Delivery partner resource

Horticulture Impact Assessment Program

PW17001 – Integrated Pest Management of Nematodes in Sweetpotatoes – Impact Assessment

June 2025

Hort Innovation

Hort Innovation Disclaimer:

ACIL Allen Reliance and disclaimer

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Executive Summary

PW17001 – Integrated Pest Management of Nematodes in Sweetpotatoes aimed to improve productivity and sustainability in the Australian sweetpotato industry by developing effective, integrated approaches to manage plant-parasitic nematodes. Delivered from 2018–19 to 2023–24 through a collaboration between Queensland Department of Agriculture and Fisheries (QDAF) and Hort Innovation, the six-year, $3.5 million investment supported a combination of chemical efficacy trials, long-term field trials, diagnostics, and industry engagement.

The project demonstrated measurable increases in marketable yield through the use of nematicides such as Metham and Vydate, with economic gains validated by 2 replicated efficacy trials. Additional long-term trials evaluating integrated management practices – including crop rotations, organic amendments, and resistant cover crops – delivered sustained yield improvements under both intensive and extensive farming systems. These outcomes support higher farmgate returns while reducing reliance on chemical inputs.

Social and environmental benefits, though not quantified, were significant. Around 80% of sweetpotato growers participated in masterclasses, workshops, and trials, strengthening industry knowledge and adoption of sustainable practices. The project also delivered Australia’s first nematode distribution survey, enhancing biosecurity preparedness and diagnostic capability, and identified promising non-chemical management options like sun hemp and pigeon pea as rotational cover crops.

The total real cost of the investment (2025 dollars) was $3.9 million, of which $2.9 million was attributable to Hort Innovation. Economic analysis, using a 5% discount rate, showed a Net Present Value (NPV) of $3.9 million and a Benefit-Cost Ratio (BCR) of 1.99 over 30 years, indicating strong return on investment. Hort Innovation’s share of returns was proportionate, with an NPV of $2.9 million and a BCR of 1.99. Sensitivity testing showed results were robust but sensitive to adoption rates and confidence in yield gains. Under conservative assumptions, the NPV remained positive, while high adoption and performance scenarios increased returns significantly.

While some environmental impacts remain unverified due to trial limitations, PW17001 provided modest economic benefits, advanced Australia’s nematode management capabilities, and positioned the industry for long-term resilience and profitability. The project supports the goals of the Sweetpotato Strategic Investment Plan by promoting sustainable production and improving farm-level outcomes through innovation and collaboration.

Context, objective, and details of investment

The sweetpotato industry is a vital sector in Australia’s horticulture industry, valued for its contribution to the domestic market and its potential for export. In 2023-24, the estimated farmgate value of the sweetpotato industry was $70 million from nearly 90,000 tonnes.[1] There are 3 varieties of sweetpotatoes grown in Australia, gold is the dominant variety, making up 90% of domestic produce in 2019-20, followed by a red variety (7%) and purple variety (3%).[2] Sweetpotatoes can be grown and harvested throughout the year allowing for continual market supply. Around 88% of production occurs around the Bundaberg region in

[1] Hort Innovation. Australian Horticulture Statistics Handbook. 2023/24. https://www.horticulture.com.au/globalassets/hort-innovation/australian-horticulture-statistics-handbook/hort-innovation-ahsh-2023-24-vegetables-r.pdf

[2] Ibid.

Queensland.[3] Other regions of production are New South Wales which accounts for 11% and Western Australia that only makes up around 1%.[4] About 89% of sweetpotatoes market are fresh domestic produce, with processing being 9% and exports 2% (valued at around $2 million in 2023-24).[5]

There have been consistent efforts in sustainable farming practices, supply chain efficiencies, and the development of pest resistant varieties. This project was the first Australian comprehensive survey of nematodes in sweetpotato growing soil identifying and filling a research gap. Plant-parasitic nematodes inhabit a diverse range of soils. This allows them to populate the light sandy ferrosol soil sweetpotatoes grow best in alongside the heavy denser soil types. Plant-parasitic nematodes damage and inhibit sweetpotato growth which generates an estimated $20 million in losses annually. PW17001 comprehensively sampled different sweetpotato producing soils to identify the nematode species associated with sweetpotato yield loss and damage.

