

Industry-specific impact assessment program: table grape

Impact assessment report for project *Biosecurity establishment for the table grape industry* (TG11001)

Impact analyst

Michael Clarke

Delivery partner:

AgEconPlus and Agtrans Research

Project code:

MT18009

Date:

8 October 2019

Disclaimer:

Horticulture Innovation Australia Limited (Hort Innovation) makes no representations and expressly disclaims all warranties (to the extent permitted by law) about the accuracy, completeness, or currency of information in this report.

Users of this report should take independent action to confirm any information in this report before relying on that information in any way.

Reliance on any information provided by Hort Innovation is entirely at your own risk. Hort Innovation is not responsible for, and will not be liable for, any loss, damage, claim, expense, cost (including legal costs) or other liability arising in any way (including from Hort Innovation or any other person's negligence or otherwise) from your use or non-use of this report or from reliance on information contained in the report or that Hort Innovation provides to you by any other means.

Funding statement:

This project has been funded by Hort Innovation, using research and development levies and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

Publishing details:

Published and distributed by: Hort Innovation

Level 7

141 Walker Street

North Sydney NSW 2060

Telephone: (02) 8295 2300

www.horticulture.com.au

© Copyright 2019 Horticulture Innovation Australia

Contents

Contents	3
Executive Summary	4
Keywords	4
Introduction.....	5
General Method	5
Background & Rationale.....	6
Project Details	7
Project Investment	8
Impacts	9
Valuation of Impacts	10
Results	12
Conclusion	14
Glossary of Economic Terms	15
Reference List.....	16
Acknowledgements	17
Abbreviations	17

Tables

Table 1: Logical Framework for Project TG11001	7
Table 2: Annual Investment in the Project TG11001 (nominal \$)	8
Table 3: Triple Bottom Line Categories of Principal Impacts from Project TG11001	9
Table 4: Australian Government Research Priorities	9
Table 5: Summary of Assumptions	12
Table 6: Investment Criteria for Total Investment in Project TG11001.....	12
Table 7: Sensitivity to Discount Rate	13
Table 8: Sensitivity to Probability of Pierce’s Disease Incursion	13
Table 9: Sensitivity to Probability of Pierce’s Disease Outbreak	14
Table 10: Confidence in Analysis of Project.....	14

Figures

Figure 1: Annual Cash Flow of Undiscounted Total Benefits and Total Investment Costs.....	13
---	----

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 *TG11001: Biosecurity establishment for the table grape industry*. The project was funded by Hort Innovation over the period August 2011 to June 2014.

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 2017/18 dollar terms and were discounted to the year 2018/19 using a 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

Investment in TG11001 has resulted in the Australian table grape industry becoming a member of Plant Health Australia (PHA), signing the Emergency Plant Pest Response Deed and striking a biosecurity levy that will be set at zero until required. As a consequence of these project related outcomes it is likely that the table grape industry will experience reduced costs in the event of an emergency plant pest incident. This impact has been quantified in the analysis. Additional unquantified social impacts are expected and include increased capacity (table grape growers, ATGA, government and PHA) and an increase in income in regional areas where table grapes are grown.

Investment Criteria

Total funding from all sources for the project was \$0.30 million (present value terms). All project funding was provided by Hort Innovation. The investment produced estimated total expected benefits of \$1.53 million (present value terms). This gave a net present value of \$1.23 million, an estimated benefit-cost ratio of 5.2 to 1, an internal rate of return of 28% and a MIRR of 11%.

Conclusions

Two social impacts were not valued. When inability to value all impacts is combined with conservative assumptions for the principal economic impact valued, it is reasonable to conclude that the valuation may be an underestimate of the actual performance of the investment.

Keywords

Impact assessment, cost-benefit analysis, TG11001, table grape, biosecurity, Plant Health Australia, Exercise Tortrix, simulation pest incursion, EPPRD.

Introduction

All research and development (R&D) and marketing levy investments undertaken by Horticulture Innovation Australia Limited (Hort Innovation) are guided and aligned to specific investment outcomes, defined through a Strategic Investment Plan (SIP). The SIP guides investment of the levy to achieve each industry's vision. The current industry SIPs apply for the financial years 2016/17 – 2020/21.

In accordance with the Organisational Evaluation Framework, Hort Innovation has the obligation to evaluate the performance of its investment undertaken on behalf of industry.

