Final Report

Benchmarking the macadamia industry 2015-2018

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Benchmarking the macadamia industry 2015-2018 MC15005

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Content

Summary

The MC15005 project delivered objective data, extension materials and activities to support decision-making and improve farm productivity and profitability within the Australian macadamia industry. In addition to macadamia growers, benchmark findings have been widely utilised by investors, processors, consultants, researchers and accountants. Benchmark data has informed processes and decision-making in financial institutions and other authorities such as the Australian Taxation Office and Plant Health Australia. Trend data has also provided objective metrics for industry strategic planning and RD&E investment.

Yield, quality, planting and cost data was collected and analysed annually. Personalised farm benchmark reports were produced annually for all participating businesses, ranking their seasonal farm performance relative to others with similar characteristics such as location, farm size, tree age and use of irrigation. Broader industry findings and seasonal trends were published via annual industry reports, which are available to all growers and industry stakeholders.

Annual meetings of benchmarking participants were facilitated in all major growing regions to discuss seasonal findings and trends. Compelling examples of high productivity or innovation were documented via at least two video case studies per season. Key benchmark findings were regularly published in industry media such as the AMS News Bulletin, and at industry events such as industry workshops and conferences.

Benchmark data informed many other RD&E projects in the macadamia portfolio through provision of custom reports, economic forecasts and seasonal trend data. Examples include breeding and regional variety trials (MC14000 and MC17006), Integrated Pest Management (MC16005), Industry Innovation and Adoption (MC15004), Industry Communication (MC15003) and crop forecasting (MC15009).

A total of 279 farms representing more than 58% of industry production participated in the final year of the project. More than 65% of respondents to project surveys indicated that after receiving their personal benchmark report they had subsequently sought information on how they could improve their farm yield and quality results. More than 77% of survey respondents also indicated that the report had directly contributed to them changing practices on their farm.

Despite a turnover in farm ownership of approximately 10% of the benchmark sample during the project, recruitment of additional participants during the project term resulted in a net 3% increase in participation over the three years.

Over the last decade a variety of factors have significantly influenced seasonal productivity and quality including weather, pests and diseases. Although the relative impact of these factors is somewhat masked across the whole benchmark sample, significant seasonal variation was observed at a farm, and in some cases, regional level. Substantial swings in wholesale price also impacted margins, particularly from 2007 to 2009. The long-term implications of reduced inputs during this period is likely to have negatively influenced productivity and quality for several following seasons.

Production variability, both between seasons and between farms in any given season, remains high. Continued seasonal collection of key productivity and cost data is recommended, both to improve confidence in long-term sample averages and to track industry trends. Continued linkage with seasonal grower observations of limiting factors is also recommended to provide insight into the relative impact of seasonal conditions on both farm and whole-industry productivity and quality.

Keywords

Macadamia; productivity; yield; quality; costs; region; farm size; tree age; planting density; farm performance

Introduction

The Australian macadamia industry comprises approximately 564 growers (Australian Bureau of Statistics agricultural census 2016-17) and 22,000 planted hectares (Australian Macadamia Society data). Production in 2018 reached 52,900 tonnes of nut-in-shell (at 10% moisture content) with an estimated farm-gate value in excess of $285M.

Industry productivity is seasonally variable, primarily due to environmental factors such as extreme weather events and pest and disease pressure. The standard deviation in seasonal saleable kernel production was measured for farms that had participated over a minimum of four seasons. The average standard deviation for these farms was 32% of the mean over an average of 8 production seasons between 2009 and 2018. Benchmark data from 2013 to 2018 also shows an average standard deviation in annual production costs per hectare of 19% of the mean for mature farms.

Productivity and costs also vary significantly between farms in any given season. Between 2009 and 2018, the between-farm standard deviation in saleable kernel production per hectare averaged 52% of the mean for mature farms. Between 2013 and 2018, the between-farm deviation in production costs per hectare averaged 41% of the mean. Between 2009 and 2018 the top quartile of the benchmark sample produced a seasonal average of 1.47 tonnes per hectare of saleable kernel, while the bottom quartile averaged just 0.34 tonnes per hectare. The sample average for this period was 0.87 t/ha.

