Delivery partner resource

Horticulture Impact Assessment Program

BS17000 – National Strawberry Varietal Improvement Program (2017-2022) – Impact Assessment

June 2025

Hort Innovation Disclaimer:

ACIL Allen Reliance and disclaimer

Funding statement:

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BS17000 National Strawberry Varietal Improvement Program (2017-2022)

Executive Summary

BS17000 aimed to improve the profitability, sustainability, and competitiveness of the Australian strawberry industry by developing locally adapted varieties for temperate, subtropical, and mediterranean climates. Led by Queensland Department of Agriculture and Fisheries (QDAF) and co-funded by Hort Innovation, the five-year, $10.14 million investment (2018–19 to 2022–23) produced 6 new varieties and embedded genomic and marker-assisted selection into the breeding process, improving R&D efficiency.

The project resulted in the commercialisation of several varieties, including *Susie-ASBP* and *Stella-ASBP* (subtropical), *Tahli-ASBP* and *Tamara-ASBP* (temperate varieties), though uptake varied. While *Susie-ASBP* showed strong fruit quality but inconsistent yield across farms, *Stella-ASBP* began broader commercial trials in 2024 with early grower feedback proving positive. Adoption of the temperate varieties appears to have dropped off, with stakeholders reporting limited ongoing use.

Beyond variety development, the project significantly strengthened the breeding program's capacity by embedding genomic prediction and marker-assisted selection, accelerating future R&D and improving varietal targeting. These technical improvements are expected to underpin the long-term success of the breeding program, with ASBP-developed varieties forecast to make up 65% of commercial strawberry plantings in Australia by 2025.

The investment has a nominal cost of $8,817,258, funded by Hort Innovation and QDAF. Economic analysis found a modest positive return, with a Net Present Value (NPV) of $0.3 million and a Benefit-Cost Ratio (BCR) of 1.03 over 30 years using a 5% discount rate. The return on Hort Innovation's share of investment was proportionate, with an NPV of $0.16 million and a BCR of 1.03. Sensitivity testing revealed that outcomes were highly responsive to adoption rates and confidence in expected benefits. Under high adoption scenarios, the NPV increased to $6.78 million with a BCR of 1.67, while low adoption resulted in a negative NPV.

While not all varieties achieved sustained commercial uptake, BS17000 delivered enduring value by modernising Australia's strawberry breeding capabilities and laying the foundation for more resilient, productive, and market-aligned varieties in future phases. The outcomes directly support the Berry Strategic Investment Plan 2022–2026, particularly in driving innovation and improving industry profitability and sustainability.

Context, objective, and details of investment

In 2023-24, over 80,000 tonnes of strawberries were produced in Australia with a value of $507.5 million.[1] Queensland and Victoria are the main strawberry growing states, making up around 75% of Australia's domestic production.[2] The majority of strawberries grown in Australia are purchased and consumed

[1] Hort Innovation. Australian Horticulture Statistics Handbook 2023/24. https://www.horticulture.com.au/contentassets/a36fdfa2427d4ad284c426663b06f15c/hort-innovation-ahsh-2023-24-fruit-r2.pdf

[2] Neal, J. 2025, February 24-27. *Cultivating Success: The strategy and impact of the Australian Strawberry Breeding Program* [Slide 3]. Berry Quest International, West Point Hotel, Hobart. Tasmania. https://drive.google.com/open?id=1QDtvJfT-9oWUOVUTGYnc-nKK8SbeHKNO&usp=drive_fs

domestically. Australia's strawberry export market makes up about only 2% of the total domestic production.[3]

BS17000 aimed to develop and commercialise strawberry varieties adapted to mediterranean, subtropical, and temperate production regions. The objective of producing new strawberry varieties was optimising profitability, sustainability and consumer satisfaction for the 3 climate regions. Australia's strawberry varieties used for growing have historically been imported from overseas countries. This has meant the growing environments and consumer preferences have differed to Australia. Each region's local industry was consulted in developing locally sourced and adapted strawberry varieties that meet Australian consumer and environmental requirements The strategy used in this project was developed in BS12021, and it expanded upon this through the inclusion of genomic prediction techniques and marker-assisted selection methodologies.