This impact assessment program addresses this requirement through conducting a series of industry-specific ex-post independent impact assessments of the apple & pear (AP), avocado (AV), mushroom (MU) and table grape (TG) RD&E investment funds.

Twenty-seven RD&E investments (projects) were selected through a stratified, random sampling process. The industry samples were as follows:

- Nine AP projects were chosen worth \$15.46 million (nominal Hort Innovation investment) from an overall population of 19 projects worth an estimated \$33.31 million,
- Seven AV projects worth \$1.91 million (nominal Hort Innovation investment) from an overall population of 27 projects worth approximately \$9.97 million,
- Five MU projects worth \$1.75 million (nominal Hort Innovation investment) from a total population of 20 projects worth \$7.94 million, and
- Six TG projects worth \$2.84 million (nominal Hort Innovation investment) from an overall population of 11 projects worth \$5.0 million.

The project population for each industry included projects where a final deliverable had been submitted in the five-year period from 1 July 2013 to 30 June 2018.

The projects for each industry sample were chosen such that the investments represented (1) at least 10% of the total Hort Innovation RD&E investment expenditure for each industry, and (2) the SIP outcomes (proportionally) for each industry.

Project *TG11001: Biosecurity establishment for the table grape industry* was randomly selected as one of the 22 unique MT18009 investments and was analysed in this report.

General Method

The impact assessment follows 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 includes both qualitative and quantitative descriptions that are in accord with the impact assessment guidelines of the CRRDC (CRRDC, 2018).

The evaluation process involved identifying and briefly describing project objectives, activities and outputs, outcomes, and impacts. The principal economic, environmental and social impacts were then summarised in a triple bottom line framework.

Some, but not all, of the impacts identified were then 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 & Rationale

Background

The Australian table grape industry consists of approximately 1,000 growers producing 175,900 tonnes of fresh table grapes per year (3 year average 2016 to 2018). Most table grapes are grown in the Sunraysia Region of Victoria on small to medium sized farms. Table grapes are also grown in NSW, South Australia, Western Australia, the Northern Territory and Queensland. Major table grape varieties include white Menindee and Thompson, red Crimson, Flame and Globe and black Autumn Royal and Pione (Hort Innovation, 2018).

Table grapes are harvested from December to May and imports, mostly from the United States (US), are available July to November. Small quantities of table grapes are also imported from Mexico, China and South Korea. Chile is also able to send table grapes to Australia and an application from Japan was pending in 2014 (Scott, 2014).

The Australian Table Grape Association (ATGA) represents growers nationally. ATGA provides a platform for industry members to collectively respond to industry wide issues, deliver research and marketing, share knowledge, and interact with government and other stakeholders (ATGA website, accessed May 2019).

Growers pay a levy of one cent per kilogram for table grapes produced in Australia. The levy is managed by Hort Innovation which directs funds to table grape R&D (50% of collected levies) and marketing programs (50% of collected levies). Typically the levy raises \$1.8 million per annum. Funds allocated to R&D are matched by the Australian Government.

Plant Health Australia (PHA) is the not-for-profit company that acts as the national coordinator of the government-industry partnership for plant biosecurity in Australia. PHA services the needs of member industries and independently advocates on behalf of the national plant biosecurity system (PHA website, accessed June 2019).

Rationale

Biosecurity is a critical issue for the Australian table grape industry. An exotic pest incursion with the capacity to reduce yield, increase cost and shut growers out of markets can occur at any time. As travel and trade increases and overseas producers seek entry to the Australian market, the risk of a pest incursion increases.

Domestic biosecurity is also an issue requiring investment. Movement of grapes between states and territories has increased and presents a biosecurity risk. Interstate protocols need review and additional monitoring is required to achieve consistency between states. Research in partnership with state governments is critical to maintaining and developing sound biosecurity policy and procedures.

Table grape industry leaders have decided that the industry needs to be an active member of PHA and to participate in decision-making affecting vine health. In the event of an exotic pest incursion, a PHA supported plan would be used to coordinate government and industry response and minimise the impact of a pest.

TG11001 was not the first attempt to improve grape industry biosecurity systems, for example:

- TG06029 *Establishment of Emergency Plant Pest Response Deed*, June 2007 to May 2008;
- TG08001 *Domestic market access for table grapes*, November 2008 to September 2010; and
- TG08012 *Biosecurity establishment for the table grape industry*, March 2009 to May 2011.

TG11001 builds on these previous initiatives.

