Impact assessment of the investment:

Trapping efficacy in table grape vineyards for area wide management of Queensland fruit fly (TG19001)

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Hort Innovation

Previous page image courtesy of Agriculture Victoria.

Disclaimer:

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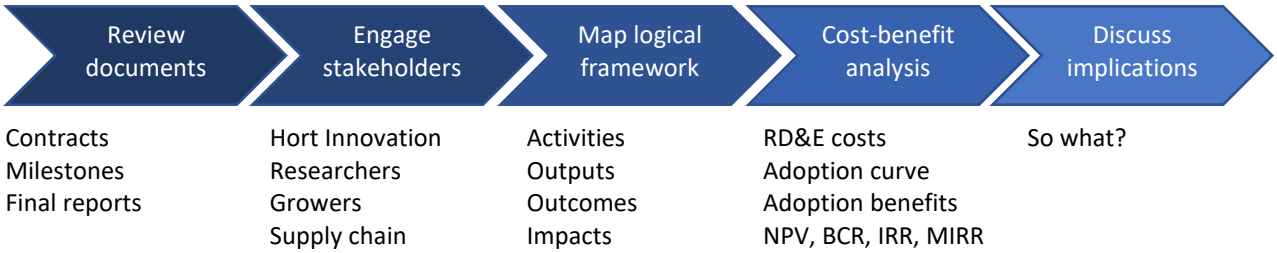
Executive summary

What the report is about

Ag Econ conducted independent analysis determine the economic, social, and environmental impact resulting from delivery of the table grape project *Trapping efficacy in table grape vineyards for area wide management of Queensland fruit fly (TG19001)*. The project was funded by Hort Innovation over the period February 2020 to September 2022 using the table grape research and development levy and contributions from the Australian Government. The project was delivered by Agriculture Victoria (formerly the Department of Jobs Precincts and Regions).

The analysis applied a five step analytical process to understand the impact pathway and collect supporting data.



Research background

TG19001 further developed mass trapping methods as a tool to assist in the control of Queensland fruit fly (Qfly) for table grape growers through a case study approach. The project assessed the performance of both existing protein traps and a new sticky trap for controlling Qfly across several trapping strategies (e.g. placement). The case studies developed new knowledge regarding trapping and broader management strategies to support an integrated approach to the management of Qfly by table grape growers.

Key findings

The nominal investment cost of $0.17 million was adjusted for inflation (ABS, 2024) and discounted (using a 5% real discount rate) to a 2023-24 present value (PV) of costs equal to $0.23 million.

The analysis conducted a detailed evaluation of the TG19001 impact pathway through a logical framework, and a review of the available data supported by consultation with stakeholders to quantify the impact pathway. From this process, economic, environmental and social impacts were identified from the research relating to improved knowledge of mass trapping strategies supporting greater integrated management options, ongoing market access and reductions in chemical use.

However the identified impacts could not be quantified due to uncertainties around the adoption profile in the context of current industry priorities and attribution of the approach in delivering industry benefits considering the contribution of other available integrated management approaches and pest pressure.

