# Horticulture impact assessment program 2020-21 to 2022-23 (MT21015)

## Annex 3: Impact assessment of the project *Developing knowledge and management of strawberry red leaf disorder* (BS19001)

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# Executive summary


## What the report is about

This report presents the results of an impact assessment of a Horticulture Innovation Australia Limited (Hort Innovation) investment in *Developing knowledge and management of Strawberry Red Leaf Disorder (BS19001)*. The project was funded by Hort Innovation over the period July 2020 to June 2021.

## Methodology

The investment was first analysed qualitatively within a logical framework that included activities and outputs, outcomes, and impacts. Actual and/or potential impacts then were categorised into a triple bottom line framework. Principal impacts identified were then considered for valuation in monetary terms (quantitative assessment). Past and future cash flows were expressed in 2020-21 dollar terms and were discounted to the year 2020-21 using a real (inflation adjusted), risk free, pre-tax discount rate of 5% to estimate the investment criteria and a 5% reinvestment rate to estimate the modified internal rate of return (MIRR).

## Results/key findings

The Hort Innovation investment in Project BS19001 has contributed to the increased knowledge and understanding of Strawberry Red Leaf Disorder (RLD). While this project was unable to confirm a cause of RLD, a better understanding of the incidence, spread and economic impact on commercial strawberry producers has been developed. This research has narrowed the search for the cause of RLD and recommendations have been included to aid future research priorities.

## Investment criteria

Total funding from all sources for the project was $0.171 million (2020-21 equivalent values) with the Hort innovation investment in the project totalling $0.096 million (2020-21 equivalent values). Neither the impacts or potential impacts identified were able to be valued in monetary terms and so a full set of investment criteria were not reported as part of this impact assessment.

## Conclusions

No project impacts were valued; however, the project was successful in some of the project objectives, particularly that of building knowledge and capability on RLD to support future research.



## Keywords

Impact assessment, cost-benefit analysis, strawberry, Red Leaf Disorder, RLD

## Introduction

Evaluating the impacts of levy investments is important to demonstrate to levy payers, Government and other industry stakeholders the economic, social and environmental outcomes of investment for industry, as well as being an important step to inform the ongoing investment agenda.

The importance of ex-post evaluation was recognised through the Horticulture Innovation Australia Limited (Hort Innovation) independent review of performance completed in 2017, and was incorporated into the Organisational Evaluation Framework.

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. The assessments were required to meet the following Hort Innovation evaluation reporting requirements:

- Reporting against the Hort Innovation's Strategic Plan and the Evaluation Framework associated with Hort Innovation's Statutory Funding Agreement with the Commonwealth Government.
- Reporting against strategic priorities set out in the Strategic Investment Plan for each Hort Innovation industry fund.
- Annual Reporting to Hort Innovation stakeholders.
- Reporting to the Council of Rural Research and Development Corporations (CRRDC).

As part of its commitment to meeting these reporting requirements, Ag Econ was commissioned to deliver the *Horticulture Impact Assessment Program 2020-21 to 2022-23 (MT21015)*. This program consisted of an annual impact assessment of 15 randomly selected Hort Innovation RD&E investments (projects) each year.

Project BS19001 *Developing knowledge and management of strawberry red leaf disorder* was randomly selected as one of the 15 investments in the 2020-21 sample. This report presents the analysis and findings of the project impact assessment.

## General method

The 2020-21 population was defined as an RD&E investment where a final deliverable had been submitted in the 2020-21 financial year. This generated an initial population of 175 Hort Innovation investments, worth an estimated $101.14 million (nominal Hort Innovation investment). The population was then stratified according to the Hort Innovation RD&E research portfolios and five, pre-defined project size classes. Projects in the Frontiers Fund, and those of less than $80,000 Hort Innovation investment being removed from the sample. From the remaining eligible population of 59 projects, with a combined value of $39.51 million, a random sample of 15 projects was selected worth a total of $9.7 million (nominal Hort Innovation investment), equal to 25% of the eligible RD&E population (in nominal terms).

The impact assessment followed general evaluation guidelines that are now well entrenched within the Australian primary industry research sector including Research and Development Corporations, Cooperative Research Centres, State Departments of Agriculture, and some universities. The approach included both qualitative and quantitative descriptions that are in accord with the impact assessment guidelines of the CRRDC (CRRDC, 2018).