Project Details

Summary

Project Code: TG11001
 Title: *Biosecurity establishment for the table grape industry*
 Research Organisation: ATGA
 Principal Investigator: Jeff Scott
 Period of Funding: August 2011 to June 2014

Objectives

The objective of this project was to ensure that the table grape industry was an active member of PHA and through that membership improve industry consultation and participation in the planning and coordination of biosecurity policies, programs and research. Through these actions the table grape industry would be better prepared and minimise the cost of an exotic pest incursion.

TG11001 was to provide resources for the table grape industry so that it is able to provide input into both state and national vine health initiatives and contribution to various state biosecurity committees especially the Victorian Biosecurity Committee and the National Biosecurity Committee.

There are many hundreds of exotic pests and it is impractical to develop response plans for every pest, host combination. By working with PHA, TG11001 would be used to develop a step process for preparedness, so that in the event of an exotic pest incursion, principles would be in place to prevent the spread of the pest until further decisions were made.

Logical Framework

Table 1 provides a description of TG11001, Biosecurity establishment for the table grape industry, in a logical framework.

Table 1: Logical Framework for Project TG11001

<p>Activities and Outputs</p>	<ul style="list-style-type: none"> • ATGA becomes a member of PHA and a signatory of the Emergency Plant Pest Response Deed (EPPRD). Being a signatory of the Deed affords the table grape industry a say in the categorisation and response to all pest or disease incursions affecting table grapes. • Table grape growers were made aware of EPPRD signatory status, the benefits afforded by the EPPRD and the need to establish a biosecurity levy to part fund emergency plant pest response. Subsequently the levy was established and struck at zero until funds are needed to combat a specific emergency response. There were no emergencies during the project period. • Formation and development of a strategic plan with other vine industries for the Victorian Viticulture Biosecurity Committee (VVBC). One of AVVBC’s priorities was the harmonisation of all interstate grape and vine entry requirements. Progress with this priority was hampered by the lack of equivalent organisations in other states and territories. Late in the delivery of TG11001, the National Viticulture Biosecurity Committee (NVBC) was re-established with funding support from Wine Australia. The reactivation of the NVBC should assist with the realisation of VVBC priorities. • ATGA participation in both the VVBC and the NVBC through TG11001 has assisted with efforts to provide Qfly pest-free area status to both the Riverland and Sunraysia. • ATGA worked with the Department of Agriculture and Water Resources (DAWR) Plant Health to understand and respond to the biosecurity implications of overseas country applications to access the Australian market. The project contributed a list of pest and disease concerns and suggested response measures. • Formulation of a plan with PHA to manage an exotic pest incursion. The plan
-------------------------------	---

	<p>addressed overall operational and organisational protocols and responsibilities for industry and government as defined by PLANTPLAN (The Australian Emergency Plant Pest Response Plan, current edition 30 November 2018).</p> <ul style="list-style-type: none"> • The plan includes technical guidelines for use by entomologists, plant pathologists, quarantine agencies and industry to manage a pest incursion. • ATGA worked with PHA to review the Viticulture Industry Biosecurity Plan including the threat summary tables (exotic pest listings). Additional exotic pests relevant to the grape industries were identified and all pests were rated against their potential for entry, establishment, spread, and economic impact. A list of High Priority Pests was subsequently prepared and published on the PHA website. • To accompany the revised Viticulture Industry Biosecurity Plan a User’s Manual was prepared for on-farm managers. A copy of the plan and user’s manual was distributed to growers and grower advisors. • ATGA participated in the conduct of an exercise with DAWR Plant Health, the wine grape and dried grape industries to simulate an incursion of the exotic Tortrix moth. In preparation for the exercise ATGA staff were trained in biosecurity response. • As a consequence of the project, the table grape industry has had Input and achieved ownership of biosecurity policy, planning and research undertaken by PHA and state biosecurity committees. • Plans are in place to manage an exotic pest incursion and a ‘worked example’ focuses on a high priority pest. • Biosecurity information has been disseminated to table grape industry stakeholders via workshop presentations, published media and the national website.
Outcomes	<ul style="list-style-type: none"> • Increased involvement of the table grapes industry with preparedness for emergency plant pest incursions.
Impacts	<ul style="list-style-type: none"> • Potential for reduced costs associated with an emergency plant pest or disease incursion on the table grape industry due to increased preparedness to respond to an outbreak in a more timely and efficient manner. • Improved capacity to respond to pest and disease pest outbreaks – growers, ATGA, government and PHA. • Increase in income in regional Australia associated with a more profitable and sustainable table grape industry.