Data from this and previous related projects (e.g. MC09001) suggest that there is significant scope for improving productivity and quality through adoption of industry best practice. Increased productivity and grower returns through increases in average yield and reduced reject is a key outcome in the macadamia strategic investment plan 2017-2021, and also previous industry strategic investment plans.

This project used several mechanisms to support positive practice change. The first was an increased awareness and understanding of individual and industry-wide productivity, quality and costs. Benchmarking ranks a farm within the spread of yield, quality and cost measurements of similar properties and businesses, and so gives an understanding of each farm's potential for improvement. Performance ranking across a range of criteria is an important first step in realising the potential to improve productivity. To this end, the project provided participants with confidential, objective rankings of their individual farm performance within the benchmark sample.

Secondly, improved understanding of the conditions and factors influencing seasonal and regional productivity and quality provided important context for practice change. These factors included pests, diseases and general limiting factors such as weather events and tree or soil health. Relating seasonal limiting factors to measured yield and quality also afforded insight into their relative economic significance at both a farm and industry level.

Thirdly, publication of case studies demonstrating high productivity and innovation provided compelling examples of best practice and achievable high productivity. Inclusion of leading growers and high productivity orchards also built confidence for decision-making and practice change.

Finally, facilitation of Benchmark Group meetings supported regional networking and the exchange of information and experience. Review, analysis and dissemination of findings at these events afforded important opportunity for open communication and shared learning between growers, consultants and other industry RD&E service providers.

Methodology

Data collection and validation

The project conducted an annual national industry census of macadamia yield, quality, planting and cost information. Two types of forms were developed to collect information from growers. The basic form covered consignment yield and quality details, planting information and limitations to production, such as weather, pests, and diseases. A second comprehensive form further included production costs across defined expenditure categories, including unpaid labour.

In the first years of the project the comprehensive form was sent only to growers who had previously indicated their willingness to contribute this information. Through refinement of data processing methods, the comprehensive form became the standard for all participants, although production cost data remains optional.

Data collection forms (Appendix A) were distributed to growers by email. Participants who did not respond to this initial call for data were telephoned by team members to expedite data collection and to assist with interpreting questions. Benchmarking team members also visited some participants in person to assist with data collection, particularly of complex data such as production costs.

Approximately 80% of participants provided consent for their seasonal yield and quality data to be sourced directly from their processor(s). This data was sourced from processors in batches to minimise disruption to their business processes. Data collection ceased at a pre-determined date following the end of each production season to ensure findings could be reported at the earliest opportunity to aid decision making.

Data was validated using a range of threshold tests to ensure accuracy and consistency, between both farms and seasons. Any data falling outside of accepted thresholds was verified with the relevant growers prior to commencement of the annual reporting cycle.

Reporting

Each year confidential farm reports (Appendix E) were produced for each participating farm business. These reports compared and ranked individual farm performance based on yield, quality and production costs. Each farm was ranked against averages of other farms of similar size, location, weighted average tree age, planting density, management structure or irrigation usage. Trend charts provided further analysis of individual farm performance over all seasons for which data was available.

In the first two years of the project, interim farm reports were produced for a subset of farms prior to the end of the data collection period. These reports provided early insight into seasonal trends, offering opportunity to influence management decisions prior to the start of the following season. These interim reports were discontinued in the third year of the project in favour of producing earlier final reports based on the whole benchmark sample. This was possible due to refinements to data collection processes as well as structural changes at one key processor.

Industry reports were also produced each season following release of farm reports, to summarise key findings for the whole benchmark sample. These included analysis of seasonal findings and long-term trends across the whole sample. They also included analysis of segments of the sample, such as top performing farms (sustained high yield per hectare over 4 or more years), percentiles and regions. Variation in seasonal productivity and quality was also analysed according to farm size, tree age, region, use of irrigation, management structure and planting density.

Report formats and content were continuously refined based on feedback from participants, industry stakeholders and the Project Reference Group. Industry reports were professionally printed and distributed to all participating growers in both electronic and hard copy formats. The electronic version was also uploaded annually to the Queensland Government Publications Portal and broadcast to the wider industry via the industry communications program.