The evaluation process involved reviewing project contracts, milestones, and other documents; interviewing relevant Hort Innovation staff, project delivery partners, and growers and other industry stakeholders where appropriate; and collating additional industry and economic data where necessary. Through this process, the project activities, outputs, outcomes, and impacts were identified and briefly described; and the principal economic, environmental, and social impacts were summarised in a triple bottom line framework.

Some, but not all, of the impacts identified were valued in monetary terms. Where impact valuation was exercised, the impact assessment uses cost-benefit analysis as its principal tool. The decision not to value certain impacts was due either to a shortage of necessary evidence/data, a high degree of uncertainty surrounding the potential impact, or the likely low relative significance of the impact compared to those that were valued. The impacts valued are therefore deemed to represent the principal benefits delivered by the project. However, as not all impacts were valued, the investment criteria reported for individual investments potentially represent an underestimate of the performance of that investment.

# Background and rationale

## Industry background

The Australian Strawberry industry includes approximately 200 growers and had annual production of 77,752 tonnes (t) in the 2020-21 season with a farmgate value of $417 million. The fresh domestic market makes up 85% of this value (Hort Innovation 2022a)

Producers in the strawberry industry pay levies to the Department of Agriculture, Fisheries and Forestry (DAFF), which is responsible for the collection, administration and disbursement of levies and charges on behalf of Australian agricultural industries. The levy is payable on the number of strawberry runners grown and Hort Innovation manages the strawberry levy funds which are directed to R&D.

## Rationale

The research and development activities of the strawberry industry are guided by the industry's Strategic Investment Plan (SIP). The Strawberry SIP 2017-21 (under which BS19001 was delivered) was managed by Hort Innovation in consultation with Strawberries Australia and the Strategic Investment Advisory Panel and addressed the Australian strawberry industry's RD&E priorities from 2017 to 2021.

In 2014, several strawberry plants growing in commercial field beds in Southeast Queensland (SEQ), Australia, displayed a reddish/maroon interveinal discoloration and decline in plant health and yield. This new red leaf disorder (RLD) was observed to varying extents in several commercial cultivars grown during winter production. An increase in the number of commercial plants affected by RLD subsequently occurred since 2014 (Kristoffersen et al 2021).

Due to the significance of this disorder to the Australian winter production and potential importance to the national strawberry industry, RLD was identified as requiring broader investigation to support management strategies.

BS19001 was undertaken as a phase 1 research project to develop a better understanding of the causes of RLD along with informing a direction for targeted future research into RLD.

### *Alignment with the Strawberry Strategic Investment Plan 2017-2021*

The Strawberry SIP 2017-21 identified pest and disease impacts as a major challenge for the industry. Project BS19001 primarily addressed Outcome 3 of the 2017-2021 SIP: Greater skills, capacity and knowledge in the industry.

### *Alignment with National Priorities*

The Australian Government's National RD&E priorities (2015a) and Science and Research Priorities (2015b) are reproduced in Table 1. The project outcomes and related impacts contribute to RD&E Priority 2 and to Science and Research Priority 1.

**Table 1. National Agricultural Innovation Priorities and Science and Research Priorities**

| Australian Government | |
|---|---|
| **National RD&E Priorities (2015a)** | **Science and Research Priorities (2015b)** |
| 1. Advanced technology<br>2. Biosecurity<br>3. Soil, water and managing natural resources<br>4. Adoption of R&D. | 1. Food<br>2. Soil and Water<br>3. Transport<br>4. Cybersecurity<br>5. Energy and Resources<br>6. Manufacturing<br>7. Environmental Change<br>8. Health. |

# Project details

## Summary

**Table 2. Project details**

| | |
|---|---|
| **Project code** | BS19001 |
| **Title** | *Developing knowledge and management of Strawberry Red Leaf Disorder* |
| **Research organization** | Queensland Department of Agriculture & Fisheries (DAF) |
| **Project leader** | Joanna Kristoffersen and Michelle Paynter |
| **Funding period** | July 2020 to June 2021 |

## Logical framework

A logical framework is shown in Table 3 to highlight the connection between the project activities, outputs, outcomes, and impact.