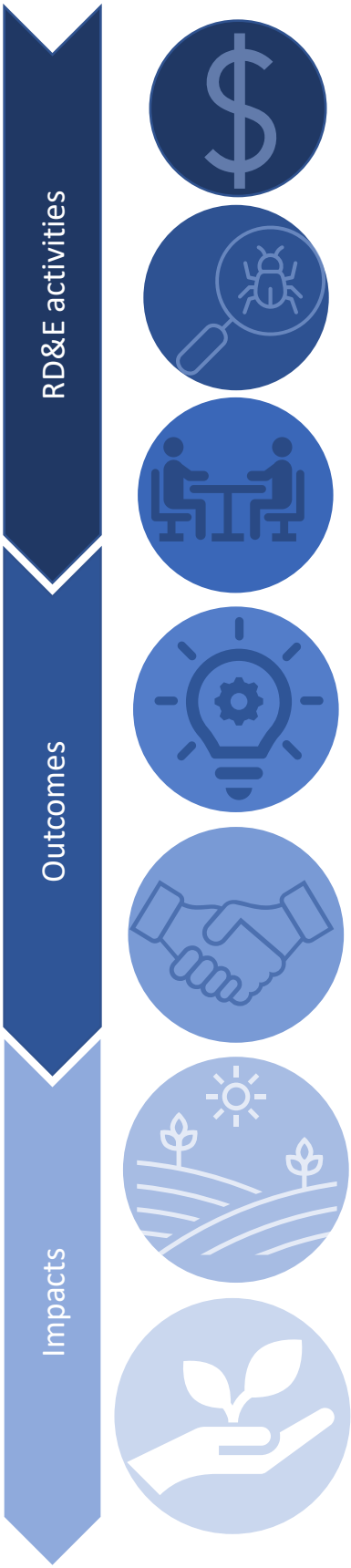
The key findings of the TG19001 impact assessment are summarized in Figure 1 below.

Keywords

Impact assessment, cost-benefit analysis, table grape, biosecurity, Queensland Fruit Fly (Qfly), integrated pest management, mass trapping

Figure 1. Summary of impact assessment findings

TG19001 Table grape Qfly mass trapping



Total RD&E costs:

- $0.17 million (nominal value).
- 100% R&D levy and Government matching.

Research activities:

- Deliver mass Qfly trapping studies testing placement layouts across different trap types and the influence of other host sites (neighbouring fruit trees).
- Laboratory testing of modified AVR and RapidAIM traps in response to field trial performance feedback.
- Investigate Qfly host suitability of major table grape varieties.

Extension activities:

- Online workshop with pest scouts and industry representatives.
- 2 x articles in table grape industry magazines.
- 1 x industry fact sheet.
- 1 x technical report.

Outcomes:

- Improved industry knowledge regarding mass trapping as a tool to manage Qfly pest pressure in commercial table grape vineyards.

Industry adoption:

- Industry currently recommends trapping as a method for surveillance as part of broad integrated management, as distinct from a direct control method (mass trapping requires consistent area wide adoption to be effective).
- Therefore, the current or future adoption profile of mass trapping could not be estimated.

Industry economic impacts:

- Avoided revenue losses from unmanaged Qfly infestation.
- Avoided cost increases from additional or unnecessary management practices.

Environmental impacts:

- Reduced chemical usage to manage Qfly populations.

Social impacts:

- Continued supply of affordable table grapes for consumption, and community spillover benefits from a profitable table grape industry.

Total attributable benefits and impact:

- Present value (PV @ 5% discount) RD&E costs of $0.23 million.
- A quantitative impact assessment was not performed due to insufficient evidence demonstrating a marg benefit to the adoption of mass trapping within current or projected practices.

Introduction

Evaluating the impacts of levy investments is important to demonstrate the economic, social and environmental benefits realised through investment to levy payers, Government and other industry stakeholders. Understanding impact is also an important step to inform the ongoing investment agenda.

Reflecting its commitment to continuous improvement in the delivery of levy funded research, development and extension (RD&E), Hort Innovation required a series of impact assessments to be carried out annually on a representative sample of investments of its RD&E portfolio. Commencing with MT18011 in 2017-18, the impact assessment program consisted of an annual impact assessment of up to 15 randomly selected Hort Innovation RD&E investments (projects) each year. In line with this ongoing program, Ag Econ was commissioned to deliver the *Horticulture Impact Assessment Program 2020-21 to 2022-23* (MT21015).