Benchmark Groups

Benchmark Group meetings provided forums for discussion of benchmark findings and exchange of information and experience. Six groups were established across the major growing areas (Central Queensland, Gympie, Glasshouse Mountains, Northern Rivers of NSW and the Mid Coast of NSW).

Participation in meetings was offered to all benchmarking participants. Key consultants, processor representatives and RD&E service providers were also invited to participate, subject to consent from participating growers.

A review of seasonal findings and observations formed the basis for the meetings, with additional content tailored to the specific priorities identified by each group to maximise relevance. The strong sense of ownership promoted by this approach resulted in high retention of members during the life of the project. Most meetings included presentations and interaction with RD&E service providers to facilitate discussion and information exchange relating to major industry-funded projects.

Surveys were conducted during most meetings to collect additional insight and to evaluate processes and outcomes. Electronic polling devices were utilised in some meetings to encourage interaction and to instantly report group findings back to participants.

Case studies

Six case studies were produced (Appendix B) to communicate compelling examples of innovation, highly productive farms or significant research outcomes. These case studies were produced in short video format and published via the Queensland Agriculture YouTube channel. Their availability was promoted to industry via the industry communications channels.

Economic analyses

Seasonal benchmark data underpinned the creation of templates for economic modelling of farm business scenarios using purpose built software (*Financial Planner for Macadamia*). This system is used by a network of consultants to support farm business planning and industry investment. The project team supports this network via annual updates to underlying templates and provision of technical software support. This tool was also used to model cash flows associated with a range of industry scenarios and research topics. These include ranking of new selections from the breeding program, assessment of emerging IPM strategies, tree replacement, supplementary irrigation, and impact of Abnormal Vertical Growth (AVG).

Statistical analyses

Fishers Least Significant Difference (LSD) was used to determine if there is a significant difference between multiple data sets.

The Pearson Correlation Coefficient was used to determine if two variables are significantly linearly related. A correlation coefficient of 1 indicates perfect positive correlation and -1 indicates perfect negative correlation. Correlation does not provide a measure of cause or effect, but rather of probable directional relationships. The level of statistical probabilities presented are 99% ($P < 0.01$) and 95% ($P < 0.05$).

Communication

In addition to presentations at Benchmark Group meetings, findings were widely presented at industry events including MacGroup meetings, industry conferences, consultants meetings and processor field days. Five articles were also published in the Australian Macadamia Society News Bulletin. Six case study videos were published via the Queensland Agriculture YouTube channel. Thirty seven custom reports were developed in response to requests from industry stakeholders.

Outputs

Farm reports

Personalised farm reports were produced for each participating business each season. Table 1 shows the number of farms providing yield and quality data during each year of the project. Recruitment of new participants offset the loss of 40 participants due to property sales between 2016 and 2018. The total bearing hectares and proportion of total industry yield covered by benchmarking farms increased steadily during the project.

Season	Total farms	Bearing farms	Bearing hectares	Tonnes of nut-in-shell	% of industry by NIS (@10% MC)
2016	273	271	9,756	29,556	57%
2017	278	274	9,820	26,098	57%
2018	278	272	9,875	31,359	58%

Table 1. Total farms providing yield and quality data by year

A subset of participating farms also provided production cost data. Table 2 shows the number of farms providing production cost data during each year of the project. Substantial effort was invested to increase provision of this data and this was reflected in significant increases in the number of businesses participating over the life of the project.

Season	Total farms	Bearing farms	Bearing hectares	Tonnes of nut-in-shell	% of industry by NIS (@10% MC)
2016	54	53	2,302	7,414	14%
2017	74	71	3,244	8,922	19%
2018	87	85	3,541	11,603	22%

Table 2. Total farms providing production cost data by year

Industry reports

Annual industry reports were produced both electronically and in bound, hard copy format. Hard copy reports were delivered to all participating farm businesses. Electronic versions were published via the Queensland Government publications portal. Links to these documents were provided to major industry stakeholders via the industry communications program. Online versions of industry benchmark reports were replaced annually as data was superseded by later versions. Electronic versions of industry reports were collectively downloaded 672 times during the project term.