Project Investment

Nominal Investment

Table 2 shows the annual investment (cash and in-kind) in project TG11001 by Hort Innovation. There were no ‘other’ investors in this project.

Table 2: Annual Investment in the Project TG11001 (nominal \$)

Year ended 30 June	Hort Innovation (\$)	Other (\$)	Total (\$)
2012	60,000	0	60,000
2013	60,000	0	60,000
2014	60,000	0	60,000
Totals	180,000	0	180,000

Program Management Costs

For the Hort Innovation investment the cost of managing the Hort Innovation funding was added to the Hort Innovation contribution for the project via a management cost multiplier (1.162). This multiplier was estimated based on the share of ‘payments to suppliers and employees’ in total Hort Innovation expenditure (3-year average) reported in the Hort Innovation’s Statement of Cash Flows (Hort Innovation Annual Report, various years). This multiplier was then applied to the nominal investment by Hort Innovation shown in Table 2.

Real Investment and Extension Costs

For the purposes of the investment analysis, investment costs of all parties were expressed in 2017/18 dollar terms using the GDP deflator index. There were no additional costs associated with project extension. The outputs of the project, including *Biosecurity Manual for the Viticulture Industry: reducing the risk of new pests impacting your vineyard version 1.0*, were provided to growers as part of the project. Project results were also communicated through the final report, relevant industry magazines and the industry’s annual conference.

Impacts

Table 3 provides a summary of the principal types of impacts delivered by the project. Impacts have been categorised into economic, environmental and social impacts.

Table 3: Triple Bottom Line Categories of Principal Impacts from Project TG11001

Economic	<ul style="list-style-type: none">• Potential for reduced costs associated with an emergency plant pest or disease incursion on the table grape industry due to increased preparedness to respond to an outbreak in a more timely and efficient manner.
Environmental	<ul style="list-style-type: none">• Nil.
Social	<ul style="list-style-type: none">• Improved capacity to respond to pest and disease pest outbreaks – growers, ATGA, government and PHA.• Increase in income in regional Australia associated with a more profitable and sustainable table grape industry.

Public versus Private Impacts

Impacts identified in this evaluation are mostly private in nature. Private benefits will be realised by table grape growers via reduced costs associated with an emergency plant pest or disease incursion. Public benefits will include increased capacity (table grape growers, ATGA, government and PHA) as well as an increase in income in regional Australia associated with a more profitable and sustainable industry.

Distribution of Private Impacts

The impacts on the table grape industry from investment in this project will be shared along the supply chain with input suppliers, growers, grower advisors, transporters, wholesalers, table grape importers, retailers and consumers all sharing impacts produced by the project. The share of impact retained by each link in the supply chain will depend on ruling supply and demand elasticities.

Impacts on Other Australian Industries

Improved biosecurity in the Australian table grape industry is also relevant to the wine grape and table grape industries. Earlier detection and management of a number of high priority table grape pests also mitigates costs in other industries where these pests will be problematic e.g. the glassy-winged sharpshooter is a pest of table grapes, wine grapes, dried grapes, blueberries, cherries, citrus, production nurseries and summerfruit.

Impacts Overseas

Project contributions to the identification of pests and diseases of concern to Australian table grape growers that may be present on imported table grapes, will lead to management strategies in exporting countries that ensure a long term sustainable trade.

Match with National Priorities

The Australian Government’s Science and Research Priorities and Rural RD&E priorities are reproduced in Table 4. The project findings and related impacts will contribute to Rural RD&E priority 2 and Science and Research Priority 1.

Table 4: Australian Government Research Priorities

Australian Government	
Rural RD&E Priorities (est. 2015)	Science and Research Priorities (est. 2015)
<ol style="list-style-type: none"> 1. Advanced technology 2. Biosecurity 3. Soil, water and managing natural resources 4. Adoption of R&D 	<ol style="list-style-type: none"> 1. Food 2. Soil and Water 3. Transport 4. Cybersecurity 5. Energy and Resources 6. Manufacturing 7. Environmental Change 8. Health

Sources: (DAWR, 2015) and (OCS, 2015)

Alignment with Table Grape Strategic Investment Plan 2017-2021

The strategic outcomes and strategies of the table grape industry are outlined in the Table Grape Strategic Investment Plan 2017-2021¹ (Hort Innovation, 2016). Project TG11001 addressed Table Grape SIP Outcome 3, Strategy 3.2.

