117. Margraf Publishers, Weikersheim, Germany: Margraf Publishers.

Year	Target region	Purpose
2017	**Western Australia**	This project commenced in December 2016 after Tomato Potato Psyllid (TPP) was detected in Western Australia. The project was then varied to include TPP management.

Year	Location of activities	Actions
2017	Australia-wide	**TPP:** This project commenced in December 2016 and Tomato Potato Psyllid (TPP) was detected in Western Australia in February 2017. The project was then varied to include TPP management. - Production and distribution (via Potatoes Australia and Vegetables Australia magazines) of an identification guide to TPP.
2017	Melbourne and Launceston	Delivery of two additional training sessions for industry advisors specifically dealing with TPP.
2017	New Zealand	Visit to New Zealand to discuss TPP control with independent advisors and researchers at Plant & Food Research
2017	South Australia: Northern Adelaide Plains, Murraylands/Mallee/Riverland, Limestone Coast/Portland (SA and VIC) and Kangaroo Island. Victoria: Portland and Ballarat NSW: Crookwell, Tablelands (Cooma)	Field demonstrations and practical training delivered in all major potato and onion production regions in South Australia, plus Portland and Ballarat districts of Victoria Kangaroo Island – all seed potato producers here have adopted IPM. Crookwell Theory workshop; Cooma-field training event held as part of the Snack Brands Australia conference in Cooma.
2018	Queensland: Gatton WA: Myalup and Manjimup Tasmania: North coast	Potato IPM workshop and field training; Onion IPM workshop Potato and Onion workshops (June); Field demonstrations September – October Workshops and field training; Potatoes and Onions
2019	WA – Myalup, Manjimup and	Field Demonstrations

	Augusta SA – Parilla; Virginia (CRT); Nuriootpa; Langhorne Creek Vic – Gippsland (Boneo, Warragul, Thorpdale, Mirboo North and KooWeeRup swamp) and Ballarat Tas – Locations near Launceston, Devonport and Wynyard	
2020	SA: Langhorne Creek, Gawler, Loxton Tasmania: North Coast	Farm visits and Zoom training – Growers and advisors
2021	QLD: Gatton Tasmania: Devonport SA: Langhorne Ck and Murray Bridge Vic: Ballarat SA and Vic Australia-wide	Workshop for Onion advisors Workshop for Onion growers and advisors Field Training and Zoom workshops Zoom Workshop for growers and advisor Zoom training workshop for AUSPICA officers Webinar for Potato Link

WA: Workshops in WA were poorly attended by growers but well attended by advisors and agreed field sites in both potato and onion crops were arranged. Subsequent visits and workshops (not part of the project) were also used to arrange further IPM trial sites in both potato and onion crops in Myalup and Manjimup.

There was an opportunity to discuss the project, run workshops and organise field demonstration sites when IPM Technologies was running IPM workshops sponsored by the chemical company FMC. These were conducted in WA, QLD and Tasmania.

Industry events.

In addition to activities organized directly as part of this project we also contributed to industry events such as conferences, field days, webinars etc., when invited to do so.

December 2017 – McCain Field Day, Ballarat

March 2018 **-** Snack Brands Australia conference and field day in Cooma, (NSW)

August 2018 - AUSPICA Potato Industry Conference: The Art of Growing Potatoes, Arts Centre, Melbourne

August 2018 – Roberts Potato Conference: Smithton, Tasmania

June 2019 – Hort Connections, Potato Workshop (Melbourne)

October 2019 – AusPica Meetings, Warragul and Ballarat

April 2021 - Webinar, IPM in Australian Potatoes (World Potato Congress)

July 2021 - RMCG Potato Pest and Disease Conference

August 2021 - Potato Link Webinar on IPM in potatoes

Travel restrictions caused by Covid19 meant that changes were required in how training was delivered and also meant changes in where field demonstrations could take place. Some training sessions were run via Zoom and Webinars instead of in-person and field visits were made when interstate travel allowed.

Outputs

Articles in grower literature as well as information guides have been produced as follows:

A guide to identification of tomato-potato psyllid (TPP) was produced and delivered to industry.

Several articles were published in Potato Industry magazines during the reporting period that relate to this project:

1 *Pat Virgara: A Beneficial Outcome*, In "Grower Success Stories" January 2019

https://ausveg.com.au/grower-profiles/pat-virgara/

2 *Project Reflection: Two decades of Integrated Pest Management,* in Potatoes Australia, December/ January 2018/2019. Pages 18 – 19,

3 *Wayne Tymensen: A trailblazer in potato pest management*, in Potatoes Australia, February/ March 2019. Pages 18 – 19.