Both interim and final versions of the industry report were produced during the first two years of the project. Interim reports were discontinued in the final year of the project in favour of earlier release of the final report.

Links to the 2009–2017 interim and final industry reports published on the Queensland Government Publications Portal are listed in the References section.

The final industry report included the following information:

- Scope and coverage of data
- Rules and assumptions
- Summary of plantings
- Metrics from the most recent season, including factors limiting production
- Seasonal yield, quality and cost trends

- Top performing farms (based on sustained performance over multiple seasons)
- Seasonal trends by region
- Productivity and quality percentiles
- Productivity and quality by tree age
- Productivity and quality by farm size
- Productivity and quality by planting density

Benchmark Group meetings

A total of 18 Benchmark Group meetings were held throughout major production regions during the project. Table 3 shows the number of farms represented by Benchmark Group participants in each region and season.

Season	Benchmark Group meeting dates and farm numbers											
	Central Qld		Gympie Qld		Glasshouse Qld		Northern Rivers NSW (large farms)		Northern Rivers NSW		Mid-north coast NSW	
	date	farms	date	farms	date	farms	date	farms	date	farms	date	farms
2016	19/08	33	18/08	9	16/08	18	23/08	27	30/08	24	20/09	20
2017	23/08	26	18/08	7	15/08	13	29/08	21	30/08	7	13/09	14
2018	28/02	24	11/12	8	13/12	12	14/03	22	25/01	10	24/01	15

Table 3. Benchmark Group meeting dates and number of participating farms by region and year

Case studies

Six case studies in short-video format were developed and published during the project (Table 4). These case studies were collectively viewed 15,978 times during the project. Links to these videos are included in the References section.

Title	Release date	Duration	Views
Maximising orchard productivity through orchard floor management	October 2016	5 min 36 sec	10,345
Investing in orchard productivity	October 2016	4 min 29 sec	1,323
A holistic approach to orchard productivity	September 2017	8 min 57 sec	1,318
Tree height reduction to maintain productivity	September 2017	8 min 56 sec	2,522
Improving yield through supplementary irrigation	September 2018	4 min 58 sec	151
Macadamia seed weevil: monitoring and control	October 2018	6 min 31 sec	319

Table 4. Video case studies produced 2015-2018

Communication

Benchmarking findings were presented at a range of industry stakeholders meetings (Table 5). Most MacGroup meetings included presentation of benchmark findings, delivered either directly by the project team or by Australian Macadamia Society (AMS) staff.

Meeting type	Dates
Consultants meeting	8-9 June 2016 7-8 June 2017 6-7 June 2018
AMS conference	18-20 October 2016 13–15 November 2018
IPM project meeting	8-9 December 2016 6 February 2018 17 November 2018
Australian Macadamia Handlers Association meeting	22 February 2019
MacGroup meetings	Regularly between 2016 - 2019

Table 5. Industry stakeholder meetings at which benchmarking findings were presented

Five feature articles were produced for the Australian Macadamia Society News Bulletin:

- Farm productivity improves for the second year in a row (May 2016)
- Stable production costs mean yield is the key to profitability (August 2016)
- Key findings from Benchmark Group meetings (February 2017)
- Performance of the top 5% of farms (April 2017)
- Insights from the 2017 interim benchmark sample (January 2018)

An article summarizing findings from the latest season is also in preparation for the next AMS News Bulletin.

Economic modelling and forecasting

Economic modelling using baseline benchmark data was used to assess of the economic viability of IPM strategies for the Fruit Spotting Bug project (MT10049) and baseline net present value assessments of regional variety trial selections (MC11001), as well as an economic evaluation of the macadamia breeding program (MV14000). Regional yield and planting data was analysed to refine yield models as part of the macadamia crop forecasting project (MC15009). The financial effect of a number of scenarios of AVG and replanting impact were modelled for the abnormal vertical growth project (MC15011).

Financial profiles used to underpin these analyses were updated annually to reflect the latest industry productivity, quality and cost information.

Table 6 details custom profiles developed to meet commonly requested inquiries from investors and industry stakeholders.