High temperatures reduce flowering and fruiting in strawberries, as well as the plants' ability to photosynthesise, which can cause yellowing or wilting in the leaves. Also, strawberries that are exposed to temperatures higher than recommended can be prone to sunburn and damage, negatively impacting the shelf life. Certain strains of fungi also thrive in high temperatures and can cause disease in strawberry plants. Part of the breeding strategy included developing the varieties to have improved resistance to certain strawberry plant diseases such as crown wilt diseases.

Observed consumer preferences for good flavour, appearance and shelf life influenced the genetic breeding of strawberries. In addition to this, strawberries that expressed greater disease or weather tolerant traits were selected for breeding. The crosses that resulted from breeding were intended to improve specific key traits required for each region whilst maintaining its existing quality.

The varieties that have been quantified in the final report are Tamara-ASBP, Tahli-ASBP, Stella-ASBP, and Susie-ASBP. 2 subtropical varieties ('SB17-230-ASBP' and 'SW20-317-ASBP'), and the 2 Mediterranean varieties (still in trial and awaiting industry feedback) were not commercialised at the time of writing the final report and have therefore been excluded from any benefit realisation.

Alignment with Strategic Investment Plan

Project BS17000 supported the Strawberry Strategic Investment Plan (SIP) 2017–2021[4] by directly contributing to Outcome 3: Increased Farm Productivity. Through the development and commercialisation of new strawberry varieties tailored to Australia's temperate, subtropical, and Mediterranean regions, the project helped improve marketable yield, fruit quality, and resilience to disease and climatic variability. By embedding genomic prediction and marker-assisted selection into the breeding process, BS17000 accelerated varietal development and enhanced the long-term efficiency and impact of the national strawberry breeding program. Strong grower engagement and on-farm trials supported knowledge transfer and adoption, aligning with Outcome 4: Improved Industry Engagement and Services. Overall, BS17000 laid a foundation for a more productive, resilient, and consumer-focused Australian strawberry industry.

[3] Hort Innovation. Strawberry Annual Investment Plan 2022/23. https://www.horticulture.com.au/globalassets/hort-innovation/levy-fund-financial-and-management-documents/annual-investment-plans-pdfs-202223/hort-innovation-aip-2022-23-strawberry.pdf

[4] Hort Innovation 2022, Strawberry Strategic Investment Plan (SIP) 2017–2021 Performance Report

Table 1 Project details of BS17000

Project code	BS17000
Title	National Strawberry Varietal Improvement Program (2017-2022)
Research organisation(s)	Queensland Department of Agriculture and Fisheries (QDAF)
Project leader	Jodi Neal
Funding period	2018-19 – 2022-23
Objective	Develop and commercially release superior strawberry varieties adapted for production across diverse regions in Australia.

Source: Hort Innovation

Related investments

The project was linked with 1 investment, as follows:

— BS22000 Australian Strawberry Breeding Program – An ongoing project, BS22000 is the next iteration of BS17000 aimed at continuing the development and commercial release of high-performing, locally adapted strawberry varieties suited to Australia's diverse growing regions, including temperate, subtropical, and mediterranean climates. Building on the success of the previous BS17000 project, this initiative enhances the national strawberry breeding program by integrating cutting-edge genomic prediction and marker-assisted selection techniques. With access to both internationally sourced and domestically maintained elite germplasm, the program seeks to strengthen the competitiveness, sustainability, and profitability of the $417 million Australian strawberry industry, which supports around 11,000 production jobs and heavily relies on the varieties bred through this initiative.

Project governance

Project governance was anchored by the involvement of Regional Reference Groups (RRGs), which provided strategic oversight and ensured alignment with industry needs. These groups, comprising growers and other key stakeholders, met annually to guide breeding objectives, review selection decisions, and provide feedback on project operations. Although consistent participation was a challenge in some regions, early engagement in future projects is recommended to strengthen group stability.

A structured project plan and regular milestone reporting supported effective tracking of progress. Project updates were shared through industry publications and events, ensuring transparency and broad stakeholder awareness.

Monitoring and evaluation were guided by 5 Key Evaluation Questions, focusing on project outcomes, relevance, stakeholder engagement, and efficiency. Continuous improvement was enabled through innovations in data management, field tools, and breeding workflows, contributing to more efficient operations and informed decision-making.

This governance model ensured the project remained responsive to industry needs and positioned it for continued success in future phases.