**Table 3. Project logical framework**

| | |
|---|---|
| Activities | • Eight strawberry fruiting farms in the South East Queensland (SEQ) region were selected to collect data on RLD incidence and severity in the 2020 fruiting season. Farms were visited every four weeks from May to September.<br>• Farm surveys, monitoring, and yield study investigations<br>• Yield data and physiological changes to the strawberry RLD affected plants were studied along with the effect of RLD on crop yield and fruit quality in strawberry plants.<br>• Various techniques such as polymerase Chain Reaction and High Throughput Sequencing were utilised in examining of existing sequence data from RLD symptomatic and asymptomatic plants.<br>• Symptomatic plants from farms were examined for viral, bacterial, fungal pathogens and insect pests.<br>• Next-generation sequencing of DNA and RNA from the plants' halobiont (leaves including colonising microbes and herbivores).<br>• Gene expression profiling of leaves from healthy vs diseased, and RLD-free plants to determine the genes induced or repressed in the development of RLD. |
| Outputs | • Project findings and developments were communicated through various communication channels. These included presenting at Queensland Strawberry Growers Association meetings, industry newsletters, on-farm interactions, phone calls, emails and more widely in Berry journal publications.<br>• Findings were extended to industry through interactions with multiple strawberry producers, multiple government representatives, researchers, and industry affiliates nationally and internationally.<br>• Authored three articles for the national industry magazine (Australian Berries Journal) distributed to more than 650 growers and industry associates per edition.<br>• Authored one peer-reviewed manuscript. |
| Outcomes | • Industry participants have a better understanding of the incidence, spread, and economic impact on commercial strawberry producers through data collected.<br>• An increase in grower confidence in identifying RLD.<br>• Advisors and consultants are more confident in providing RLD information and advice to strawberry growers including increased information sharing and integration amongst growers and advisors.<br>• New areas of information have been discovered, that can potentially be extended through a PhD Investigation.<br>• Publications and presentations have allowed information to be readily available to key stakeholders.<br>• Although the cause of RLD was not confirmed, knowledge acquired and potential leads discovered in this phase of the project will assist Phase 2. |
| Impacts | • [Economic and Social] Increased knowledge of and research capacity relating to RLD provided a foundation for future research to build upon a better understanding of its incidence, spread, and economic impact on commercial strawberry producers. |

# Project costs

## Nominal investment

**Table 4. Project nominal investment**

| Year end 30 June | Hort Innovation ($) | DAF ($) | Total ($) |
|---|---|---|---|
| 2021 | $82,827 | $74,775 | $157,602 |
| Total | $82,827 | $74,775 | $157,602 |

## Program management costs

R&D costs should also include the administrative and overhead costs associated with managing and supporting the project. The Hort Innovation overhead and administrative costs were calculated for each project funding year based on the data presented in the *Statement of Comprehensive Income* in the *Hort Innovation Annual Report* for the relevant year. Where the overhead and administrative costs were equal to the total expenses, less the research and development and marketing expenses. The overhead and administrative costs were then calculated as a proportion of combined project expenses (RD&E and marketing), averaging 16.2% for the BS19001 funding period (2021). This figure was then applied to the nominal Hort Innovation investment shown in Table 4.

## Real Investment costs

For purposes of the investment analysis, the investment costs of all parties were expressed in 2020-21 dollar terms using the Implicit Price Deflator for Gross Domestic Product (ABS, 2022).

## Extension costs

There were no additional costs associated with BS19001 for project extension. Results were communicated to other researchers as part of the project.

# Valuation of impacts

## Impacts valued

As no cause of RLD was able to be confirmed through the project, no direct industry impact was valued.

## Impacts not valued

While no direct benefit for growers was able to be identified, the project has the potential to support future impacts by providing a foundational knowledge of RLB incidence, spread, and economic impact for future research to build upon. Given the uncertainties of the funding and timeline of future research, this benefit was not able to be quantified.

## Public versus private impacts

The impacts identified from the investment in BS19001 are predominantly public in nature in the form of capacity built in the research sector.

## Distribution of private impacts

Private economic benefits are anticipated to be captured by individual strawberry growers and supply chain participants in the event that further research is undertaken on RLD leading to management strategies and improved disease management. The total private impacts will be redistributed between growers and supply chain participants depending on both short- and long-term supply and demand elasticities.

## Impacts on other Australian industries

As RLD is specific to the strawberry industry it is unlikely any other Australian industries will benefit from the investment in BS19001.

## Impacts overseas

No significant overseas impacts from investment in BS19001 were identified, but as RLD affects strawberry industries worldwide the project findings may inform future RLD research overseas.

# Results

All cashflows were discounted to 2020-21 using a real discount rate of 5%.