Year	Farm characteristics			
	Stage	Size Ha	Irrigation status	Productivity
2016	Established	30	irrigated	average
	Established	30	irrigated	high
	Established	30	non-irrigated	average
	Established	30	non-irrigated	high
	New	30	irrigated	high
	New	30	non-irrigated	high
2017	Established	30	irrigated	average
	Established	30	non-irrigated	average
	Established	30	non-irrigated	high
2018	Established	100	irrigated	average
	Established	100	irrigated	high
	Established	100	non-irrigated	average
	Established	100	non-irrigated	high
	New	100	irrigated	high

Table 6. Custom financial profiles developed 2015- 2018

Ad-hoc analysis and services

The project team provided analyses and reports to investors, industry stakeholders, RD&E service providers and other authorities. Detail of these interactions and the services provided was documented via narratives from 2017 onwards. Although details and data associated with many of these interactions are confidential, a general summary of the services delivered is shown in Table 7.

Subject	Documented enquiries	Description of enquiry
New farm development (Qld)	10	Economic assessment of new farms with customised projected productivity, quality and expenditure
New farm development (NSW)	5	
Established farm acquisition	2	Supporting documentation for decision making and to support finance applications
Industry expansion inquiry for Government	1	Industry metrics to inform senior management
Real estate enquiry	1	Information to guide valuation of farms
Research / studies	4	Data and economic profiles to support research projects.
Sugar redevelopment to macadamia	2	Cost breakdown data for assessment of viability and due diligence
Justification of farm costs vs productivity	2	Economic assessment of benchmark data to support farm expenditure decisions
Securing finance for capital	1	Benchmark data used to support business cases for farm capital expenditure
Orchard depreciation	1	Yield x age data to inform depreciation in young orchards
Custom analysis	8	Data analysis specific to tree age, farm size, regions and irrigation status
Total	**37**	

Table 7. Ad-hoc enquiries managed and services delivered by the project (2017 onwards)

The project also directly supported other macadamia industry projects with a range of data and analyses as shown in Table 8.

Project code	Project title	Data and analyses provided
MC11001 MC14000	Regional variety trials Macadamia breeding	Economic evaluation of the macadamia breeding program and baseline net present value assessments of selections from regional variety trials to prioritise varieties for commercial release
MC15009	Crop forecasting	Yield x age benchmark data used to refine early yield models for refinement of annual forecasts
MC16005	Integrated pest management	Analysis of factory insect reject levels and cash flow impact of emerging integrated pest management strategies
MC15011	Abnormal vertical growth	Economic impact of AVG and financial profiles of re-planting strategies
MC15004	Industry innovation and adoption program	Contributed analysed yield, quality and limitations information to MacGroup presentations
MC15003	National macadamia communication program	AMS News Bulletin articles on productivity, costs, top performing farms and Benchmark Group findings

Table 8. Data and analyses provided to other industry-funded projects and service providers

Outcomes

Participation has been maintained between the 2016 and 2018 seasons with an average of 57% of industry (by production) represented in the benchmark sample. High ongoing participation rates indicate that clients are finding value in participating in the project. One hundred and twenty one farms have now participated in benchmarking for eight years and 217 farms have participated for five or more years.

Farm reports

During each year of the project an average of 272 farms gained insight into their ranking in the industry for productivity and quality through the provision of customised farm benchmark reports. These reports increased awareness and understanding of potential productivity and quality gains by comparing their farm to farms of a similar size, tree age, locality, region and irrigation status. All respondents to the final benchmark participant survey found farm benchmark reports useful for decision-making (see M&E section).

An average of 70 farms per year gained insight into how their expenditure compared with other farms by submitting production cost data. Annual cost of production analyses confirmed a generally rising trend in annual production costs during the project. They also provided insight into the high variability in production costs between farms, both per hectare and per tonne of nut in shell. This information and more detailed findings across major heads of expenditure were widely requested during the project. Production costs were also frequently discussed and debated at regional Benchmark Group meetings.

Industry reports

Benchmarking participants, processors, consultants, researchers, investors and other stakeholders have used annual industry reports to inform a wide range of decision-making. All surveyed benchmark participants found industry benchmark reports useful for improving understanding of their farm's productivity or quality in relation to other farms (see M&E section).