Impact pathway

A clear pathway from inputs to impacts can be identified for the investment. Overall, the investment produced 3 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 BS17000

Pathway	Description
Inputs and Activities	**Development of 6-year breeding strategy** • The overarching objective of the breeding strategy was to produce varieties with desirable traits, those being profitability, sustainability, and consumer satisfaction. **Generation and assessment of genetic variation** • Parents were selectively chosen based upon their expression of desirable traits. The crosses developed aimed to improve specific key traits required based upon the region without sacrificing the quality of other positive traits. • Seed exchanges were maintained with overseas partners throughout this project. Plants were also assessed for moderate to high heritability of traits. **Evaluation of selections in clonal trials** • Seedlings were clonally propagated. Data was analysed through a quantitative genetic approach to estimate breeding and clonal values. Across all regions, a consistent set of 17 fruit traits – including yield, fruit count, sugar content, acidity, flavour, shape, uniformity, internal and external colour, gloss, firmness, shelf life, and resistance to rain, sunburn, and bruising – were assessed from each production region and thresholds were established comparing each trait to those of leading commercial varieties. The clonal values were then run through economic models to identify those most likely to increase profitability. **Evaluation of selections in on-farm trials** • Producers from 8 different production regions were selected and supplied with virus-free plant material from the advanced-stage clonal trials. In total, 12 on-farm trial sites were involved, representing both in-ground and substrate production systems. These included sites in temperate regions (Victoria, Tasmania, South Australia, Western Australia, Queensland), subtropical regions (Moreton Bay, Wide Bay, Gold Coast), and the Mediterranean region (Perth), ensuring broad geographic and environmental representation. **Routine screening and genome-wide parental selection** • Marker assisted selection through routine screening for perpetual flowering/day neutrality and "peach" flavour was performed across all 3 breeding nodes. • Genomic selection was performed on subtropical material and prediction models were developed for the temperate breeding nod. Leaf samples from temperature and subtropical nodes were sent to Genotyping Australia for genetic marker analysis and the results were intended to strengthen genomic prediction models and re-assess prediction accuracy. **Disease resistance screening, high heath testing and in-vitro storage** • Disease resistance screening was undertaken on commercial and pre-commercial accessions. Testing was performed for Colletotrichum crown rot, fusarium wilt, charcoal rot, and powdery mildew. • Molecular and biological virus indexing was undertaken of all new pre-commercial accessions and established before being sent for formal testing. The material was then properly stored in a way that preserves the nucleus material.
Outputs	**6 varieties developed and positioned for commercialisation:** • Subtropical: 'Susie-ASBP' (released), 'Stella-ASBP' (pending PBR application). • Temperate: 'Tahli-ASBP' and 'Tamara-ASBP' (released).

Pathway	Description
	• Mediterranean: 6 semi-commercial selections trialled; 2 identified for potential release. • Specialty: 2 unique blush and white varieties ('SB17-230-ASBP' and 'SW20-317-ASBP') offered for tender. Superior varieties made available to consumers. • 2 temperate varieties known as ‘Tahli-ASBP’ and ‘Tamara-ASBP’ released. ‘Susie-ASBP’ is a new subtropical variety. One variety suitable for substrate culture available to fruit producers. • ‘Tahli-ASBP’ performs especially well in substrate. Advanced breeding techniques • Incorporated genomic prediction and marker-assisted selection. • Used DNA markers to identify traits such as “peach” flavour and perpetual flowering. Knowledge dissemination and industry engagement • 2 peer-reviewed journal articles published • 12 articles in the Australian Berry Journal and Simply Red • 9 conference presentations, 14 industry presentations, 10 breeding trial tours. 25 media interviews across various platforms
Outcomes	Domestic and International growers gain access to new strawberry varieties. • Varieties tailored to Australia’s distinct growing regions, improving alignment with local climate and consumer demands • Enhanced suitability for alternative systems like substrate culture Greater adoption and commercial uptake • In 2021-22 ASBP varieties represented 47% of all commercial plants sold across Australia. This is set to increase to 65% by 2025. Enhanced grower engagement and knowledge transfer • Strong grower input through regional Reference Groups • On-farm trials increased relevance and likelihood of adoption Support for sustainable and competitive national industry • Established a breeding pipeline that can adapt to changing market and environmental demands
Impacts	Increased gross margins due to higher fruit weight • Higher fruit weight of new strawberry varieties increases pack-out value and improves profitability per kilogram harvested Increased gross margins from higher yield • Higher yield due to improved genetics leads to higher overall yields per plant, allowing growers to achieve greater returns from the same land area Cost savings • Production of more disease resistant varieties induce cost savings, including higher crop reliability Faster breeding cycles • Faster breeding cycles using genomic tools reduce time and cost from breeding to release, enhancing R&D efficiency Versatility across production systems