The 2 main species covered by this project were Root-knot nematodes (RKN) and Reniform nematodes, although other species of nematodes were also included in management strategising. RKN are widely distributed in the dominant sweetpotato growing regions of Queensland and NSW. RKN and Reniform enter and feed on the root systems of sweetpotato plants and interfere with proper root function causing stunting and skin damage/discolouration and low yields. At the time of conception and project commencement there was only one registered chemical and minor use permit for RKN control, making it imperative to find alternative control methods. This project intended to research and develop trials for 6 key focus areas related to the pest management of nematodes in sweetpotatoes. The focus areas identified were:

1. extension of current knowledge on soil health and nematode management to update industry on available nematode knowledge, build capacity within the project team, understand industry practices and collate historical data
2. initial industry wide grower surveys to identify nematode species present in sweetpotato growing soils with more intensive surveys and follow up sampling to assess impact of variable management on nematodes and sweetpotato production
3. control of weeds and sweetpotato volunteers to identify nematode weed hosts and control options
4. cover crops and sweetpotato variety nematode resistance screening for susceptibility to RKN and reniform nematodes and the impact of these nematodes on skin quality of 2 sweetpotato varieties
5. nematicides and biofumigants - 2 field trials to investigate the efficacy of currently available nematicides and biofumigant residues against RKN in sweetpotato systems.
6. 2 long-term field trials to assess potential integrated nematode management options (including soil amendments, cover crops, tillage, and bed formations) for their applicability to and impact on, sweetpotato production systems.

[3] Hort Innovation. (2021). *Sweetpotato strategic investment plan 2022–2026*. https://www.horticulture.com.au/globalassets/hort-innovation/levy-fund-financial-and-management-documents/sip-2022-2026-pdfs/hort-innovation-sip-2022-26-sweetpotato.pdf

[4] Ibid.

[5] Ibid.

Alignment with Strategic Investment Plan

Project PW17001 directly supported the Sweetpotato Strategic Investment Plan (SIP) 2017–2021[6] by generating new knowledge and promoting the adoption of integrated nematode and soil health management practices to improve yield and on-farm sustainability (Outcome 2). It strengthened industry capability through grower-focused extension activities including masterclasses, field walks, and project updates (Outcome 4), and supported innovation in farming systems through research on cover crops, soil amendments, and reduced tillage. Overall, the project aligned with SIP priorities to improve productivity, support industry efficiency, and enhance the sweetpotato industry's long-term resilience.

Table 1 Project details of PW17001

Project code	PW17001
Title	Integrated Pest Management of Nematodes in sweetpotatoes
Research organisation(s)	Queensland Department of Agriculture and Fisheries (QDAF)
Project leader	Sandra Dennien
Funding period	2018-2023
Objective	Develop and assess integrated nematode management strategies for the Australian sweetpotato industry to reduce yield losses caused by plant parasitic nematodes – particularly root-know and reniform nematodes – by improving soil health, identifying resistant cultivars and cover crops, evaluating non-chemical control methods, and enhancing industry knowledge and practices.

Source: Hort Innovation

Related investments

The project was linked with one investment, as follows:

— PW21002 causes and management strategies for skin loss in sweetpotatoes – This investment supports the development of a best-practice manual for Australian sweetpotato growers to reduce skin loss and improve crop quality, profitability, and sustainability. The research team is collaborating with growers to gather data on farming and environmental factors affecting skin loss, with a focus on nutrient management. This work builds on findings from a previous levy-funded project (PW18001) that highlighted the need for further study into nutrient and environmental influences on skin damage.

PW21002 builds on foundational insights from PW17001, which enhanced understanding of soil health, nutrient cycling, and nematode management—factors now being investigated for their role in skin loss disorders. The long-term farming systems trials and organic amendment research under PW17001 highlighted soil and environmental variables that may influence post-harvest quality, directly informing PW21002's focus on linking field and post-harvest practices to skin condition.

Project governance

The Integrated Pest Management of Nematodes in Sweetpotatoes (PW17001) project was delivered through a collaborative and transparent governance structure that ensured alignment with industry priorities and

[6] Hort Innovation. (2017). *Sweetpotato strategic investment plan 2017–2021.* https://www.horticulture.com.au/globalassets/hort-innovation/levy-fund-financial-and-management-documents/sip-pdfs-new/hort-innovation-sipsweetpotato-2017-21.pdf

fostered strong stakeholder engagement.

A **Project Reference Group (PRG)** was established at the outset, comprising project team members, sweetpotato growers, and representatives from the Australian Sweetpotato Growers (ASPG). This group provided strategic direction, oversight, and feedback throughout the project's duration. The PRG met biannually, enabling regular updates on progress, timely resolution of challenges, and shared decision-making to adaptively manage the project.

In addition to the core project team, formal **collaborator agreements** were established with key partners including Biological Crop Protection, Central Queensland University, and ASPG. These partnerships expanded the project's technical capability, supported delivery of outputs across multiple regions, and strengthened industry connections.

This governance framework ensured that the project remained highly responsive to the needs of growers, effectively integrated research and extension activities, and maintained a high level of accountability to funding partners and stakeholders.

Impact pathway

A clear pathway from input to impacts can be identified for the investment. Overall, the investment produced 2 impactful benefits for both levy payers and the broader communities. Table 2 shows the logical pathway to impact of the investment.