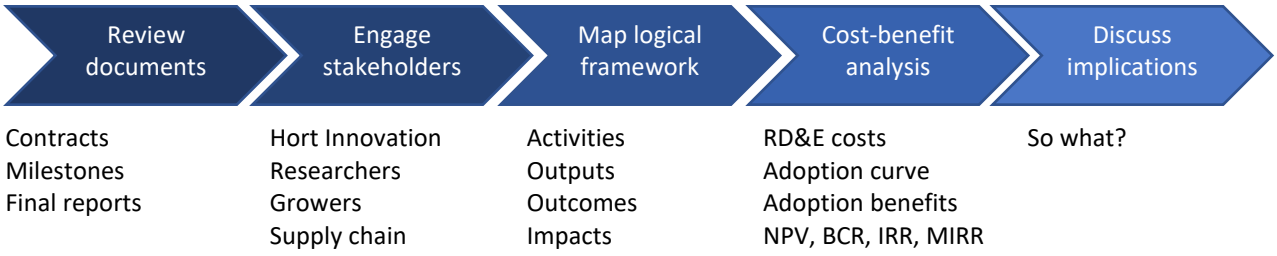
Trapping efficacy in table grape vineyards for area wide management of Queensland fruit fly (TG19001) was randomly selected in the 2022-23 sample. This report presents the analysis and findings of the project impact assessment.

The report structure starts with the general method of analysis used, followed by the RD&E background and an outline of the impact pathway in a logical framework, then describes the approach used to quantify the identified costs and benefits including any data gaps and limitations to the analysis, presents the results including from the sensitivity analysis, and finally discusses any implications for stakeholders.

General method

The impact assessment built on the impact assessment guidelines of the CRRDC (CRRDC, 2018) and included both qualitative and quantitative analysis. The general method that informed the impact assessment approach is as follows:

1. Review project documentation including project plan, milestone reports, outputs and final report.
2. Discuss the project delivery, adoption and benefits with the Hort Innovation project manager, project researcher/consultant, growers and other relevant stakeholders (see *Stakeholder consultation*).
3. Through a logical framework, qualitatively map the project's impact pathway, including activities, outputs, and outcomes to identify the principal economic, environmental, and social impacts realised through the project
4. Collect available data to quantify the impact pathway and estimate the attributable impacts using cost-benefit analysis (over a maximum 30 years with a 5% discount rate), and then sensitivity test the results to changes in key parameters.
5. Discuss the implications for stakeholders.



The analysis identified and quantified (where possible) the direct and spillover impacts arising from the RD&E. The results did not incorporate the distributional effect of changes to economic equilibrium (supply and demand relationships) which was beyond the scope of the MT21015 impact assessment program. A more detailed discussion of the method can be found in the *MT21015 2022-23 Summary Report* on Hort Innovation project page Horticulture Impact Assessment Program 2020/21 to 2022/23 (MT21015).

Project background

The Australia table grape industry has experienced recent growth in production volumes, primarily driven by export demand. The volume of table grape exports has increased from 72,000 tonnes to 132,000 tonnes over the 10 year period to 2022/23 with the industry exporting up to 70% of total production volume (Hort Innovation 2024). Ongoing access to export markets therefore remains critical to supporting the future growth and market sustainability for the table grape industry.

A threat to ongoing export market access is the extent to which the table grape industry can manage the presence of Qfly, a

native pest endemic across the eastern states of Australia. Qfly infestations can cause significant damage to a range of fruit and vegetable host crops including table grapes, with production losses of up to 3% annually being experienced in endemic areas (Hort Innovation 2018) As Qfly populations are not active overseas, many table grape export markets have developed protocols, such as cold treatment, in order to eliminate the risk of Qfly incursion through fruit imported from Australia (e.g. through larvae). While not all export markets specify Qfly management and treatment protocols to facilitate trade, they still maintain an interest in the overall management of Qfly throughout Australia. Therefore the table grape industry has a strong requirement for management practices and technologies that can control Qfly, in order to maintain and improve export market opportunities and production efficiencies.

