FEBRUARY 2022

Macadamia

Strategic Investment Plan 2017-2021

PERFORMANCE REPORT

Hort Innovation
Strategic levy investment

MACADAMIA FUND

Macadamia SIP performance report

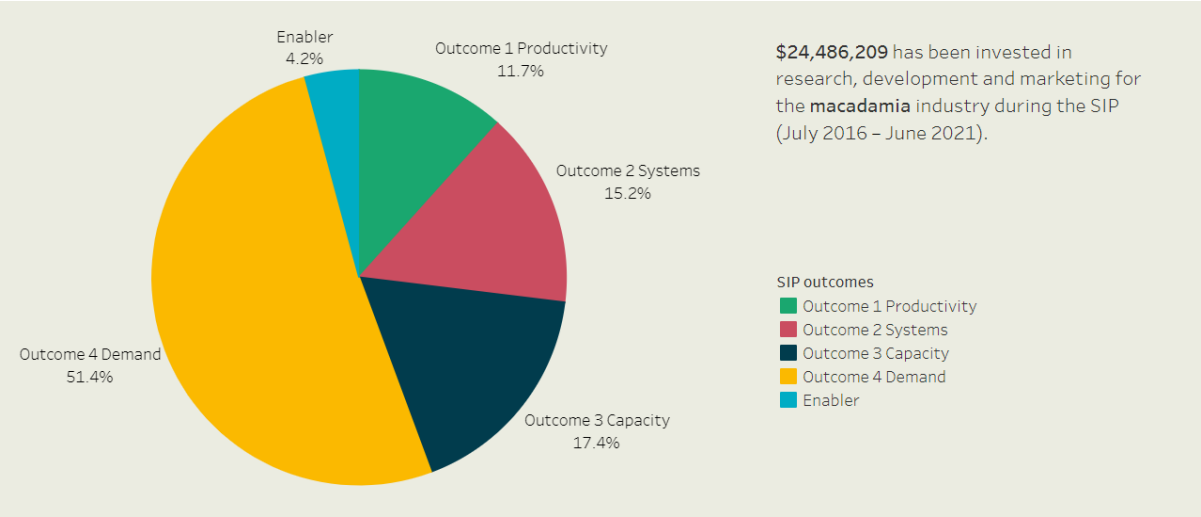
This performance report reviews the performance of levy investments delivered against the macadamia Strategic Investment Plan (SIP), which was active for the 5-year period from 2016/17 to 2020/21. The SIP was developed to strategically guide research and development (R&D) and marketing levy investment in accordance with core industry priorities. The SIP featured four outcome areas, 19 strategies and 29 key performance indicators (KPIs), summarised in Table 1. A total of $24.5 million was invested into the Macadamia Fund over the 5-year period of the SIP. The total investment expenditure allocated against each outcome is provided in Figure 1.

Table 1: Macadamia SIP outcomes

Outcome	Description	Expenditure allocation*
1. Productivity	Increased productivity and grower returns through an average yield increase to 5 tonnes nut-in-shell per hectare by 2021	11.7%
2. Systems	Improved production systems covering plant breeding, intensive orchards and novel technologies	15.2%
3. Capacity	Improved capacity to lead and support current and future industry needs	17.4%
4. Demand	Market demand for Australian macadamias has increased and expanded	51.4%

**Total investment $24.5 million as of June 2021. Balance of expenditure comprises of enabler investments, which includes expenditure to support the delivery of the SIP including advisory meeting and publication costs.*

Figure 1: Macadamia SIP investment expenditure analysis



SIP performance analysis

This performance report reviews the investment achievements delivered within each outcome area that have generated impact for growers. The overall status of each strategic area, informed through an assessment of KPI performance, is also provided. The evaluation status and criteria were:

Strategic area status	Criteria
Achieved	KPIs for this strategic area were met
In progress	Investment delivery remains ongoing
Not achieved	Investment was not prioritised in this strategic area

The results have been informed from evidence compiled through reviewing investment documentation and engagement with project managers. Outcomes generated through the investments are documented and brief case studies of flagship performance and impact for each outcome area are also provided.

Outcome 1: Productivity – Increased productivity and grower returns through an average yield increase to 5 tonnes nut-in-shell per hectare by 2021

Investment in this outcome, encompassing pest and disease management, physiology, mature nut recovery and objective measures of environmental sustainability, provides the knowledge to improve current production systems in the near-term, and radically improved production systems for the mid-term future.