Pat Virgara is a potato grower in Virginia, SA and the article relates the successful implementation of IPM with the help of his CRT advisor, Paul Pezziniti through this project.

The second article describes the current project and compares it to when Paul Horne first started helping potato growers to implement IPM over 20 years ago.

Wayne Tymensen is a Victorian potato grower (seed and crisping) who has used IPM successfully for over 20 years with help from Paul Horne. The article describes his experiences of using IPM compared to previously relying on insecticides.

Several articles about the project and its successful implementation in onions were prepared for industry magazines.

1. *"IPM now the way for Dolling Produce",* in Onions Australia magazine, Volume 36, p.10. This describes the changes made over a three-year period by Dolling produce in the way they manage pests in onions as a result of this project.

   http://www.onionsaustralia.org.au/wp-content/uploads/2019/10/OA_Magazine_Vol36.pdf

2. *"Demonstrations of IPM in Onions*", in the Onion Project 2019 Annual Magazine, pages 14-15.

   https://www.horticulture.com.au/globalassets/hort-innovation/resource-assets/vn18003-onion-magazine_december-2019.pdf

3. *"Integrated pest management project provides insights to growers".* Onions Australia Volume 38, 2021, pages 23-24

   https://www.onionsaustralia.org.au/wp-content/uploads/2021/11/OA-Mag_Vol38.pdf

- During the course of this project, we have often been asked for a photo-guide to pest and beneficial insects. IPM Technologies has produced and printed such a guide, and this has been distributed to potato growers with Potatoes Australia magazine in winter, 2021.
- An information sheet on potato tuber moth biology and control was prepared for Potato Link, December 2021.
- A summary article on IPM in Australian potato production has been prepared for Potato Link, December 2021.

Outcomes

This project increased both awareness and adoption of IPM in potato and onion crops around Australia. In addition to assisting farmers directly (both large and small businesses), the training of field officers from major processors (McCain, Snackbrands and Simplot), major reseller agronomy companies (such as IK Caldwell, Elders, Nutrien (Landmark), EE Muir and Sons, Serve-Ag, Roberts, CRT's, Farmer Johns; Western Ag) and independent advisors means that IPM will become the mainstream approach to pest control for many years to come.

Workshops, Zoom meetings, webinars and articles all helped to increase awareness of IPM and that it is a practical and efficient means of controlling pests that can be used immediately and also provide sustainable control of pests into the future. This information was available to both growers and advisors, but an important aspect in achieving successful practice change (to using IPM) was the demonstrations of IPM in commercial crops. This allowed advisors to see the value in using an IPM approach while still learning about it and not having to give advice with which they were not comfortable. After being involved in the demonstrations and seeing the decision-making process it provided advisors with confidence in IPM and they were then able to advise many more farmers in this method of controlling pests.

The involvement of advisors (resellers, independent advisors and field officers) was an important component of this project and allowed extension of IPM advice to reach many more farmers than just those involved directly with field demonstrations. It also has provided the industry with a framework for controlling pests into the future and so IPM will continue to be the mainstay of pest management even if new pesticides become available. There is now an understanding by growers and advisors that good advice does not mean just applying the cheapest pesticide product.

Changing to using IPM does not mean eliminating the use of insecticides but in many cases for Australian potato and onion growers, insecticide use can be reduced significantly. Draft strategies are provided in this report, and the comments from industry indicate that where IPM has been adopted there has been a significant move away from insecticide use.

Monitoring and evaluation

The aim of this project was to make Australian potato and onion growers and advisors aware of IPM and to demonstrate IPM in commercial crops. These aims have been achieved, as evidenced by the attendance at workshops and involvement in field demonstrations. However, another aim was to encourage implementation of IPM in commercial crops. This aim has also been achieved with selected examples being written up in grower literature (eg, Onions Australia and Potatoes Australia).

In addition to reducing pesticide use in the short-term, this project provides a framework for sustainable control of pests of potatoes and onions in Australia for many years to come. The involvement of the advisors, including reseller agronomists and the chemical industry has made on-going implementation of IPM secure.

One way to assess the success of this project is to read comments provided by growers and advisors who took part in the project. The quotes below are all from people who took part and who represent different target audiences by location, industry sector and type of advisor (IDO, Field Officer, Certification Officer, Reseller agronomist).