While a range of pesticides exist to control Qfly in table grape production such as the organophosphate cover spray, their availability has gradually been withdrawn as a result of ongoing assessment processes of the Australian Pesticides and Veterinary Medicines Association. As a result, the table grape industry (as well as other horticulture industries impacted by Qfly) are more reliant on integrated management approaches, including trapping, baiting and broader area wide management. The application of integrated pest management practices to support biosecurity outcomes has therefore emerged as a significant research priority for the table grape industry.

TG19001 was undertaken to explore the potential of mass trapping techniques in table grape vineyards. The research sought to develop mass trapping strategies focusing on the placement and type of traps to directly control Qfly populations, given that trapping was used only for surveillance purposes (monitoring numbers). As such the research sought to expand the integrated management practice toolkit for table grape growers to control Qfly.

TG19001 aligned with the Table Grape Strategic Investment Plan (SIP) 2022-2026 through:

- Outcome 2: Industry supply, productivity and sustainability. Strategy 7. Reduce the impact of endemic pests and diseases and the potential impact of an exotic pest/disease incursion by improving industry preparedness and resilience to biosecurity threats

Project details

TG19001 was funded from 2020 to 2022 (Table 1).

Table 1. Project details

Project code	TG19001
Title	Trapping efficacy in table grape vineyards for area wide management of Queensland fruit fly
Research organization(s)	Agriculture Victoria (formerly the Victorian Department of Jobs, Precincts and Regions)
Project leader	Paul Cunningham
Funding period	February 2020 to September 2022
Objective	Develop and validate mass trapping techniques to support an integrated management approach to control Qfly in table grape vineyards.

Logical framework

The impact pathway linking the project's activities and outputs, and their assessed outcomes and impacts have been laid out in a logical framework (Table 2).

Table 2. Project logical framework detail

RD&E activities

Grower engagement and site selection

- On farm meetings and grower discussion to inform background of current Qfly management approaches.
- Engagement with industry to inform site selection across the Sunraysia region to conduct mass trapping studies.
- Identify eight suitable sites.

Preliminary trials

- Set monitoring traps across eight potential sites.
- Deploy for eight weeks and count Qfly captures.

Deliver mass trapping studies

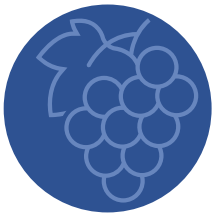
- Set out traps in commercial table grape vineyards to test various placement strategies across different trap types.
- Trapping strategies include:
  - Trapping in the block
  - Trapping in the block perimeter
  - Timing of trap in vineyard (10 or 12 weeks)
- Trap types tested include:
  - Agriculture Research Victoria's (AVR) trap containing a synthetic blend of fruit volatiles for mated females.
  - Protein-baited biotraps.
  - Male cue-lure biotraps (comparison trap).
  - RapidAIM smart traps (real time monitoring).
- Check and collect captured insects every two weeks to check capture trate and determine mating status of females.
- Investigation of the impact of 'hot spots' in vineyards from neighbouring fruit trees of varying distances to the commercial vineyard.

Investigate Qfly host suitability of different grape varieties

- Conduct laboratory trials for x5 major grape varieties to assess attraction of Qfly.
- Observe the rate of landing and stinging of fruit.
- Observe larval survival following manual infestation of Qfly eggs.

Modification of traps

- AVR traps
  - Modify sticky glue adherent with localised insecticide in the AVR sticky trap to mitigate the potential impact of dust.
  - Conduct laboratory trials measuring modified trap performance.
- RapidAIM traps
  - Include a protein lure to increase female capture potential and monitor movement.
  - Include of odour lures and a red visual cue into trap design.
  - Perform greenhouse trials to measure the fly behaviour and real time monitoring of the trap.



Workshop and grower survey

- Deliver online workshop with pest scouts and industry representatives to communicate and discuss project results.
- Administer online survey to understand table grape grower perceptions of Qfly.