Analysis of yield and quality data over 10 seasons and cost data over 6 seasons has identified and quantified variability and trends associated with production regions, tree age, farm size, planting density and use of irrigation. Some of the key learning that has informed industry or guided further analysis include:

- There is high variability in productivity between farms (standard deviation is 52% of the mean)
- There is high variability in productivity between seasons for any given farm (8-year average standard deviation is 32% of the mean)
- Examples of sustained high orchard productivity was identified in all production regions, and across all farm size and tree age groups
- Average long-term productivity per hectare was highest in the Central Queensland region
- Average productivity for the top 25% of farms (based on sustained productivity over 4+ years) was 400% higher than the remainder of the sample.
- Insect damage is the leading cause of factory reject. Highest average levels were recorded in the NSW Mid-North Coast region
- The incidence of insect damage among small farms (< 10 Ha) is relatively high compared with all other farm size groups
- Lack of available moisture caused high immaturity in some seasons, particularly in South East Queensland
- Average internal discolouration rejects are higher in Bundaberg compared with other regions
- Average production costs per hectare and per tonne have increased over the last five seasons, particularly employment and crop nutrition costs
- Average long-term saleable and reject kernel recovery was highest in the NSW Mid-North Coast region

Data collected on major limitations to production has provided an overview of environmental, management and pest and disease limitations for each season. In 2017 and 2018, weather-related environmental factors contributed to over 40% of reported limitations.

The format and content of the final industry report was revised in the first year on the project to maximise industry uptake. Improvements include removal of statistical analyses, emphasis on visual charts and info-graphics rather than tabular data, and interpretation of seasonal findings wherever possible. 46% of participants found the new layout to be more useful than previous reports. All final survey respondents found the industry report sections on farm size, seasonal results, top performing farms and results for all farms either very useful or useful. Ninety eight percent of respondents found the sections on tree age and costs of production either useful or very useful.

Benchmark groups

Benchmark Group participants were surveyed following each meeting to evaluate impact and establish priorities for ongoing discussions. In the final Benchmark Group survey 77% of participating growers (representing 91 farms) indicated they had changed, or planned to change practices as a result of the attending the meetings (see M&E section).

Benchmark Group participation rates remained relatively stable through the project. An average of 103 farms per year participated in regional meetings, providing insight into seasonal and regional farm productivity, quality and costs. Inclusion of researchers, consultants and processors in the meetings was highly valued by participants for the insight and experience these stakeholders were able to add to discussions. Incorporating empirical data from the meetings, such as seasonal observations and limitations, in farm and industry reports extended some key learnings from Benchmark Groups to the wider industry.

Case studies

The six video-based case studies have attracted more than 15,000 views via the Queensland Agriculture YouTube channel. Video has proven very effective for reducing complexity and identifying key messages. The 24-hour accessibility of web-based video suits the target audience and the use of grower champions has built trust. These case studies re-inforce other positive industry messages and initiatives such as Integrated Orchard Management and Integrated Orchard Nutrition.

97% of survey respondents in 2018/19 found video case studies useful for increasing awareness of farm performance (see M&E section). The most viewed case study was “Maximising orchard productivity through orchard floor management” with over 10,000 views and accounting for 65% of all case study views. This reflects the recent relevance of this topic, with many orchards undertaking orchard floor management as a first step toward rejuvenation.

Communication

Information from MC15005 was extended to clients through industry meetings and media. Yield, quality and costs trends were presented at MacGroup meetings, which further raised the profile of the benchmarking project. Participation was also enhanced through collaboration with project MC15003 National macadamia grower communication program, which promoted benchmarking through News Bulletins and e-blasts.

Seasonal productivity and factory reject levels were presented at three annual pest consultants meetings. These were delivered as part of the Australian macadamia industry innovation and adoption program (MC15004). Results presented at these events reached most industry pest consultants, providing insight into the relative impact of pests and diseases at a regional and whole industry level.

Five articles were published in the AMS New Bulletin during the project. The News Bulletin reaches an average of more than 750 readers, affording significant opportunity for communication of findings.