## Investment criteria

As no impacts were valued, the investment criteria were limited to the Present Value of Investment Costs (PVC). The PVC was reported for the length of the project investment period plus 30 years from the last year of investment (2020-21) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

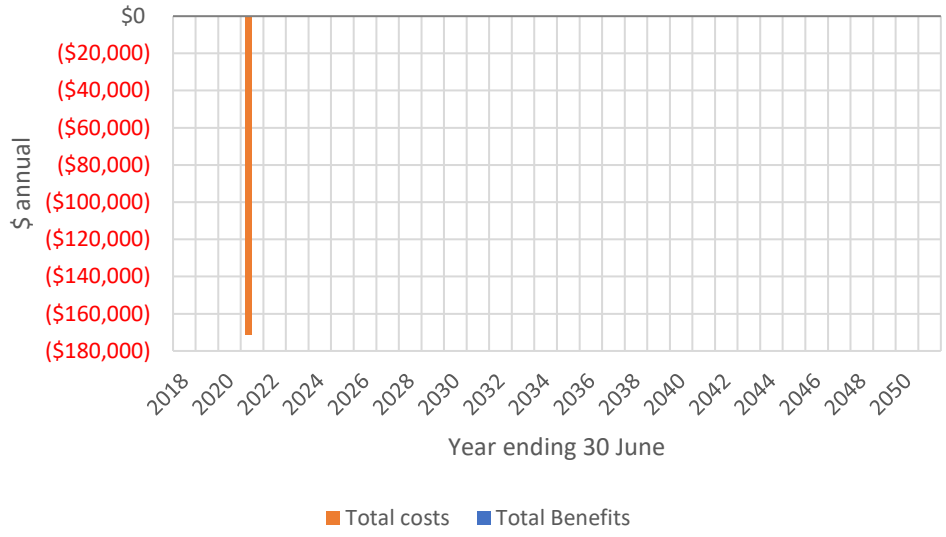
Table 5 shows the impact metrics estimated for different periods for the total investment. Hort Innovation was the only investor in BS19001.

**Table 5. Impact metrics for Total Investment in Project BS19001**

| Impact metric | Years after last year of investment | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 5 | 10 | 15 | 20 | 25 | 30 |
| **PVC** | 171,039 | 171,039 | 171,039 | 171,039 | 171,039 | 171,039 | 171,039 |

Figure 1 shows the annual undiscounted cash flows for the total investment of BS19001. Cash flows are shown for the duration of the investment plus 30 years from the last year of investment.

**Figure 1. Annual cash flow of undiscounted total benefits and total investment costs**




# Discussion and conclusions

RLD is a relatively new disease to the Australian Strawberry industry first discovered in 2014 in SEQ with very little known on its cause or management practices to control it. The main impact of work under project BS19001 has been social in nature as it has contributed to the increased knowledge and understanding of Strawberry RLD. While this project was unable to confirm a cause of RLD, a better understanding of the incidence, spread and economic impact on commercial strawberry producers has been developed. This research narrowed the search for the cause of RLD and the information generated from this work laid the foundation for subsequent research, thereby moving strawberry growers and industry closer to finding the cause of RLD. Any findings on RLD and enhanced research capacity is important to the industry as the disease continues to threaten the viability of SEQ Strawberry growers and potentially have serious implications for the national industry if not properly identified and managed.

## Acknowledgements

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## Glossary of economic terms

| | |
|---|---|
| Cost-benefit analysis | 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. |
| Benefit-cost ratio | The ratio of the present value of investment benefits to the present value of investment costs. |
| Discounting | The process of relating the costs and benefits of an investment to a base year using a stated discount rate. |
| Internal rate of return | 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 | The internal rate of return of an investment that is modified so that the cash inflows from an investment are re-invested at the rate of the cost of capital (the re-investment rate). |
| Net present value | 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. |
| Present value of benefits | The discounted value of benefits. |
| Present value of costs | The discounted value of investment costs. |

## Abbreviations

CRRDC Council of Rural Research and Development Corporations

DAFF Department of Agriculture, Fisheries and Forestry (Australian Government)

GDP Gross Domestic Product

GVP Gross Value of Production

IRR Internal Rate of Return

MIRR Modified Internal Rate of Return

PVB Present Value of Benefits

PVC Present Value of Costs

RLD Red Leaf Disorder

RD&E Research, Development and Extension

SIP Strategic Investment Plan