RD&E outputs

- **1 x final report** on the Hort Innovation website.
- **2 x industry communication articles.** Published in the quarterly industry *Vine* Magazine
  - Grand designs: Designing a female mass trapping strategy for managing fruit flies in table grapes (May 2020).
  - Mass trapping female fruit flies in vineyards (August 2021).
- **1 x industry factsheet:** Trapping efficacy in table grape vineyards for area-wide management of Qfly.
- **1 x technical report:** Development of mass trapping protocols and evaluation programs for Qfly in Table Grapes covering the experimental protocols and the results of all mass trapping case studies and additional field work conducted.
- **1 x experimental report:** Results of the experimental study concerning host suitability of 5 table grape varieties.
- **1 x online workshop** conducted with industry pest scouts and industry representatives.
- **1 x online grower survey and results.**

Outcomes

- Increased industry knowledge regarding mass trapping as a tool to manage Qfly in table grape vineyards, supported by improved understanding of Qfly behaviour in vineyards, specifically:
  - The performance and suitability of mass trapping strategies (trap placement, timing) and trap selection.
  - The impact of nearby host fruit trees on supporting increased Qfly risk for commercial vineyards as a source of shelter and mating site.
- Increased knowledge of future research priorities that may contribute to additional capacity to manage Qfly in table grape vineyards.

Impacts

Increased industry capacity and capability to implement mass trapping as a tool in the area wide management of Qfly, supporting:

- [Economic] Avoided vineyard revenue losses, including from reduced productivity and decreased marketable yield resulting from unmanaged Qfly infestation.
- [Economic] Avoided vineyard cost increases from additional or unnecessary management practices responding to uncontained Qfly outbreaks and infestation.
- [Economic] Reduced risk of compromised international and domestic market access status through demonstrated control and management practices.
- [Social] Avoided loss of fresh and affordable domestic table grapes, resulting in decreased table grape consumption and a decline in associated health and wellbeing benefits (CSIRO 2003).
- [Socio-economic] Avoided loss of industry spillovers that would result from a decline in the table grape industry as a source of employment and economic stimulant to local communities (The CIE 2023).
- [Environmental] Avoided environmental impacts that would result from increased chemical use in response to management of Qfly populations.

Project costs

The project was funded by Hort Innovation, using the table grape research and development levy and contributions from the Australian Government.

Nominal investment

The project funding period was 2020 to 2022 (Table 3). Hort Innovation overhead costs were added to the direct project cost to capture the full value of the RD&E investment.

Table 3. Project nominal investment

Year end 30 June	Hort Innovation project costs ($)	Hort Innovation overheads[1] ($)	Total nominal cost ($)
2020	30,000	4,813	34,813
2021	60,000	9,550	69,550
2022	60,000	9,500	69,500
Total	**150,000**	**23,863**	**173,863**

1. The overhead and administrative costs were calculated from the Financial Operating Statement of the Table Grape Fund Annual Reports, averaging 15.9% for the TG19001 funding period (2020-2022).

Present Value of investment

The nominal total investment cost of $0.17 million identified in Table 3 was adjusted for inflation (ABS, 2024) into a real investment of $0.20 million (2023-24 equivalent values). This was then further adjusted to reflect the time value of money using a real discount rate of 5% (CRRDC 2018), generating a present value (PV) of costs equal to $0.23 million (2023-24 PV).

Project impacts

The impact pathways identified in Table 2 were evaluated against available data to determine if their impact could be quantified with a suitable level of confidence.

None of the economic, environmental or social impacts identified through the logical framework process were able to be quantified due to limitations in available data. Limitations related to the extent to which table grape growers have adopted mass trapping strategies as informed through TG19001 and the attribution of mass trapping relative to other integrated management practices. While TG19001 did completed a monitoring and evaluation process which provided high-level statements of industry knowledge and awareness of mass trapping strategies, little evidence to support an evaluation of TG19001 adoption and vineyard productivity was available.