Pathway	Description
	• Versatility across production systems gives growers production flexibility and supports modern horticultural practices Reduced pesticide usage • Increased disease resistance helps reduce pesticide usage as well as minimised use of resources like water, support more sustainable production **Enhanced grower knowledge and participation** • Strong engagement with regional Reference Groups and on-farm trials aids in enhanced grower knowledge and strengthens grower participation, and reinforces feedback loops between growers, researchers, and advisors. **Scientific advancement and capacity building** • Through use of advanced breeding methods, production of 2 peer-reviewed journal articles, and the integration of predictive agriculture, boosting national R&D expertise and positioning **Increased domestic industry resilience** • Tailoring varieties to local conditions aids in resilience of the domestic industry

Source: ACIL Allen

Cost and benefits

Costs

Cost of the investment

The investment was a collaboration between Hort Innovation and QDAF. Hort Innovation contributed over $4 million in cash and incurred approximately $590,000 in overhead costs (ex-GST amounts). Queensland DAF contributed $4.2 million 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 BS17000

Contribution	2018-19	2019-20	2020-21	2021-22	2022-23	Total
Hort Innovation – Cash	$1,084,094	$800,014	$820,019	$544,003	$812,032	**$4,060,162**
Hort Innovation – Overheads	$166,781	$111,091	$115,982	$76,989	$119,793	**$590,636**
Queensland DAF – In kind	$833,292	$833,292	$833,292	$833,292	$833,292	**$4,166,460**
Total	**$2,084,167**	**$1,744,397**	**$1,769,293**	**$1,454,284**	**$1,765,117**	**$8,817,258**

Source: Hort Innovation

The total nominal investment of $8.8 million is adjusted for inflation to represent the real value of 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 (adjusted for changes in purchasing power due to inflation).

Cost of the investment, in nominal terms and real terms, is provided in Table 4 below.

Table 4 Real costs of the investment BS17000

Organisation	Hort Innovation	Queensland DAF	Total
Nominal costs	$4,650,798	$4,166,460	$8,817,258
Real costs ($2025 financial year)	$5,369,459	$4,772,396	$10,141,855

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 BS17000

Type of impact	Assessment	Description
Economic impact	Quantified	**Increased gross margins due to higher fruit weight** – New strawberry varieties consistently produced larger fruit weight, which increases pack-out value and improves profitability per kilogram harvested. The benefit was estimated by calculating the difference in fruit weight between the new varieties and industry average, then translating this into an increase in gross margin using an established relationship between fruit size and gross margin. The gross margin increase was applied only to regions where the new varieties are expected to be adopted — for example, a new temperate variety would be grown exclusively in temperate regions, so the associated benefit was calculated only for those areas.
	Quantified	**Increased gross margins from higher yield** – Improved genetics led to higher overall yields per plant, allowing growers to achieve greater returns from the same land area. This benefit was estimated by calculating the difference between the yield of the new varieties and the industry average. This yield difference was then converted into an increase in gross margin using an established relationship that maps percentage increases in yield to corresponding increases in gross