Table 2 Impact pathway of PW17001

Pathway	Description
Inputs and Activities	**Project setup and governance** • Funded by Hort Innovation using industry levies • Project Reference Group (PRG) formed with growers, researchers, and Australian Sweetpotato Growers (ASPG) to guide and review progress • Milestone-based reporting with continuous feedback and review **Research team, collaboration and capacity building** • Multidisciplinary team drawn from DAF, Central Queensland University (CQU), Biological Crop Protection, and other partners • Around 5 nematology and soil health experts engaged nationally and internationally • 4 nematology workshops for research staff • Staff trained via 4 nematology workshops and hands-on diagnostic skills • Built on past research (MT09067, VG09052, VG13004) to expand knowledge **Survey and baseline data collection** • National nematode survey launched; samples analysed at SARDI • Grower-submitted samples enhanced diagnostic coverage • Over 40 on-farm surveys assessed current practices in nematode and soil health management • Integrated historical data from VG09052 and VG13004 for trend analysis **Soil health and environmental monitoring** • Soil surveys across farms and reference environments to assess nutrients, pH, organic carbon and biology • Ongoing monitoring linked soil health indicators with pest suppression **Glasshouse and pot trials**

<table>
<tr><th>Pathway</th><th>Description</th></tr>
<tr><td></td><td>

Screened 103 cover crops and 24 sweetpotato cultivars for nematode resistance
Assessed biofumigants and nematode related damage to roots and yield

Long term field trials at Bundaberg Research Facility, 2018-2023

Nematode population, soil health, yield and economic outcomes monitored across 2 integrated trials:

Intensive trial focused on integrated nematode management using crop rotations, resistant cultivars, organic amendments
Extensive trial explored sustainable practices like minimum tillage, alternate crops, and soil building strategies

Nematicide efficacy trials

2 nematicide efficacy field trials were conducted – one on sandy loam soil and another on red clay soil
Evaluated nematode suppression and yield impacts under real world conditions

Weed and volunteer sweetpotato management

Identified RKN-hosting weeds (via Nemaplex and field identification); herbicide studies assessed herbicide strategies and plant-back intervals

Extension of existing knowledge and industry engagement

Built upon and referenced findings from MT09067 and VG09052 to tailor nematode management approaches to sweetpotato production
Historical sampling protocols and soil health frameworks adapted for current context
Designed and delivered 4 Masterclasses and 3 training workshops to extend knowledge on integrated nematode management and soil health and encourage grower-led innovation and adaptive management. Developed practical training resources for growers
Coordinated field walks and grower updates aligned with major project milestones

</td></tr>
<tr><td>Outputs</td><td>
Project planning, governance and reporting

A program logic, monitoring and evaluation plan, stakeholder engagement plan, and project risk register with 10 milestone reports submitted and approved over the life of the project. 10 PRG meetings held over the life of the project

Extension, communication, and industry engagement

4 sweetpotato soil health and nematode management masterclasses delivered in key growing areas
A 92-page masterclass handbook and 11 nematode and soil health factsheets provided to participants
8 ASPG newsletter updates published covering key project activities
3 herbicide factsheets and 1 nematicide factsheet
One pest alert fact sheet developed for GRKN
6 case studies from intensive nematode surveys
A soil test interpretation guide
Online lucid key development for crop rotation planning based on nematode resistance
Between 2018 and 2023, the project delivered approximately 3 field walks and around 8 project updates—both in-person and virtual—to share research findings
5 scientific conference presentations to share research findings with the broader community

</td></tr>
</table>

<table>
<tr><th>Pathway</th><th>Description</th></tr>
<tr><td></td><td>Data and knowledge products
National nematode survey report developed, detailing the distribution and identity of pest nematodes across 85 sampled fields across 5 major production regions
Notification to Biosecurity Queensland of an extended range for R. reniformis, based on survey results
Integrated reports on 2 long term field trials on integrated nematode management and sustainable farming systems. Includes reporting on soil physical and chemical properties, biological monitoring, and yield and quality assessments
Reports from 2 long-term pot trials assessing varietal susceptibility to R. reniformis and M. javanica
Reports on the resistance status of 103 cover crop cultivars and 24 sweetpotato cultivars
2 nematicide efficacy trial reports detailing performance across sandy and red soils
Weed species survey report (2019-2023), including nematode host status, herbicide use evaluation and tabulated nematode host status using Nemaplex data
2 reports on the effects of herbicide applications on sweetpotato volunteers and plant back periods
Herbicide review report on the use of possible products for the sweetpotato industry in Australian
Capacity building and research capability
Training outputs delivered to research staff via 4 nematology workshops
Development of technical capacity within the research team, including advancement of 4 staff into long term research roles in nematology and soil health
Nematode survey protocols, soil sampling guide, and diagnostic reports developed and distributed to the project team to support consistent data collection and analysis</td></tr>
<tr><td>Outcomes</td><td>Improved producer knowledge through masterclasses, factsheets, and updates, leading to informed decision making and better understanding of soil health and nematode control
Greater adoption of integrated nematode management as a result of grower participation in hands-on, on-farm trial activities
New scientific knowledge on nematode distribution enabled regional pest mapping and informed risk-based management strategies
Research capacity strengthened via team training in nematode sampling, diagnostics, data collection, and reporting methods
Sustainable farming systems validated through long-term trials demonstrating maintained yields and improved pest control
Improved biosecurity readiness following the confirmed range extension of R. reniformis and notification to Biosecurity Queensland
Weed host surveys and herbicide trials supported improved nematode suppression and more strategic weed and volunteer control
Increased use of resistant crops and cultivars based on new data on nematode resistance and suitability to local farming systems</td></tr>
</table>