Discussions with project stakeholders and staff from the Australian Table Grape Association (ATGA) responsible for delivering industry extension identified that a diverse range of attitudes exist amongst growers regarding Qfly management requirements. Some growers have relied on pest scout services (who may routinely trap for surveillance/control) while a wider majority had historically shown little motivation, awareness or interest towards the merits of integrated management beyond conventional control. As a result, the extension efforts remain focused on promoting the general merits of integrated management approaches for growers which does include trapping as a method for surveillance (but not mass trapping for population control). This general focus is considered to be more relatable to growers given that their knowledge and attitudes of alternative management practices is only beginning to emerge, compared with conventional control.

For mass trapping to function as a genuine method of Qfly population control, stakeholders noted that area wide adoption would be required. As the current extension focus remains on encouraging placement of traps for monitoring/surveillance and subsequent baiting within the vineyard, control capacity (reduced pest pressure) and net management cost savings associated with area wide mass trapping in a commercial setting remain unclear. These uncertainties are amplified when considering that integrated management approaches will vary between grower depending on size, available resources and seasonal pest pressure which impact the attribution of mass trapping in achieving broader control outcomes.

As a result, while TG19001 did identify strategies in support of mass trapping for Qfly control, current industry priorities (with a focus on trapping for surveillance) and challenges presented from the condition of area wide management has resulted in an uncertain adoption profile, further compounded by the variation in the expected contribution of mass trapping in achieving control relative to other complimentary controls. These factors result in a high level of uncertainty regarding the economic, environmental and social impact supported by TG19001, making it too difficult to quantify with confidence.

Implications and learnings

The delivery of TG19001 developed new knowledge of mass trapping strategies to support the control of Qfly in table grape vineyards. Understanding the suitability and application of mass trapping has the opportunity to strengthen the table grape industry's capacity to utilise integrated management approaches in response to continuing withdrawals of conventional chemical control options. This is especially relevant given the table grape industry's reliance on export markets and the associated need to have suitable management techniques to control Qfly pest pressure to support reputation with trading partners and mitigate crop losses.

Feedback from industry stakeholders identified that since TG19001, grower knowledge and attitudes towards integrated approaches such as trapping and baiting has been improving, based on increased enquiry numbers received by the ATGA. This change has been in part driven by broader extension of integrated management approaches, and strong Qfly pressure experienced in the 2023/24 season. The learnings from TG19001 have also contributed to this change, through increased confidence of the suitability of trapping strategies, in particular the merit of trapping around the vineyard perimeter, which has relevance when trapping for both control and surveillance.

As the potential impacts from Qfly and the subsequent importance of robust management practices are increasingly recognised by table grape growers, the role of extension and communication in demonstrating appropriate actions and strategies is key. While a range of management strategies are being promoted to support the control of Qfly through industry extension, mass trapping (reflecting the knowledge generated through TG19001) is not considered to be a priority strategy due to the perception that the practice exceeds what growers are willing to undertake, given the current focus on building consistent and results-driven outcomes from other general integrated management practices. Therefore while TG19001 has demonstrated in principle merit of a mass trapping program to support Qfly control in table grape, and will likely continue to influence trapping strategies, the extent and magnitude industry direct impact could not be reliability estimated.

This result identifies the influence of existing industry practices and the associated priority placed on applying these practices in support of biosecurity and pest & disease management. Regarding integrated management of Qfly in table grapes, attitudes towards potential practices were influenced by variation in the perceived importance of Qfly in terms of crop damage, effectiveness of conventional chemical treatments and implications for protocol export markets (which current cold-treatment protocols presently satisfy). As new potential management practices are identified, the underlying attitudes supporting adoption will be influenced by how readily they can be integrated with existing practices and the extent to which these practices themselves are already utlised across the industry. In the case of TG19001, while the research outcomes have merit to support and strengthen the integrated management toolkit for Qfly, the existing cultural practices and capacity regarding integrated management within the industry impacted the extent to which a practical pathway for adoption and broader benefit could be defined.