Valuation of Impacts

Impacts Valued

Analyses were undertaken for total benefits that included future expected benefits. A degree of conservatism was used when finalising assumptions, particularly when some uncertainty was involved. Sensitivity analyses were undertaken for those variables where there was greatest uncertainty or for those that were identified as key drivers of the investment criteria.

A single impact was valued – reduced costs associated with an emergency plant pest incident.

Impacts Not Valued

Not all of the impacts identified in Table 3 could be valued in the assessment. Two social impacts were hard to value due to lack of evidence/data, difficulty in quantifying the causal relationship and the pathway between TG11001 and the impact and the complexity of assigning monetary values to the impact.

The impacts identified but not valued were:

- Improved capacity to respond to pest and disease pest outbreaks – growers, ATGA, government and PHA.
- Increase in income in regional Australia associated with a more profitable and sustainable table grape industry.

Valuation of Impact: Reduced Costs Associated With an Emergency Plant Pest Incident

The signing of the EPPRD, the striking of a biosecurity levy and involvement in other PHA activities has a number of potential positive impacts for the table grape industry. Overall, these impacts will contribute to the possibility of a reduced cost of emergency plant pests and diseases on the Australian table grape industry. PHA has identified a number of benefits of the EPPRD and a biosecurity levy these include:

- The direct involvement of the industry in decision-making from the outset of an emergency.
- Involvement of senior people with authority to commit to actions and funding decisions.
- A consistent and agreed national approach for managing incursions.
- The removal of disincentives to report suspicion of pests and diseases.
- Wider commitment to risk mitigation by all parties.
- Maintenance of a reserve of trained personnel and technical expertise, with trained and accredited personnel being required to be involved in the emergency plant pest responses wherever possible.

¹ For further information, see: <https://www.horticulture.com.au/hort-innovation/funding-consultation-and-investing/investment-documents/strategic-investment-plans/>

The Biosecurity Manual for the Viticulture Industry produced as part of the project and the Viticulture Industry Biosecurity Plan identify the top ranked threats to the viticulture industry. There are three threats that are considered high risk (when considering factors such as entry potential, establishment potential, spread potential and economic impact). These were Pierce's disease, Black rot and the Glassy-winged sharpshooter (GWSS which is a vector for Pierce's disease). For all three of these pests, the entry potential is rated as high, which is defined as 'pest entry is very likely or certain'.

The impact of Pierce's disease on South Australia if it were to become established was estimated by Wittwer, McKirdy and Wilson (2006). The study was focused on a hypothetical outbreak in the Barossa Valley and used a general equilibrium model to analyse the regional and national economic impact on the grape and wine industry, including downstream impact on wine producers. This estimate was \$135 million (net present value). The scenario was assumed to affect 10 wine grape properties totalling 150 ha and the response necessitated complete removal of all vines on these properties, with the properties being placed under quarantine until the disease was eliminated. In addition, all vines within a 10 km radius were subject to additional spraying to restrict the vectors of Pierce's disease. It was assumed that after 5 years the pathogen is eradicated and affected properties are removed from quarantine.

As the disease is common to all grape varieties (wine, table and dried) an outbreak will affect all three industries. The only difference is impact between the industries will be related to in which region the outbreak occurs and what are the dominant varieties grown in that region.

It is assumed that the probability of an incursion of Pierce's disease is high, with an annual probability of 50%. It is further assumed that there is an annual probability of that incursion leading to an outbreak of the scale described by Wittwer et al. (2006) of 5%.

By table grapes becoming a signatory to the EPPR, establishing a biosecurity levy and being an active member of PHA, it is assumed that this probability can be reduced to 4%. This is because the industry being involved in this way can lead to increased probability of eradication due to improved detection, awareness and a more professional, faster and efficient response.

The small assumed impact (shift of probability from 5% to 4%) is in recognition of the fact that the wine grapes industry and other horticultural crops would already share a large burden of the disease prevention measures.

Attribution

TG09011 is not the table grape industry's first foray into establishment of biosecurity systems with PHA. Other projects including TG06029 (Establishment of EPPRD) and TG08012 (Biosecurity establishment for the table grape industry) have laid much of the groundwork. Consequently a modest attribution factor of 30% has been assigned.