All feedback has been highly positive and comments from growers and advisors have been provided in previous Milestone reports. A couple of examples show typical feedback is provided here that is representative of the different sectors and locations of the potato and onion industries:

Seed Potatoes

Nigel Crump, CEO AuSPICA (formerly Vic SPA)

The approach to insect management, in particular potato moth and aphids, using integrated pest management principles, whilst this is not a mandatory condition of AuSPICA certification, it is fully supported by seed potato certification. Managing insect pests using crop scouting to determine thresholds of insect pests is sound practice. Furthermore, the in-crop, maintenance of beneficial insect populations that predate known potato pests assists in producing crops with minimal economic pest damage.

Processing

Anne Ramsay

Executive Officer, Potato Processors Association of Australia Inc

"Paul and his team have delivered one of the most effective extension programs funded by our processing levies. Processing growers make up 68% of the grower market and at the commencement of the project five years ago, we estimate that approximately 35% of our growers were using an integrated approach to pest management. Today we estimate that has grown significantly with an estimated 70-80% of growers integrating elements of IPM into their pest management programs."

"IPM has been, and will continue to be, a game changer for companies in reaching sustainability targets and achieving cost effective productivity growth".

"The IPM Technologies team led an extension approach that worked. They offered a team of highly skilled and respected personnel, their extension activities offered a mixture of hands on and theoretical training, and they provided ongoing support through the adoption phase that led to increased uptake".

Other:

FMC workshops: A series of workshops run by FMC took place at locations around Australia, and participants included both potato and Onion growers in some of the meetings. Feedback from participants in the workshops was extremely positive. Formal feedback was not gathered from all meetings, but an assessment based on comments from participants and later from FMC was conducted and this was also 100% positive.

Paul Horne and Jessica Page are contributing two chapters in the second edition of the internationally produced book "Insect Pests of Potatoes" published by Wiley. One chapter is on "Integrated Pest Management in Potato

Crops", and the other is about managing pests of potatoes in "Australia and New Zealand". While these are not direct outputs of this current project, they indicate that our work on IPM in potatoes is of worldwide interest.

Similarly, Paul Horne has delivered a webinar on IPM as one of a sequence of webinars being organized by the World Potato Congress. These webinars are held between the actual Congress events and have a worldwide audience. Once again, this suggests that there is interest from outside Australia in hearing about what we are doing with IPM here.

Recommendations

Each region has its own particular set of pests to deal with. While there is a general IPM template which can be modified as appropriate, specific and local projects are also needed to tailor pest management projects for local requirements.

For example, in the Victorian region near Thorpdale and Mirboo North, potato wireworm (*Hapatesus hirtus*) can be a serious problem. This is especially so for seed producers who may lease paddocks and so have no paddock history to assess risk of damage. This pest needs to be dealt with before planting and so soil applied insecticides are used. So this pest is important in this region but is not a problem at all in most areas where potatoes are grown. Similarly, African black beetle is a problem for some growers in Gippsland but not in most other areas. So these pests need controlling and are important to some growers but are not significant on a national level.

Refereed scientific publications

None to report

Intellectual property, commercialisation and confidentiality

No project IP, project outputs, commercialisation or confidentiality issues to report

Acknowledgements

This project was only possible with the support and co-operation of many people throughout the potato and onion industries, who helped advertise or organize meetings, invited IPM Technologies to speak at meetings or invited us to prepare articles. This includes people from grower organisations, industry development officers and also many from reseller agronomy positions and chemical companies. We thank all those who were involved and contributed to the success of this project.

Appendices

1. Sample IPM Strategy for Potatoes
2. Sample IPM Strategy for Onions

Appendix 1: An Example of an IPM strategy for potatoes, as developed by IPM Technologies and demonstrated in commercial crops to collaborating growers and advisors