Type of impact	Assessment	Description
		margin, accounting for diminishing returns. The gross margin increase was applied only to regions where the new varieties are expected to be adopted.
	Quantified	**Cost savings from disease resistance** – Resistance to crown rot, fusarium wilt, and powdery mildew reduces the need for fungicides and replanting, cutting input costs and increasing crop reliability. The benefit was calculated based on estimated annual savings per 1,000 plants for growers adopting disease-resistant cultivars. This per-plant saving was then scaled to total annual savings for each applicable region, using regional planting areas and typical plant density. The cost savings were only applied to regions where the new disease-resistant varieties are expected to be adopted.
	Unquantified	**Faster breeding cycles using genomic tools** – Genomic prediction and marker-assisted selection reduce time and cost from breeding to release, enhancing R&D efficiency. Lack of data and high variability across various varieties makes this benefit difficult to quantify.
	Unquantified	**Versatility across production systems** – Compatibility of varieties with both in-ground and substrate culture gives growers production flexibility and supports modern horticultural practices. This was difficult to monetise due to context-dependent value. Flexibility benefits vary widely by grower setup (in-ground vs substrate), and quantification would require complex modelling of adoption scenarios and system transitions.
Environmental impact	Unquantified	**Reduced pesticide usage due to disease resistance** – Fewer fungicide applications lower chemical runoff, protect beneficial insects, and reduce occupational risks for workers. Higher-performing, disease-resistant varieties also minimise use of resources like water, supporting more sustainable production. Potential reductions in water and nutrient use are difficult to isolate from other agronomic practices and would require detailed life-cycle assessments. Lack of data makes accurate monetisation infeasible.
Social impact	Unquantified	**Enhanced grower knowledge and participation** – Strong engagement with Regional Reference Groups and on-farm trials gave growers a voice in breeding priorities, increasing the relevance and adoption of new varieties. While they improve relevance and adoption, it's difficult to assign a dollar value without overstating effects or relying on unverifiable assumptions about long-term behaviour change.
	Unquantified	**Scientific advancement and capacity building** – The project contributed to Australian scientific capability using advanced breeding methods, 2 peer-reviewed journal articles, and integration of predictive agriculture, boosting national R&D expertise and positioning. Over 27 presentations across field days, trial walks, and conference presentations, along with 25 media appearances, also helped disseminate results and build community awareness of such innovation. This impact depends on future research utilisation and effectiveness of communication activities, both of which are highly variable and difficult to directly link to measurable financial outcomes. As a result, quantification is too indirect and temporally uncertain to support a robust valuation.

Type of impact	Assessment	Description
	Unquantified	**Increased domestic industry resilience** – Tailoring varieties to local conditions strengthens the self-reliance of the Australian strawberry sector. This is an indirect impact and monetising it would be highly speculative since resilience is inherently counterfactual – it becomes visible only during adverse events.

Data and assumptions

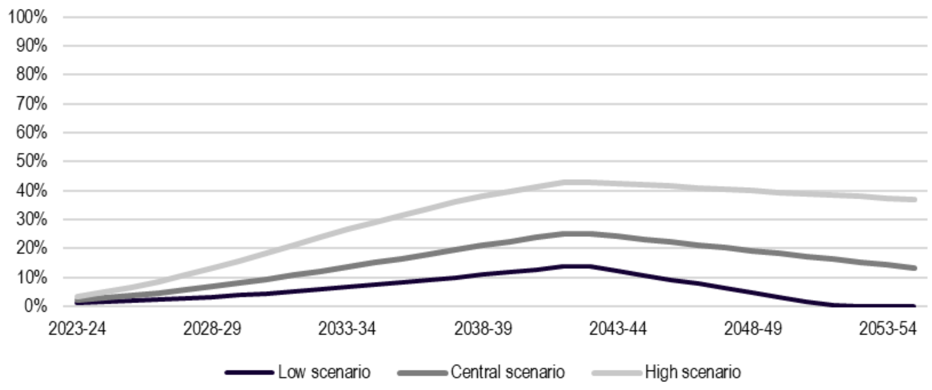
The required data, assumptions and calculations used to estimate the impacts of the investment are presented in Table 6 below. The data was sourced from project data, external sources through literature review, industry data provided by Hort Innovation and other publicly available databases. Assumptions 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, the potential emergence of newer, higher-performing varieties over time, and seasonal yield variations between early and late harvests.

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 BS17000

Data/Assumption	Value, source and rationale
Data	
Production or farm gate value	$507,500,000 Australian Horticulture Statistics Handbook 2023-24
Gross margin as a share of farm gate value	25% Based on FY 2017/18 Strawberry investment and gross margin analysis commissioned by Natural Resources and Environment Tasmania *the figure is an average of substrate and in-ground production gross margin.
Average fruit weight	30 grams Average range of 20-40 grams - Information provided by Wendy Morris, Berries Australia
Average yield per plant	700 grams ** Based on an early season yield of 600-750 grams and a late season yield starting at a minimum of 800 grams. Based on information provided by Wendy Morris, Berries Australia
Gross margin and fruit size relationship	Gross margin increases by 22% if fruit size increases by 75% or 30 grams. ** This means gross margin increases by 0.7% if fruit size increases by 1 gram. Mark E. Herrington, Malcolm Wegener, Craig Hardner, Louella L. Woolcock, Mark J. Dieters, Influence of plant traits on production costs and profitability of strawberry in southeast Queensland, Agricultural Systems. https://www.sciencedirect.com/science/article/abs/pii/S0308521X11001636?via%3Dihub
Fruit weight for Susie	25.8 grams Information provided by Dr. Jodi Neal