Summary of strategic area and achievement status:

The strategies in the SIP that were identified to support macadamia productivity are listed below. An achievement status is provided based upon internal evaluation of project performances:

Strategic area	Status
Reduce unsound kernel and nut-in-shell by further enhancing the industry's integrated pest and disease management (IPDM)	In progress
Commit to long-term research to improve the understanding of the physiology of the macadamia, an Australian native with a relatively short history of domestication	Not achieved
Improve harvest efficiency, and resultant nut capture	Achieved
Reduce nut loss along the value chain	Not achieved
Develop, agree and report objective measures of environmental sustainability	In progress

KPI callouts:

- The project *Benchmarking the macadamia industry 2019-2021* (MC18002) reported macadamia nut-in-shell (NIS) yield increased 12% to a 4-year average (2018-2020) of 2.9 tonnes/ha, but below the SIP target of 5 tonnes/ha.
- MC18002 also reported the 4-year average reject kernel recovery (RKR) was 2.7%, which was a 7% improvement on the average prior to the development of the SIP, but remained above the target 2.5%. Insect damage was the largest contributor to RKR increased levels from prior to development of the SIP to account for 1% RKR (37% of total RKR).
- Significant work was completed in the minor use permit space, notably through projects *Generation of residue data for pesticide minor use permit applications in macadamias* (MC15002), *Macadamia industry minor use program* (MC16002), *Minor use coordinator* (MT17007) and *Generation of residue, efficacy and crop safety data for pesticide applications in horticulture crops 2017* (ST16006).
- Through the multi-industry *Australian-grown Horticulture Sustainability Framework* (HA19001) the sustainability priorities and metrics were developed in consultation with stakeholders to help share the macadamia and wider horticulture industries sustainable, ethical, and safe farming practice stories.

Case study: Macadamia integrated disease management (MC16018) and Integrated pest management program for the Australian macadamia industry (various projects from MC16004 to MC16008)

Significant economic losses due to pests and diseases resulting in reduction in orchard productivity was identified as a major concern to growers, which was substantiated by high associated RKR losses.

The projects aimed to deliver a holistic integrated pest and disease management (IPDM) program that was adaptable, saleable, acceptable, and measurable. Furthermore, through extension and communication activities in conjunction with *Australian macadamia industry innovation and adoption program* (MC15004), increases in knowledge, awareness, and adoption of IPDM adoption were made to ultimately increase macadamia productivity reflected in reduced RKR, increased saleable yield per hectare.

MC16004 to MC16008 developed improved macadamia integrated pest management (IPM), including inter-row vegetation management, the use of compounds, odours and lures, pest risk matrixes pest identification and management guides, and laboratory colonies of pest and biological control agents. A significant finding for this project was that insectaries in the inter-row can increase species diversity of arthropod communities. This in turn created a more complex food web, benefiting the health of the macadamia orchard, without any corresponding increases in pests of macadamias.

Ongoing at the end of the SIP, MC16018 focussed on pathogen biology and disease epidemiology, host resistance and varietal susceptibility, diagnostics and surveillance, and crop protection for managing emergent and endemic priority diseases including husk spot, Phomopsis husk rot, flower bight complex, Phytophthora root rot, and branch dieback.

Outcome 2: Systems – Improved production systems covering plant breeding, intensive orchards and novel technologies

This outcome embraced longer-term fundamental research required to shift current production into radically improved systems that feature the following: new varieties on dwarfing rootstocks; higher density of trees; higher returns earlier in an orchard's life; consistently higher yields; lower production risk; and novel production technology.

Summary of strategic area and achievement status:

The strategies in the SIP that were identified to support improved production are listed below. An achievement status is provided based upon internal evaluation of project performances:

Strategic area	Status
Leverage past investment and continue to commit to a long term effort to deliver a radically improved production system	Achieved
Develop novel technologies that facilitate improved production	In progress
Incubate grower-inspired innovation for wider application in the macadamia industry	In progress
Scan opportunities for novel technologies in other agricultural and non-agricultural sectors	Not achieved

KPI callouts:

- The project *Transforming subtropical and tropical tree crop productivity (*AI13004) found that selective pruning produced greater NIS yield than the industry standard mechanical hedging and topping. In addition, intensive planting systems had greater canopy volume per hectare and greater total light interception during early orchard life. This led to higher and earlier orchard yields in the precocious flowering variety 'A203', which at 5-years of age, when planted at high density (1,000 trees/ha) produced 4.9 tonnes/ha NIS compared with 2.9 tonnes/ha for low density planting (312 trees/ha).
- Ongoing project *Genetic diversity and population structure of wild and domesticated macadamia* (MC18004) and completed project *Establishing an open-source platform for unravelling the genetics of Macadamia: integration of linkage and genome maps* (MC15008) have increased understanding of the genetic diversity and population structure of wild and domesticated Macadamia and advanced industries understanding of the relationships between wild and planted varieties. The genomic research contributed to improved macadamia systems by supplying genetic linkage maps for use in breeding activities.
- The macadamia breeding program has continued to progress genetic improvement for the Australian macadamia industry, selecting for the industry-defined target traits of yield, tree size, nut quality and pest resistance. (See case study below.)

Case study: Macadamia second generation breeding and conservation (MC14000) and National macadamia breeding and evaluation program (MC19000)

The macadamia SIP 2017-2021 recognised plant breeding as a critical component of improved macadamia production systems, with enhanced yield, tree size, nut quality, rootstocks and pest resistance that will provide the industry an advantage over international competitors.

With this objective, the projects in the macadamia breeding program have progressed genetic improvement for the Australian macadamia industry that was started in 1997/98 (through project *Macadamia regional variety trials – phase 3, series 2* (MC11001)) and which resulted in the release of four new commercial cultivars in 2017.

During the 5-year period of the SIP, key program outcomes from the macadamia breeding investments have contributed to improved production systems, productivity, and profitability:

Through an evaluation of more than 5,000 seedling progeny, 18 selected progeny were expected to increase farm profitability by more than 30% through early production, high KR and reduced management costs. Five new selections were propagated for inclusion in the project *Macadamia regional variety trials series 4* (MC17006).

In the high-density trial, the project was able to reduce the nursery management costs by planting seedlings within six months of germination (rather than the conventional 24 months).

The project was also successful at reducing evaluation costs by approximately 80% through high density planting and shortening the progeny evaluation cycle by half (five years).

Outcome 3: Capacity – Improved capacity to lead and support current and future industry needs

The macadamia SIP 2017-2021 identified industry development and data insights, especially extension, as a high program priority.

Summary of strategic area and achievement status:

The strategies in the SIP that were identified to support macadamia industry capacity are listed below. An achievement status is provided based upon internal evaluation of project performances:

Strategic area	Status
Continue to support adoption of R&D outputs by effective extension	Achieved
Deliver meaningful data on production, planting, environmental performance, international supply and demand in a timely manner	Achieved
Ensure industry stakeholders remain engaged through an effective communications program	Achieved
Enhance skills and capacity to support current and future industry needs	Achieved

KPI callouts:

- Together, the projects *Macadamia grower communication program* (MC15003) and *Australian macadamia industry innovation and adoption program* (MC15004) engaged more than 90% of industry production, with stakeholders rating the outputs highly and indicating a high intent to adopt new practices.
- The project *Benchmarking the Macadamia Industry 2019-2021* (MC18002) produced an annual benchmark report, productivity case study videos, a companion fact sheet, and approximately 12 ad-hoc reports for industry stakeholders. Industry benchmark reports have been downloaded from the AMS web site more than 2,600 times since the site was updated in early 2018. A survey of benchmark participants indicated that 77% of participating growers had changed, or planned to change, practices as a result of the project.
- Ongoing at the end of the SIP, *Macadamia Crop Forecasting 2020-2022* (MC18003) has collected data sets through collaborations that revised the spatial matrix of Australian macadamia areas. Using historical satellite images, the data collection team outlined their latest algorithms for estimating 'productive' rather than just 'total' macadamia areas, as well as the estimation of the ages of these blocks, and patterns of production by regions and ages of trees.

Case study: Australian macadamia industry innovation and adoption program (MC15004)

From 2016 to 2021, this investment enhanced innovation and technology adoption and facilitated capacity building in the Australian macadamia industry.

The project supported the role and activities of a dedicated industry development manager (IDM), who was responsible for undertaking constant engagement with growers and the wider industry, the management of emerging issues, and the identification and development of new opportunities for the industry.