Counterfactual

If project TG09011 had not been delivered it is possible that the table grape industry would still have joined PHA and this is estimated by the analyst to be 50% likely.

Summary of Assumptions

A summary of the key assumptions made for valuation of the impacts is shown in Table 5.

Table 5: Summary of Assumptions

Variable	Assumption	Source/Comment
Impact: Reduced Costs Associated with an Emergency Plant Pest Incident		
Cost to Australia of a moderate Pierce's disease outbreak.	\$135 million (present value)	Wittwer et al., 2006.
Annual probability of Pierce's disease incursion	50%	Analyst estimate based on risk ratings provided in Viticulture Industry Biosecurity Plan. NB: Pierce's disease is caused by <i>Xylella fastidiosa</i> ; this is the industry's number one exotic plant pest – see http://www.agriculture.gov.au/pests-diseases-weeds/plant
Given an incursion, annual probability of Pierce's disease outbreak of assumed scale without TG11001 investment.	5%	Analyst estimate after considering Wittwer et al., 2006.
Given an incursion, annual probability of Pierce's disease outbreak of assumed scale with TG11001 investment.	4%	Analyst estimate after considering Wittwer et al., 2006.
Attribution factor.	30%	Analyst estimate – prior explanation.
Counterfactual	50%	Analyst estimate – prior explanation.
Year of first impact.	2016/17	Three years after TG11001 completion – time is required for systems to be established and 'ramped up' on-farm.

Results

All costs and benefits were discounted to 2018/19 using a discount rate of 5%. A reinvestment rate of 5% was used for estimating the Modified Internal Rate of Return (MIRR). The base analysis used the best available estimates for each variable, notwithstanding a level of uncertainty for many of the estimates. All analyses ran for the length of the project investment period plus 30 years from the last year of investment (2013/14) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

Investment Criteria

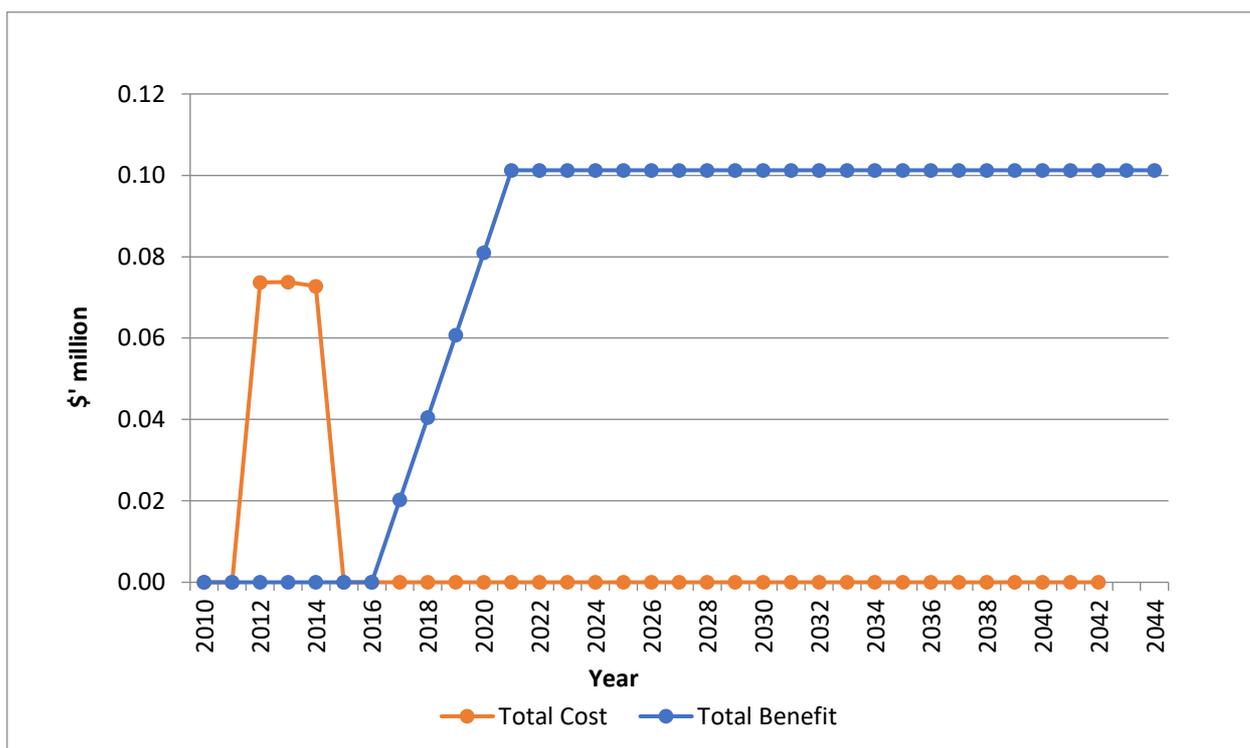
Table 6 shows the investment criteria estimated for different periods of benefit for the total investment. Hort Innovation was the only contributor to this project so there is no second set of analyses showing results for Hort Innovation.