Pathway	Description
Impacts	• **Increased yield from effective nematicide use** – Chemical treatments provided effective protection during crop growth, resulting in higher marketable yields and fewer quality defects linked to nematode infection • **Improved yield through integrated nematode management** – Long-term trials showed that sustainable practices – such as organic amendments, crop rotation, and minimum tillage – led to measurable yield gains by reducing nematode-related losses and enhancing soil health • **Nematode suppression and improved soil health through resistant cover crops** – Several cover crop species, including Saia oats, pigeon pea, and sun hemp, showed resistance to key nematode species. These offer promising options for crop rotation that may reduce nematode populations over time and support healthier soils • **Lower use of chemical inputs** – As a result of integrating biological and ecological practices like organic amendments, nematode-resistant crops, and crop rotations, the project has contributed to a reduction in the use of chemical pesticides and nematicides on participating farms • **Knowledge transfer and capacity building** – Around 80% of sweetpotato growers participated in extension activities, including masterclasses and workshops, gaining valuable skills and knowledge to better manage nematode pests and enhance soil health • **Improved industry collaboration and engagement** through field walks, extension events, and hands-on trials. The collaborative approach has resulted in increased trust and a sense of shared purpose among stakeholders, facilitating ongoing improvements in farming practices and pest management strategies. • **Increased awareness of biosecurity and pest management** – Growers have become more aware of biosecurity risks and the importance of pest and disease management

Source: ACIL Allen

Cost and benefits

Costs

Cost of the investment

The investment was a collaboration between Hort Innovation and QDAF. Hort Innovation contributed $2,238,690 in cash and incurred $397,069 in overhead costs (ex-GST amounts). Queensland DAF contributed $855,947 through in-kind contributions. Table 3 below shows the total nominal cash and in-kind contributions from each partner across the duration of the investment.

Table 3 Nominal costs of the investment by contributing partners of PW17001

Contribution	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	Total
Hort Innovation - Cash	$273,331	$411,213	$413,434	$600,613	$92,361	$447,738	**$2,238,690**
Hort Innovation – Overheads	$57,887	$70,899	$63,230	$89,212	$14,022	$101,819	**$397,069**
Queensland DAF – Cash and In-kind	$143,531	$168,659	$182,612	$183,214	$175,527	$2,405	**$855,947**
Total	**$474,749**	**$650,771**	**$659,276**	**$873,039**	**$281,910**	**$551,962**	**$3,491,706**

Source: Hort Innovation

The total nominal investment of $3.49 million is then adjusted for inflation to represent the real value of the investment. Adjustment for inflation is meant to present historical costs in today's dollars by making periods comparable by converting nominal values to real values by way of adjusting for changes in purchasing power due to inflation.

Costs of the investment, in nominal terms and real terms, are provided in Table 4 below.

Table 4 Real costs of the investment PW17001

Organisation	Hort Innovation	Queensland DAF	Total
Nominal costs	$2,635,759	$855,947	$3,491,706
Real costs ($2025 financial year)	$2,960,136	$976,720	$3,936,857

Source: ACIL Allen, modelled using ABS's implicit GDP deflator

Benefits

Table 5 below summarises the potential benefits of the investment and categorised them into 3 categories: economic, environmental and social impact. It provides a description of the benefits and how the investment could achieve them. The table also shows the assessment method that was used for each benefit.