Supported by a number of projects, state agencies and other resources, with particular collaboration with the project *Australian Macadamia Industry Communications Program* (MC18000), MC15004 delivered key activities across a range of channels including 75 MacGroups, 29 field days and workshops, 60 grower stakeholder meetings and consultations, 15 factsheets, an annual Awards of Excellence, and 22 YouTube videos.

The extension strategy recognised the significant range of skills and background across the industry by using a peer learning approach, where experienced growers could share learnings and best practices with less experienced growers.

The project engaged more than 90% of industry production (above the target of 60%), with feedback from participants showing that:

- 56% of stakeholders identified the project resources as essential, with 38% rating them valuable
- 93% of consultants rated the consultant workshops as high or very high value
- 47% of growers made significant enterprise and orchard management practice changes as a result of MC15004, with 41% of growers having made several changes, and 12% having made some changes. This compares to a target of 30% grower practice change for the project.

The main areas of practice changes were in soil health and nutrition (such as increased organic matter and ground cover), irrigation and drainage, orchard floor and canopy management, and pest and disease management.

Outcome 4: Demand – Market demand for Australian macadamias has increased and expanded

The macadamia SIP 2017-2021 recognised that an effective marketing program had the potential to drive demand, and underpin the premium paid for Australian macadamias and the price received by levy-paying growers.

Summary of strategic area and achievement status:

The strategies in the SIP that were identified to support macadamia demand are listed below. An achievement status is provided based upon internal evaluation of project performances:

Strategic area	Status
Develop a five-year marketing plan supported by annual operating plans with clear reporting criteria that meet Hort Innovation monitoring and evaluation requirements	Achieved
Deliver meaningful data on production, planting, environmental performance, international supply and demand in a timely manner	Achieved
Ensure industry stakeholders remain engaged through an effective communications program	Achieved
Enhance skills and capacity to support current and future industry needs	Achieved

KPI callouts:

- A 5-year Strategic Marketing Plan (2017-2022) was delivered by the *Australian Macadamia Marketing Manager* (MC18507), including multiple international consumer campaigns in Japan, South Korea, Taiwan, China, Germany, and global consumer promotion.
- Projects *Macadamia Crop Forecasting 2015-2018* (MC15009) and *Benchmarking the macadamia industry 2019-2021* (MC18002) combined with *Horticultural trade data* (MT19005) underpinned engagement with domestic and export marketing strategies.
- *The effect of macadamia nuts on cardiometabolic risk factors and adiposity: a randomised intervention study* (MC17005) found that adding macadamias to the diet of overweight/obese adults with elevated cardiometabolic risk, successfully lowered total cholesterol and low-density lipoprotein without gains in body weight.

Case study: Australian Macadamia Marketing Manager (MC18507)

Keeping demand ahead of supply was seen as vital to provide stability for Australian macadamia growers and drive continued investment in productivity improvements leading to a more stable, reliable output. This in turn would provide greater security of supply for customers and increase their confidence in the product.

Through the Australian Macadamia Market Development Manager, a 2017-2022 Strategic Marketing Plan sought to position the Australian and global industries to meet the challenge of expected significant increases in production. The program aimed to create new demand through a trade-focused program that would increase the use of macadamias in food manufacturers' innovation pipelines and ultimately lead to new product launches.

The SIP incorporated two operational plans: The Innovation Initiative (1 July 2017 to 30 June 2020) and #discovermacadamias (1 July 2020 to 30 June 2022).

Key outcomes at the end of the SIP included:

- A global usage and attitude study across six markets (Australia, USA, China, Japan, Taiwan and South Korea) was completed delivering new knowledge across these markets
- Development of a marketing toolkit specifically for use by the commercial sector. The toolkit contained more than 200 assets and 88% of marketers reported using it, adding significant value to the industry and contributes to Australia's leadership status
- 65% of surveyed growers reported reading the market report and marketing related news in the AMS Bulletin and 75% ranked marketing content in the industry e-news as useful
- The trade-focused program has positively impacted the use of macadamias in food manufacturers' innovation pipelines and driven new product launches. Five consumer insight research studies highlighting the opportunity areas for new development with macadamias were completed and released to the stakeholders. Two innovation challenges were developed and executed resulting in a range of new creative concepts released to primary marketers for use in their marketing to food manufacturers
- Australia maintained strong market share in key markets and a price premium over the average from all origins for over five years to 2021.