Table 6: Investment Criteria for Total Investment in Project TG11001

Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Benefits (\$m)	0	0.13	0.54	0.89	1.16	1.37	1.53
Present Value of Costs (\$m)	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Net Present Value (\$m)	-0.30	-0.17	0.24	0.59	0.86	1.07	1.24
Benefit-Cost Ratio	0	0.43	1.84	3.01	3.92	4.63	5.19
Internal Rate of Return (%)	negative	negative	19.9	26.6	27.9	28.3	28.4
MIRR (%)	negative	negative	13.5	14.6	13.5	12.4	11.4

The annual undiscounted benefit and cost cash flows for the total investment for the duration of TG11001 investment plus 30 years from the last year of investment are shown in Figure 1.

Figure 1: Annual Cash Flow of Undiscounted Total Benefits and Total Investment Costs



Sensitivity Analyses

A sensitivity analysis was carried out on the discount rate. The analysis was performed for the total investment and with benefits taken over the life of the investment plus 30 years from the last year of investment. All other parameters were held at their base values. Table 7 present the results. The results are moderately sensitive to the discount rate. At a 10% discount rate project costs exceed project benefits.

Table 7: Sensitivity to Discount Rate
(Total investment, 30 years)

Investment Criteria	Discount rate		
	0%	5%	10%
Present Value of Benefits (\$m)	2.63	1.53	1.03
Present Value of Costs (\$m)	0.22	0.30	0.39
Net Present Value (\$m)	2.41	1.24	0.64
Benefit-cost ratio	11.96	5.19	2.63

A sensitivity analysis was then undertaken for the assumed probability of a Pierce’s disease incursion due to TG11001 and participation in PHA activities. At a 25% chance of incursion, project benefits continue to exceed project costs – Table 8.

Table 8: Sensitivity to Probability of Pierce’s Disease Incursion
(Total investment, 30 years)

Investment Criteria	Annual Probability of Pierce’s Disease Incursion		
	25%	50% (base)	75%
Present Value of Benefits (\$m)	0.77	1.53	2.30
Present Value of Costs (\$m)	0.30	0.30	0.30
Net Present Value (\$m)	0.47	1.24	2.00
Benefit-cost ratio	2.6	5.19	7.79

A final sensitivity test examined the assumed change in probability of a Pierce’s disease outbreak with TG11001 and participation in PHA activities. The base assumption of a 1% (5% less 4%) reduction in outbreak probability was tested at 0.25% and 2%. Even at the lower level of assumed change in probability, project benefits continue to exceed project costs project benefits – Table 9.

Table 9: Sensitivity to Probability of Pierce’s Disease Outbreak
(Total investment, 30 years)

Investment Criteria	Annual Probability of Pierce’s Disease Outbreak		
	0.25%	1% (base)	2%
Present Value of Benefits (\$m)	0.38	1.53	3.07
Present Value of Costs (\$m)	0.30	0.30	0.30
Net Present Value (\$m)	0.08	1.24	2.77
Benefit-cost ratio	1.30	5.19	10.38

Confidence Rating

The results produced are highly dependent on the assumptions made, some of which are uncertain. There are two factors that warrant recognition. The first factor is the coverage of benefits. Where there are multiple types of benefits it is often not possible to quantify all the benefits that may be linked to the investment. The second factor involves uncertainty regarding the assumptions made, including the linkage between the research and the assumed outcomes.

A confidence rating based on these two factors has been given to the results of the investment analysis (Table 10). The rating categories used are High, Medium and Low, where:

- High: denotes a good coverage of benefits or reasonable confidence in the assumptions made
- Medium: denotes only a reasonable coverage of benefits or some uncertainties in assumptions made
- Low: denotes a poor coverage of benefits or many uncertainties in assumptions made

Table 10: Confidence in Analysis of Project

Coverage of Benefits	Confidence in Assumptions
High	Medium-high

Coverage of benefits was assessed as high: the major benefit, reduced cost of an emergency plant pest incident was quantified.