Pests	Beneficials[3]	Cultural controls	Compatible chemicals/sprays	Monitoring (weekly)
Potato tuber moth	➢ Damsel bugs ➢ Parasitic wasps	➢ Soil management ➢ Overhead irrigation to seal ground cracks ➢ Avoid high-setting varieties ➢ Time of harvest ➢ Cold storage post-harvest	➢ **Belt or Coragen** to target heavy infestations of larvae in leaf-mines ➢ **Synthetic pyrethroid (e.g. Ambush)** applied at spray off or after senescence if necessary	➢ Use pheromone traps to indicate level of adult activity ➢ Check along edge of crop for larvae in leaf mines ➢ Check exposed tubers for larvae and their feeding damage ➢ Direct search for adults flying out of disturbed foliage ➢ Pull apart large larvae to check for parasitic wasp maggots inside
Aphids (and virus)	➢ Ladybirds ➢ Lacewings ➢ Hoverflies ➢ Parasitic wasps	➢ Use certified seed ➢ Control self-sown potatoes ➢ Control weeds[4] ➢ Isolation (for seed crops) ➢ Border strip plantings to attract beneficials	➢ **Confidor** in-furrow ➢ **Chess** ➢ **Mainman** ➢ **Movento** ➢ **Versys**	➢ Look for adults and nymphs on undersides of leaves ➢ Check lower leaves for green peach aphid ➢ Check for signs of predators (e.g. lacewing/hoverfly eggs) and signs of parasitism (aphid mummies)
Thrips (and tomato spotted wilt virus)	➢ Predatory thrips ➢ Predatory bugs ➢ Predatory mites ➢ Predatory beetles	➢ Use certified seed ➢ Control self-sown potatoes ➢ Control flowering weeds, especially TSMV hosts (e.g. fat hen)[2] ➢ Isolation (for seed crops)	➢ **SuccessNeo** ➢ **Movento**	➢ Check for adults and juveniles on leaves and in flowers ➢ Tap flower heads over cupped hand, container or sticky card ➢ Look out for predatory thrips and predatory bugs (pirate bugs)
Loopers Heliothis Cutworm	➢ Predatory bugs ➢ Lacewings ➢ Parasitic wasps	➢ For cutworm: weed control/grazing management prior to planting	➢ **Dipel** ➢ **Vivus** (only for Heliothis) ➢ **Belt or Coragen**	➢ Check leaves for eggs, larvae, frass and chewing damage ➢ Check for signs of parasitism (e.g. eggs turning black; wasp or fly maggots inside or attached to larvae)
Rutherglen bug			➢ For adults: use **soap spray** to move them onto other vegetation ➢ For nymphs: use border spray if necessary – registered products (**Carbaryl** and **Methidathion**) are highly disruptive to beneficials	➢ Direct search in crop for adults ➢ Check for damage to growing tips if there is a high population of adults ➢ Check weeds and edge plants for nymphs
Redlegged earth mite	➢ Resident predatory mites and beetles	➢ Control broadleaf weed hosts (e.g. capeweed) in the season prior to planting	➢ For susceptible autumn/winter crops: spray following Time-Right strategy during pasture phase prior to planting ➢ **Lorsban** border spray if they are moving into the crop from edges	➢ Monitor capeweed and clover during pasture phase in season prior to planting ➢ Check potato plants (and nearby broadleaf weeds) at emergence
Vegetable weevil		➢ Control broadleaf weed hosts (e.g. marshmallow) in the season prior to planting	➢ For susceptible autumn/winter crops: apply appropriate chemical treatment during pasture phase in season prior to planting	➢ Check broadleaf weed hosts during pasture phase in season prior to planting ➢ Check leaves for larvae and chewing damage in autumn/winter
Slugs		➢ Grazing management during pasture phase prior to planting	➢ Metaldehyde and iron-chelate based baits	➢ Direct search or use tiles to monitor during pasture phase in season prior to planting
Whitefringed weevil		➢ Rotation (avoid planting into ground previously sown to legumes)	➢ **Regent/Albatross** rotary hoed in prior to planting	➢ Spade check (for larvae) prior to planting
Cockchafers		➢ Rotation/grazing management	➢ **Lorsban** rotary hoed in prior to planting	➢ Spade check (for larvae) prior to planting

[3] All beneficials listed are expected to occur naturally, if disruptive pesticides are not applied.

[4] Include an insecticide in the tank when spraying off weeds.

		➢ Time of planting/harvest		
		➢	➢	➢

Appendix 2: An example of an IPM strategy for Onions

An IPM strategy for onions, as developed with growers and advisors					
Pest	**Region**	**Beneficial**	**Cultural**	**Pesticide (ideal)**	**Monitoring (weekly)**
Cutworm	Tasmania, Victoria	Parasitoid wasps	Rotation	Lorsban as early as possible	Look for eggs and first instar caterpillars
Thrips	All	Predatory thrips, mites, beetles and bugs	Apply a layer of mulch to provide habitat for predators	Benevia SuccessNeo Movento	Inspect growing tips for adult and juvenile thrips. Search in organic matter for predators.