Data/Assumption	Value, source and rationale
Total yield for Susie	535 grams per plant Information provided by Dr. Jodi Neal
Fruit weight for Stella	23.6 grams Information provided by Dr. Jodi Neal
Total yield for Stella	551 grams per plant Information provided by Dr. Jodi Neal
Marketable yield as a proportion of total yield	80% Menzel, C.M. Yield and Fruit Weight of Six Strawberry Cultivars over Two Seasons in Subtropical Queensland, Australia. Horticulturae 2025, 11, 226. https://doi.org/10.3390/horticulturae11030226
Total yield for Tahli	1033 grams per plant Information provided by Dr. Jodi Neal
Total yield for Tamara	816 grams per plant Information provided by Dr. Jodi Neal
Additional gross margin due increase in yield	10% increase in yield - $1,200 20% increase in yield - $2,200 30% increase in yield - $3,100 40% increase in yield - $3,900 Base gross margin in the study is $35,840 per hectare Mark E. Herrington, Malcolm Wegener, Craig Hardner, Louella L. Woolcock, Mark J. Dieters, Influence of plant traits on production costs and profitability of strawberry in southeast Queensland, Agricultural Systems. https://www.sciencedirect.com/science/article/abs/pii/S0308521X11001636?via%3Dihub *numbers derived from graphs in the source
Fruit weight for Tahli	22.8 grams Information provided by Dr. Jodi Neal
Fruit weight for Tamara	21.7 grams Information provided by Dr. Jodi Neal
Strawberry industry share across states	Queensland – 42% Tasmania – 4% Victoria – 36% Western Australia – 11% South Australia – 7% New South Wales – 1% Slides: BQ125 - Dr. Jodi Neal- Queensland Department of Primary Industries https://drive.google.com/open?id=1QDtvJfT-9oWUOVUTGYnc-nKK8SbeHKNO&usp=drive_fs
Subtropical areas in Australia	2 out of 3 zones in Queensland are subtropical Slides: BQ125 - Dr. Jodi Neal- Queensland Department of Primary Industries https://drive.google.com/open?id=1QDtvJfT-9oWUOVUTGYnc-nKK8SbeHKNO&usp=drive_fs
Temperate areas in Australia	South Australia, Victoria and Tasmania are completely temperate zones. 1 out of 3 zones in Queensland is temperate.

Data/Assumption	Value, source and rationale
	1 out of 2 zones in Western Australia is temperate. Slides: BQ125 - Dr. Jodi Neal- Queensland Department of Primary Industries https://drive.google.com/open?id=1QDtvJfT-9oWUOVUTGYnc-nKK8SbeHKNO&usp=drive_fs
Gross margin per hectare	$76,930 ** based on average of substrate and in-ground crop - $72,680 and $81,179 Strawberry investment and gross margin analysis commissioned by Natural Resources and Environment Tasmania
Strawberry production across Western Australia	170 hectares Government of Western Australia. Department of Primary Industries and Regional Development. Agriculture and Food. Strawberries. https://www.agric.wa.gov.au/crops/horticulture/fruit/strawberries
Density of plants	40,000 – 45,000 plants per hectare *Central scenario is an average of the numbers above (i.e. 42,500 plants per hectare) Plant Health Australia. Case Study 32. https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/10-139.pdf
Annual savings for strawberry growers per 1000 plants due to disease resistant varieties	$182.40 - $204.50 *Central scenario is an average of the numbers above (i.e. $193.45) Li, Z., Gallardo, R. K., McCracken, V., Yue, C., Whitaker, V., & McFerson, J. R. (2020). Grower willingness to pay for fruit quality versus plant disease resistance and welfare implications: The case of Florida strawberry. Journal of Agricultural and Resource Economics, 45(2), 199–218. https://doi.org/10.22004/ag.econ.302450
Assumption	
Attribution	Attribution to the project. 64.5%, based on nominal costs of the investment as a proportion to total nominal costs of related investments.
Counterfactual	Development of new varieties is an outcome 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 have started in 2023-24 when Susie variety was commercialised at 2% and grows to 25% of industry in 2042-43. It is assumed that at this point, newer varieties would be available and will start replacing the varieties developed in this project. **Figure 1 Adoption curve**  *Source: ACIL Allen*