Table 5 Summary of potential impacts of PW17001

Type of impact	Assessment	Description
Economic impact	Quantified	**Increased yield from effective nematicide use** – 2 nematicide efficacy trials on sandy loam and red soil demonstrated that chemical treatments provided effective protection during crop growth, resulting in higher marketable yields and fewer quality defects linked to nematode infection. Treatments such as Metham and Vydate showed measurable increases in marketable root weight compared to baseline control (Nimitz normal), highlighting a clear economic benefit. This increase in root weight was used as a proxy for yield gain, with farm gate value estimated by attributing 60–80% of yield improvements to root weight. To capture the range of potential economic outcomes, high, medium, and low benefit scenarios were calculated based on the best-performing,

Type of impact	Assessment	Description
		second best-performing, and average treatment effects across both trials.
	Quantified	**Improved yield through integrated nematode management** – The economic benefit of improved yield from integrated nematode management was derived through 2 long-term field trials designed to evaluate sustainable practices aimed at reducing nematode-related losses and enhancing soil health. • In the Intensive trial, which followed conventional sweetpotato practices with high rates of organic amendments, yield gains were calculated by comparing the yield (tonnes/ha) from organic matter amendments to the untreated control (average of Nil and Nimitz). This difference was then translated into an increase in farm gate value using a $/ha conversion. • For the Extensive trial, which applied minimum tillage and a diverse crop rotation system, the average yield from treatments (V-furrow, double and incorporated amendments) was compared to the average of Nil and nematicide treatments. The resulting percentage increase in yield was similarly converted to a $/ha farm gate benefit.
Environmental impact	Unquantified	**Lower use of chemical inputs** – As a result of integrating biological and ecological practices like organic amendments, nematode-resistant crops, and crop rotations, the project has contributed to a reduction in the use of chemical pesticides and nematicides on participating farms. This has positive implications for the environment, reducing the risk of chemical runoff and pollution. The environmental benefits remain unquantified due to limited statistical support. The long-term nematode management trial produced uncertain results requiring further modelling.[7] The nematicide trial showed no significant impact on microarthropods and the biofumigant study remains inconclusively pending further analysis.[8]
	Unquantified	**Nematode suppression and improved soil health through resistant cover crops** – Screening trials identified several cover crop species – such as Saia oats, pigeon pea, and sun hemp – that exhibit resistance to the key nematodes Meloidogyne incognita and M. javanica. These crops show promise as rotational options to suppress nematode populations, potentially reducing future crop damage and improving soil health. Early observational trials noted a decline in root-knot nematode numbers following specific cover crop use, suggesting both environmental benefits and potential long-term economic gains. Further field validation is needed to confirm and quantify these outcomes. The cover crop trial was unreplicated and observational, and while the soil testing trial initially showed promising trends, the target pest population disappeared, preventing conclusive analysis.[9]

[7] Hort Innovation. (2024). Final Report: Integrated pest management of nematodes in sweetpotatoes. Hort Innovation.

[8] Ibid

[9] Ibid

Type of impact	Assessment	Description
Social impact	Unquantified	**Knowledge transfer and capacity building** – Around 80% of sweetpotato growers participated in extension activities, including masterclasses and workshops, gaining valuable skills and knowledge to better manage nematode pests and enhance soil health. This has strengthened local capability and enabled farmers to make more informed choices for sustainable farming. Additionally, the project supported the training and professional growth of 4 research staff, positioning them for ongoing career advancement and potential leadership roles within the industry. While such impacts enhance relevance and adoption of project outcomes, assigning a precise dollar value would require speculative assumptions about long term behaviour change and adoption rates, making any valuation potentially misleading.
	Unquantified	**Improved industry collaboration and engagement** – Through field walks, extension events, and hands-on trials, the project fostered collaboration and strengthened relationships between growers, researchers, and industry stakeholders. The collaborative approach has resulted in increased trust and a sense of shared purpose among stakeholders, facilitating ongoing improvements in farming practices and pest management strategies. The extent to which these outcomes lead to measurable benefits depends on the degree of practice adoption and information dissemination that occurs as a result of this trust and collaboration. Given the variability and indirect nature of these effects, assigning a robust dollar value would require speculative assumptions and is therefore not appropriate.
	Unquantified	**Increased awareness of biosecurity and pest management** – Growers have become more aware of biosecurity risks and the importance of pest and disease management. The nematode survey and dissemination of results have not only provided vital pest management information but also highlighted the importance of biosecurity measures, improving the resilience of the industry against future pest incursions. General biosecurity awareness and preparedness have long term value, but these benefits are preventative in nature and cannot be easily isolated or monetised.

Source: ACIL Allen

Data and assumptions

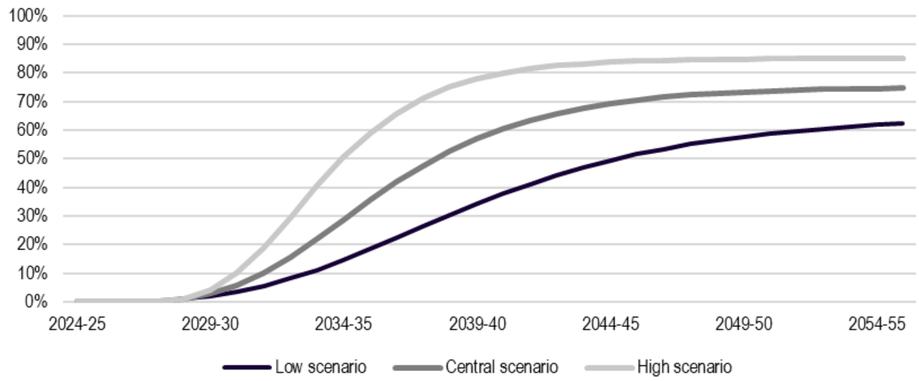
The required data, assumptions and calculations used to estimate the impacts of the investment are presented in Table 6 below. The data were sourced from project data, external sources through literature review, industry data provided by Hort Innovation and other publicly available databases.