Confidence in assumptions was rated as medium–high: data drew on a comprehensive analysis of the impact of Pierce’s disease on grape production (Wittwer et al., 2006).

Conclusion

Investment in TG11001 has resulted in the Australian table grape industry becoming a member of Plant Health Australia (PHA), signing the Emergency Plant Pest Response Deed and striking a biosecurity levy that will be set at zero until required. As a consequence of these project-related outcomes it is likely that the table grape industry will experience reduced costs in the event of an emergency plant pest incident. This impact has been quantified in the analysis. Additional unquantified social impacts are expected and include increased capacity (table grape growers, ATGA, government and PHA) and an increase in income in regional areas where table grapes are grown.

Two social impacts were not valued. When inability to value all impacts is combined with conservative assumptions for the principal economic impacts valued, it is reasonable to conclude that the valuation may be an underestimate of the actual performance of the investment.

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.
Investment criteria:	Measures of the economic worth of an investment such as Net Present Value, Benefit-Cost Ratio, and Internal Rate of Return.
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.

Reference List

- Council of Rural Research and Development Corporations. (2018). Cross-RDC Impact Assessment Program: Guidelines. Canberra: Council of Rural Research and Development Corporations. Retrieved from http://www.ruralrdc.com.au/wp-content/uploads/2018/08/201804_RDC-IA-Guidelines-V.2.pdf
- Department of Agriculture and Water Resources. (2015). Agricultural Competitiveness White Paper. Canberra: Commonwealth of Australia. Retrieved from <http://agwhitepaper.agriculture.gov.au/SiteCollectionDocuments/ag-competitiveness-white-paper.pdf>
- Hort Innovation (2016) Table Grape Industry Strategic Investment Plan 2017-2021. Retrieved from <https://www.horticulture.com.au/globalassets/hort-innovation/levy-fund-financial-and-management-documents/sip-pdfs-new/hortinnovation-sip-table-grape-2017-2021.pdf>
- Hort Innovation (2018) Australian Horticulture Statistics Handbook, 2017/18. Retrieved from <https://www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/australian-horticulture-statistics-handbook/>.
- Office of the Chief Scientist. (2015). Strategic Science and Research Priorities. Canberra: Commonwealth of Australia. Retrieved from http://www.chiefscientist.gov.au/wp-content/uploads/STRATEGIC-SCIENCE-AND-RESEARCH-PRIORITIES_181214web.pdf
- PHA Factsheet (undated) Glassy Winged Sharpshooter <http://www.planthealthaustralia.com.au/wp-content/uploads/2013/11/Glassy-winged-sharpshooter-FS-Viticulture.pdf>
- Scott, J (2014) Biosecurity Establishment for the Table Grape Industry, TG11001 Final Project Report. Report prepared for Hort Innovation
- Viticulture Industry Biosecurity Plan (2009) <https://vinehealth.com.au/industry/plans-and-policies/viticulture-industry-biosecurity-plan/>
- Wittwer, G., McKirdy, S., and Wilson R. (2006) "Analysing a Hypothetical Pierce's Disease Outbreak in South Australia using a Dynamic CGE Approach. Centre of Policy Studies General Working Paper No. G-162, Monash University.

Acknowledgements

AgEconPlus and Agtrans Research would like to thank all the project and program personnel associated with Horticulture Innovation Australia Limited that were involved in the evaluation process. Their cooperation and feedback throughout the evaluation process contributed significantly to this report.

Specific acknowledgements:

Jeff Scott, General Manager, ATGA

Abbreviations

ATGA	Australian Table Grape Association
CRRDC	Council of Research and Development Corporations
DAWR	Department of Agriculture and Water Resources (Australian Government)
EPPRD	Emergency Plant Pest Response Deed
GVP	Gross Value of Production
IRR	Internal Rate of Return
MIRR	Modified Internal Rate of Return
NVBC	National Viticulture Biosecurity Committee
OCS	Office of Chief Scientist Queensland
PHA	Plant Health Australia
PVB	Present Value of Benefits
RDC	Research and Development Corporation
R&D	Research and Development
RD&E	Research, Development and Extension
SIP	Strategic Investment Plan
VVBC	Victorian Viticulture Biosecurity Committee