Data/Assumption	Value, source and rationale
Benefit apportionment factor	Stella – Stella was still undergoing broader trials at the time the BS17000 final report was completed. Since only a portion of the intended R&D or program activities had been completed at the time of the final report, the benefit was pro-rated based on the proportion of work undertaken. Based on information given by Dr. Jodi Neal, 66% of the work was completed, so 66% of the projected gross margin benefit was included in the final benefit calculation. Tahli and Tamara – While these 2 varieties had been commercialised, they remained in the market for only 2 years. The benefits were adjusted according to the proportion of time the variety had been available on the market. Assuming a variety stays on the market for 6 years (analyst assumption), a 33% (i.e. 2/6) apportionment factor has been assigned.
Cost of adoption by growers and industries	Since the market does not distinguish between different strawberry varieties, it is assumed that there are no consumer acceptance costs associated with increasing the availability of new varieties. Furthermore, due to a lack of detailed information on additional costs, the costs of adoption by growers and the broader industry are considered negligible for the purposes of this cost-benefit analysis.
Confidence level for gross margin increase	While under trials conducted by the project, some increase in fruit weight and yield can be observed, stakeholder's input also informed that these results are not guaranteed to be consistently achieved in production under different environment factors. This impact is assessed to have a medium to high level of confidence of 75%.
Confidence level for disease resistance increase	There is less certainty in the disease resistance increase for the new varieties compared to the increase in fruit weight and yield as demonstrated by the research report. This impact is assessed to have a medium level of confidence of 50%.
Calculation	
Total yield for Susie	*Marketable yield for Susie / Marketable yield as a proportion of total yield*
Percentage increase in gross margin due to fruit weight for each variety	*Increase in gross margin if fruit weight increases by 1 gram (i.e. 0.7%) x Difference in fruit weight between new variety and average fruit weight (i.e. 19 grams)*
Percentage share increase in yield	*Difference in yield between new variety and average yield per plant / Average yield per plant*
Percentage increase in gross margin per hectare due to increase in yield	*Additional gross margin due to x% increase in yield / per hectare base gross margin (i.e $35,840)*
Total gross margin	*Farm gate value (in $) x Gross margin as a share of farm gate value*
Total area under strawberry production across Australia	*Area under strawberry production in Western Australia / Western Australia's contribution to national strawberry production*
Subtropical or temperate share of strawberry	*Share of state x number of zones within that state located in subtropical or temperate regions*

Data/Assumption	Value, source and rationale
production in Australia	
Gross margin owing to subtropical/ temperate region	*Total gross margin x Subtropical or temperate share of strawberry production in Australia*
Area under subtropical/ temperate region	*Total area under strawberry production across Australia x Subtropical or temperate share of strawberry production in Australia*
Increase in gross margin due to higher fruit weight when new variety is adopted	*Percentage increase in gross margin due to fruit weight for new variety x Gross margin owing to subtropical or temperate region*
Increase in gross margin due to higher yield when new variety is adopted	*Per centage increase in gross margin per hectare due to increase in yield x Gross margin per hectare x Area under subtropical or temperate region (in hectares)*
Number of plants in subtropical/ temperate region	*Density of plants per hectare x Area under subtropical or temperate region (in hectares)*
Total annual savings in subtropical or temperate areas due to disease resistant varieties	*(Annual savings for strawberry growers per 1000 plants due to disease resistant varieties/1000) x Number of plants in subtropical or temperate region*

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 $0.3 million and a BCR of 1.03 at 30 years after investment completion, using a 5% discount rate.

When taking only costs and benefits attributable to Hort Innovation into account, the investment generated an NPV of $0.16 million and a BCR of 1.03 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 BS17000

	Years after investment completion						
	0	5	10	15	20	25	30
Whole investment							
PV of Costs ($m)	$10.14	$10.14	$10.14	$10.14	$10.14	$10.14	$10.14
Benefits ($m)	$0.00	$0.98	$3.32	$7.27	$12.73	$17.88	$21.94