Assumptions were informed by stakeholder consultations and are intentionally designed to be conservative considering key uncertainties surrounding the adoption and impact of research outputs. These uncertainties include the rate and extent of industry uptake, variability in grower responses, and the variability in uptake of sustainable practices between intensive and extensive trial systems. As many projects have a long-term focus and benefits may take years to fully emerge, using conservative assumptions helps avoid overstating expected returns. This cautious approach reflects best practice in economic evaluation where future adoption patterns and external influences cannot be predicted with high confidence.

Table 6 Data and assumptions used for PW17001

<table>
<tr><th>Data/Assumption</th><th colspan="5">Value, source and rationale</th></tr>
<tr><td>Data</td><td colspan="5"></td></tr>
<tr><td>Production/farm gate value</td><td colspan="5">$69,600,000 across 89,203 tonnes
Australian Horticulture Statistics Handbook 2023-24</td></tr>
<tr><td>Data</td><td colspan="5"></td></tr>
<tr><td>Yield</td><td colspan="5">50 tonnes/ha
Bugajim, C., Groves, K., Henderson, C. W. L., & Brown, P. (2024). Yield performance of virus free sweetpotato (Ipomoea batatas) cultivars in the highlands of Papua New Guinea. New Zealand Journal of Crop and Horticultural Science, 52(4), 374–382. https://doi.org/10.1080/01140671.2024.2314475</td></tr>
<tr><td>Share by variety</td><td colspan="5">Gold variety -90%
Red variety – 7%
Purple and white variety – 3%
Australian Horticulture Statistics Handbook 2023-24</td></tr>
<tr><td>Share of Beauregard and Orleans cultivars</td><td colspan="5">There are 3 gold varieties across Australia which make up a total of 90% of the market – Beauregard, Bellevue and Orleans. Beauregard is no longer commercially available and has been replaced by cultivar Orleans.
Beauregard – 0%
Orleans – 70%
Bellevue – 20%
Information provided by Sandra Dennien</td></tr>
<tr><td>Correlation between average root weight and the root yield</td><td colspan="5">81.2%
Yahaya, S. U., Saad, A. M., Mohammed, S. G., & Afuafe, S. O. (2015). Growth and yield components of sweet potato (Ipomoea batatas L.) and their relationships with root yield. American Journal of Experimental Agriculture, 9(5), 1–7. https://doi.org/10.9734/AJEA/2015/20078</td></tr>
<tr><td>Average individual root weight across Orleans cultivar (Nematicide efficacy trial on Sandy Loam soil)</td><td colspan="5">Treatment
1. Metham – 371.5 grams
2. Nimitz – 363.8 grams
3. Vydate – 363.7 grams
PW17001. Final report. Integrated pest management of nematodes in sweetpotatoes</td></tr>
<tr><td>Average root weight per plot across Beauregard cultivar (Nematicide efficacy trial on red soil)</td><td colspan="5">Treatment
1. Metham – 45 kg/plot
2. Nimitz – 31 kg/plot
3. Vydate – 50 kg/plot
PW17001. Final report. Integrated pest management of nematodes in sweetpotatoes
* these values are approximate since they have been derived from graphs
** Beauregard is no longer commercially available but is still used as a baseline.</td></tr>
<tr><td rowspan="4">Marketable mean root weight across the Intensive trial</td><td>Treatment</td><td>Harvest 1 2020</td><td>Harvest 2 2021</td><td>Harvest 3 2022</td><td>Harvest 4 2023</td></tr>
<tr><td>Nil</td><td>45</td><td>40</td><td>19</td><td>59</td></tr>
<tr><td>Nimitz</td><td>50</td><td>50</td><td>17</td><td>43</td></tr>
<tr><td>Organic matter</td><td>65</td><td>37</td><td>28</td><td>52</td></tr>
</table>