To ensure future research focused on integrated pest and disease management strategies supporting biosecurity outcomes is characterised by an accessible and achievable impact pathway, considering the feasibility of extending research findings with existing practices is key. Ensuring that prospective research outcomes support and align with existing and potential capacity and cultural gaps will ensure that target audiences and beneficiaries can establish a clear adoption pathway in support of impact.

Stakeholder consultation

Where possible, Ag Econ sought to engage multiple stakeholders across key areas of the logical framework and impact pathway to augment existing information and data sources, and reduce any uncertainty or bias from individual stakeholders. All stakeholders were engaged through telephone or online meetings, with follow up emails as necessary. Consultation followed a semi-structured approach in line with broad topics relating to the impact pathway and associated data requirements. Table 4 outlines the stakeholders consulted as part of this impact assessment and the topics on which they were consulted.

Table 4. Stakeholder consultation by theme

Stakeholder details		Consultation topics						
Stakeholder and organisation	**Stakeholder type**	**Related research**	**Research inputs**	**Research outputs**	**Research immediate outcomes**	**Follow on research**	**Stakeholder adoption**	**Impact areas and data**
Greg Chandler, Hort Innovation Head of Biosecurity R&D	RD&E process owner / manager	✓	✓	✓	✓	✓	✓	✓
Paul Cunningham, Agriculture Victoria	RD&E practitioner	✓	✓	✓	✓	✓	✓	✓
Jessica Henneken, Agriculture Victoria	RD&E practitioner	✓	✓	✓	✓	✓	✓	✓
Alison MacGregor, ATGA Extension Manager	RD&E practitioner (external to project) and industry representative				✓	✓	✓	✓

Glossary of economic terms

Benefit-cost ratio (BCR)	The ratio of the present value of investment benefits to the present value of investment costs.
Cost-benefit analysis (CBA)	A conceptual framework for the economic evaluation of projects and programs in the public sector. It differs from a financial appraisal or evaluation in that it considers all gains (benefits) and losses (costs), regardless of to whom they accrue.
Direct Effects	Impacts generated for the funding industry as a result of adoption of the RD&E outputs and recommendations, typically farm level outcomes relating to productivity and risk.
Discounting and Present Values	The process of relating the costs and benefits of an investment to a base year to reflect the time value of money or opportunity cost of RD&E investment. The analysis applies a real discount rate of 5% in line with CRRDC Guidelines (CRRDC 2018) with results sensitivity tested at discount rates of 2.5% and 7.5%.
Economic Equilibrium	Due to a market's underlying supply and demand curves, changes in supply will have an impact on price and vice-versa. The Economic Equilibrium is the point at which market supply and price are balanced. Estimating the magnitude of market response to changes in supply or demand is a complex and demanding task that is considered beyond the scope of most CRRDC Impact Assessments (CRRDC 2018).
Gross Margin (GM)	The difference between revenue and cost of goods sold, applied on a per hectare basis and excluding fixed or overhead costs such as labour and interest payments.
Internal rate of return (IRR)	The discount rate at which an investment has a net present value of zero, i.e. where present value of benefits = present value of costs.
Modified internal rate of return (MIRR)	The internal rate of return of an investment that is modified so that the cash inflows generated from an investment are re-invested at the rate of the cost of capital (in this case the discount rate).
Net present value (NPV)	The discounted value of the benefits of an investment less the discounted value of the costs, i.e. present value of benefits - present value of costs.
Nominal and real values	Nominal values reflect the actual values in a given year (e.g. contracted RD&E expenses). These are converted to real (inflation adjusted) values to make them comparable across time.
Spillover Effects	Impacts generated for stakeholders who did not fund the RD&E, including other agricultural industries, consumers, communities, and the environment.

Abbreviations

AVR Agriculture Victoria Research

CRRDC Council of Rural Research and Development Corporations

RD&E Research, Development and Extension

SIP Strategic Investment Plan

Qfly Queensland Fruit Fly

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