PV of Benefits ($m)	$0.00	$0.92	$2.64	$4.94	$7.43	$9.30	$10.45
NPV ($m)	-$10.14	-$9.23	-$7.50	-$5.20	-$2.71	-$0.85	$0.30
BCR	0.00	0.09	0.26	0.49	0.73	0.92	1.03
IRR	Negative	Negative	Negative	Negative	1.0%	3.4%	4.4%
MIRR	Negative	Negative	Negative	Negative	2.4%	4.0%	4.7%
Attributable to Hort Innovation							
PV of Costs ($m)	$5.37	$5.37	$5.37	$5.37	$5.37	$5.37	$5.37
Benefits ($m)	$0.00	$0.52	$1.76	$3.85	$6.74	$9.47	$11.61
PV of Benefits ($m)	$0.00	$0.48	$1.40	$2.62	$3.94	$4.92	$5.53
NPV ($m)	-$5.37	-$4.88	-$3.97	-$2.75	-$1.43	-$0.45	$0.16
BCR	0.00	0.09	0.26	0.49	0.73	0.92	1.03
IRR	Negative	Negative	Negative	Negative	1.0%	3.4%	4.4%
MIRR	Negative	Negative	Negative	Negative	2.4%	4.0%	4.7%

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 BS17000

	NPV (in $m)	BCR	IRR	MIRR
Under standard assumptions (Central case scenario and 5% discount rate)	$1.48	1.15	5.1%	5.1%
3% discount rate	$5.27	1.52	5.1%	5.1%
7% discount rate	-$1.17	0.88	5.1%	5.1%
Low adoption (starts at 1.5% and reaches 3.6% in 5 years)	-$3.57	0.65	1.6%	3.1%
High adoption (starts at 4.6% and reaches 11.7% in 5 years)	$8.55	1.84	8.5%	6.8%
Gross margin benefit (Low confidence at 60%) (Central scenario -20%)	$1.65	1.16	5.2%	5.1%
Gross margin benefit (High confidence at 90%) (Central scenario +20%)	$1.30	1.13	5.0%	5.0%
Disease resistance benefit (Low confidence at -20%) (Central scenario -20%)	-$1.02	0.90	3.6%	4.2%

Disease resistance benefit (High confidence at +20%) (Central scenario +20%)	$3.97	1.39	6.5%	5.8%

Source: ACIL Allen

Key findings

The following key findings have been identified for this assessment:

— **Commercialisation of 6 varieties** – At the conclusion of the BS17000 investment, 6 new strawberry varieties had been developed and staged for commercialisation. Of these:

  — **Susie-ASBP**, a subtropical variety, demonstrated higher fruit weight but underperformed in yield. Consultation feedback indicated inconsistent performance across farms, limiting its commercial success to date.

  — **Stella-ASBP** was still undergoing broader trials. While its impact remains uncertain, stakeholder input highlighted that without its evaluation under BS17000, its commercial potential may not have been realised. To address this, a proportional benefit factor was applied to reflect incomplete R&D. First commercial sales began in 2024, and early feedback from growers has been positive.

  — **Tahli-ASBP and Tamara-ASBP**, the 2 temperate varieties, were evaluated, but adoption appears to have declined, with stakeholders reporting they have largely fallen out of use.

— **Strengthening of Breeding Capacity** – The project successfully embedded genomic prediction and marker-assisted selection into the breeding process, significantly enhancing the efficiency of R&D. These advances have laid the groundwork for faster, more targeted breeding in future phases.

— **Data reporting limitations observed** – Initial yield and fruit weight results for new commercial varieties were extracted from graphs, with detailed tabulated data provided later by the research scientist. For future projects, including clear, numerical trial data in tables within the final report is recommended to support more efficient assessment of project impact.

— **Recommendation to include comparisons with commercial benchmarks** – It is important to reference currently successful commercial varieties across Australia and their associated yield and fruit weight data. This would support a more robust economic impact assessment by highlighting value-added benefits in comparison to existing market options. While identifying an average may be challenging, providing a range of early- and late-season performance metrics, along with estimated market share, would enable more meaningful comparisons.

— **Foundations for Future Impact** – While not all varieties were widely adopted, the knowledge, tools, and capacity developed through BS17000 have created a strong platform for future success. Continued investment in breeding disease-resistant and high-performing varieties remains critical to improving the sustainability, profitability, and competitiveness of the Australian strawberry industry.

Consultations

The following stakeholders were consulted on this assessment:

— Kathryn Young, Hort Innovation

— Dr Jodi Neal, Principal Plant Breeder, Strawberry Production Systems Team Leader, Agri-Science Queensland

— Wendy Morris, Berries Australia – Queensland

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