Data/Assumption	Value, source and rationale			
	PW17001. Final report. Integrated pest management of nematodes in sweetpotatoes *these values are approximate since they have been derived from graphs			
Marketable mean root weight across the Extensive trial	Treatment	Harvest 1 2020	Harvest 2 2021	Harvest 3 2022
	Grass/brassica			
	Nil	25	170	100
	Nematicide	40	135	100
	Double	60	125	120
	Incorporated	80	130	115
	V-furrow	65	150	112
	Grass/legume			
	Nil	25	170	80
	Nematicide	30	140	80
	Double	50	120	110
	Incorporated	75	125	100
	V-furrow	60	160	112
	PW17001. Final report. Integrated pest management of nematodes in sweetpotatoes *these values are approximate since they have been derived from graphs			
Plot area	15 m^2 (Length of each plot - 10 metres since total row length is 50 metres and there are 5 plots along each row Width of each plot – There are 13 rows, and the width of the trial area is 19.5 metres) PW17001. Final report. Integrated pest management of nematodes in sweetpotatoes			
Assumption				
Attribution	Attribution to the project: 91% based on the nominal costs of the investment as a proportion to total nominal costs of related investments. Since further trial is required, it is assumed that this component would be attributed another 30% of the impacts. Therefore, the project has a 64% attribution (91% x 70%).			
Counterfactual	Outcomes of this project are unlikely to be achieved by organisations other than Hort Innovation and QDAF. The counterfactual scenario can be assessed as there is a very low likelihood the project would be undertaken.			
Adoption	Adoption is assumed to start in 2028-29 (5 years from now) after future trial and commercialisation activities are completed and achieve a rapid uptake as the benefit for the industry is clear and of high value. Adoption is assumed to reach 70% and plateau. **Figure 1 Adoption curve**			

Data/Assumption	Value, source and rationale
	 *Source: ACIL Allen*
Cost of adoption by growers and industries	The cost of adoption of more effective nematicide has not been included in the model because both the baseline and the treatment involve commercially used nematicides, and the comparison reflects a substitution rather than an introduction of a new practice. In the absence of any information on cost of adopting integrated management practices, we have assumed this cost to be negligible.
Confidence	Assumed to be 50% as there are several uncertainties regarding future trials and commercialisation.
Weightage for intensive and extensive trials	To reflect their practical relevance, the trials were weighted based on their applicability to the industry. The intensive trial was given a 70% weighting due to its alignment with current farm practices, and the extensive trial was assigned the remaining 30%, as it was more experimental.
Improved yield due to integrated management practices	The economic gains from increased yields through integrated nematode management were determined using 2 long-term field trials focused on evaluating sustainable methods to minimise losses caused by nematodes and improve soil health. Both trials used the Beauregard cultivar; however, since Beauregard is no longer commercially cultivated in Australia, the yield-related economic benefits have been attributed to the Orleans variety instead. This substitution is justified as the only notable difference between the 2 cultivars is that Orleans tends to produce more uniformly sized and shaped roots.[10]
Calculations	
Per tonne farm gate value	*Production (or farm gate value in $) / production in tonnes*
Number of hectares across Australia under sweetpotato production	*Production (in tonnes) / yield (in tonnes/ha)*
Percentage increase in root weight from baseline	*(Root weight under treatment / Root weight under baseline) -1*
Percentage increase in yield due to increase in root weight	*Correlation factor between root weight and yield x percentage increase in root weight from baseline*

[10] Information provided by Sandra Dennien.

Data/Assumption	Value, source and rationale
Increase in farm gate value due to increased yield	*Percentage increase in yield x Production value (in $)*
Converting increase in root weight between treatment and baseline from kg/plot to tonnes/ha	*(Average difference between treatment(s) and baseline across all harvest periods / area of 1 plot (in m^2)) x 10*
$ per hectare increase in farm gate value due to intensive or extensive trial	*Increase in root weight between treatment and baseline (in tonnes/ha) x $/tonne farm gate value x share of cultivar on which the trial was based*
Total increase in farm gate value	*$ per hectare increase in farm gate value due to extensive or intensive trial x number of hectares across Australia*
Increase in farm gate value due to intensive and extensive trial	*(probability of intensive trial adoption x farm gate value increase due to intensive trial) + (probability of extensive trial adoption x farm gate value due to extensive trial)*

Source: ACIL Allen

Net impact

A summary of the net impact of the investment is presented in Table 7. The results show that, taking all quantified costs and benefits into account, the investment produced a positive net result. The investment has an NPV of $3.9 million and a BCR of 1.99 at 30 years after investment completion.

When taking only costs and benefits attributable to Hort Innovation into account, the investment generated an NPV of $2.93 million and a BCR of 1.99 at 30 years after investment completion. The benefits attributed to Hort Innovation were in proportion to the nominal costs.

Table 7 Net impact results of PW17001

	Years after investment completion						
	0	5	10	15	20	25	30
Whole investment							
PV of Costs ($m)	$3.94	$3.94	$3.94	$3.94	$3.94	$3.94	$3.94
Benefits ($m)	$0.00	$0.02	$0.87	$4.04	$8.86	$14.33	$20.00
PV of Benefits ($m)	$0.00	$0.01	$0.60	$2.34	$4.44	$6.31	$7.83
NPV ($m)	-$3.94	-$3.92	-$3.34	-$1.60	$0.50	$2.37	$3.90
BCR	0.00	0.00	0.15	0.59	1.13	1.60	1.99
IRR	Negative	Negative	Negative	Negative	4.8%	7.4%	8.5%
MIRR	Negative	Negative	Negative	Negative	4.9%	6.6%	7.2%
Attributable to Hort Innovation							
PV of Costs ($m)	$2.96	$2.96	$2.96	$2.96	$2.96	$2.96	$2.96

Benefits ($m)	$0.00	$0.01	$0.66	$3.04	$6.66	$10.77	$15.04
PV of Benefits ($m)	$0.00	$0.01	$0.45	$1.76	$3.34	$4.75	$5.89
NPV ($m)	-$2.96	-$2.95	-$2.51	-$1.20	$0.38	$1.79	$2.93
BCR	0.00	0.00	0.15	0.59	1.13	1.60	1.99
IRR	Negative	Negative	Negative	Negative	4.8%	7.4%	8.5%
MIRR	Negative	Negative	Negative	Negative	4.9%	6.6%	7.2%

Source: ACIL Allen

Sensitivity analysis

Sensitivity analysis was conducted to test the robustness of susceptibility of the analysis to key assumptions and parameters. Given the uncertainty of a number of assumptions used in this CBA, sensitivity testing is important to determine the appropriateness of underlying assumptions. The results of the sensitivity analysis are presented in Table 8 below.

Table 8 Sensitivity analysis results of PW17001 at 30-year horizon

	NPV (in $M)	BCR	IRR	MIRR
Under standard assumptions (Central case scenario and 5% discount rate)	$3.90	1.99	8.5%	7.2%
3% discount rate	$7.28	2.85	8.5%	7.2%
7% discount rate	$1.64	1.42	8.5%	7.2%
Low adoption (starts at 1.1% and reaches 11.6% in 5 years)	$1.58	1.40	6.3%	5.9%
High adoption (starts at 1.1% and reaches 39.0% in 5 years)	$6.18	2.57	10.4%	8.2%
Confidence (Low at 25%) (Central scenario -20%)	$2.33	1.59	7.2%	6.4%
Confidence (High at 75%) (Central scenario +20%)	$5.46	2.39	9.6%	7.9%
Increase in yield due to increased nematicide use and increase in farm gate value due to integrated nematode management practices (Low scenario)	-$1.58	0.60	3.58%	4.06%
Increase in yield due to increased nematicide use and increase in farm gate value due to integrated nematode management practices (High scenario)	$6.42	2.63	12.47%	9.52%

Source: ACIL Allen

Key findings

The following key findings have been identified for this assessment:

- **Improved yield and economic return** – quantifying yield improvements were achieved through both chemical and integrated pest management approaches:
  - **Nematicide trials** demonstrated measurable increases in marketable root weight. Products such as Metham and Vydate outperformed baseline treatments, confirming their economic value.
  - **Integrated trials** combining soil amendments, crop rotations, and resistant varieties resulted in sustained yield gains under both intensive and extensive farming systems, leading to higher farmgate returns.
- **Increased industry knowledge and practice change**, with 80% of growers engaged in masterclasses and on-farm demonstrations. Tools such as soil test guides, resistance data, and factsheets supported informed decision-making and broader adoption of sustainable practices.
- **New diagnostic capability and scientific data**, including Australia's first comprehensive nematode distribution survey. Biosecurity was enhanced through the confirmed extension of *R. reniformis*, with diagnostic protocols and staff training boosting long-term research capability.
- **Advancements in non-chemical management**, with cover crops like sun hemp and pigeon pea identified as potential biological control options. While some findings are preliminary, they indicate opportunities for reducing chemical inputs and improving soil health.
- **Stronger industry collaboration**, enabled by participatory research, inclusive governance, and regular engagement. This built trust, strengthened grower-researcher relationships, and encouraged innovation in pest and soil management.
- **Unquantified but meaningful social and environmental benefits**, including increased biosecurity awareness, stronger industry networks, and greater resilience to pest pressures, which support long-term industry sustainability.
- **Data reporting limitations noted** – Marketable mean root weight outcomes from intensive and extensive trials were derived from graphs rather than tabulated data. Future projects would benefit from presenting clear, numeric trial results in tables to enable more accurate and efficient impact assessment.
- **Comparison to commercially used baselines recommended** – While nil treatments serve as appropriate scientific controls, economic impact assessments benefit from comparisons with the most commonly used commercial practices (for example, standard nematicide treatments). This enables a clear understanding of the value added by trialled treatments relative to real world farm performance.

Consultations

The following stakeholders were consulted on this assessment:

- Araz Solomon, R&D manager, Hort Innovation
- Sandra Dennien, Principal Research Horticulturist, Queensland Department of Primary Industries.

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