The benchmarking project is recognised as a reputable and independent source of industry productivity and quality metrics. AMS industry award winners for the 2017 and 2018 seasons were selected according to their rank in the benchmark sample. Participation in benchmarking is now a prerequisite for consideration of eligibility for industry awards.

Economic modelling and forecasting

Annual updating of financial profiles has ensured that the latest economic and agronomic data is available for decision-making. This is particularly important during the current period of industry expansion. Benchmark data and economic profiles have provided a reliable, objective basis for assessing potential farm business productivity and profitability. Growers, consultants, processors, accountants, investors and researchers have used these data and profiles to support business cash flow forecasting and decision-making for investment, expansion and capitalisation. Although details of specific farm investments must remain confidential, a total of more than 2000 hectares of potential new farm development have been documented since 2017.

Monitoring and evaluation

Three anonymous surveys and a mid-term project review informed the assessment of progress against the three primary objectives identified in the Monitoring and Evaluation (M&E) plan. These were to:

- Increase awareness of individual farm performance and industry productivity trends
- Identify and facilitate adoption of management practices that lead to high orchard productivity
- Increase knowledge and understanding of the economics of macadamia production

In 2016, 45 growers completed a web-based survey of all benchmarking participants. In 2017, a survey was conducted in conjunction with regional Benchmark Group meetings, using electronic polling devices to capture and report feedback. This produced 57 responses representing 88 farms. A survey was also conducted in 2018/19 in conjunction with regional Benchmark Group meetings, this time via questionnaires distributed to participants (Appendix C). A total of 51 participants representing 91 farms responded. A mid-term review of the project was conducted by the Project Reference Group (PRG) in late 2017, using parameters provided by Hort Innovation. Review findings were reported directly to Hort Innovation in March 2018.

Effectiveness

All surveys have shown that farm and industry reports are highly valued by growers for decision-making. In the most recent survey, all respondents indicated that their farm reports were useful for increasing awareness of the factors affecting their farm's performance (83% very useful, 17% useful). Similarly, all survey respondents indicated that the industry report was useful for increasing awareness of seasonal trends and factors affecting farm productivity and quality (66% very useful, 34% useful).

Survey results also show that the project has resulted in practice change and adoption of best practice. Over 77% of respondents in the latest survey identified practice changes made or planned as a result of their participation in the project. A further 18% were unsure at this stage and 5% had made no change.

Farm business profiles developed from benchmark trend data have provided reliable, objective information to inform the assessment and forecasting of farm business productivity and profitability (see tables 7 and 8). This is a necessity for financial planning by both current and potential growers.

Case studies were produced in short-video format following the success of the video-based approach as measured through the 2015 evaluation of the macSmart project (MC09002). In that survey 72% of respondents indicated videos contributed to their decision to change farm management practices and 94% indicated that they found videos useful or very useful for accessing relevant information. In the most recent benchmark survey all respondents indicated that the case studies were useful for increasing awareness of factors affecting farm productivity and quality (36% very useful, 64% useful).

As part of the mid-term review, the PRG was asked to rate their satisfaction with project activities in terms of addressing expected outcomes and impacting industry. The average of all ratings was 8.2 out of 10. The PRG members commented that the project is fully engaged with the industry and acknowledged high annual participation rates. The PRG also noted that industry trusts the quality of the information produced by the benchmarking team and this means the information is used and the industry is better informed.

Relevance

High ongoing rates of participation in the project indicate that it has been relevant to the intended audience. Participation has grown to over 58% of the national industry (by production), despite a high turnover of farms during the project term. More than 200 farms have participated in benchmarking for five or more years and more than 120 farms have participated since benchmarking began in 2009.

Benchmark Group meeting agendas are developed in consultation with participants and content is tailored to cover important regional and seasonal issues. Inclusion of regional consultants and processor representatives provides further local experience and perspective. Hosting of Benchmark Group meetings on farm, wherever possible, provides opportunity to see and discuss topical issues and management practices.

Provision of data and reports to support 37 documented enquiries (Table 7) and seven industry-funded RD&E projects (Table 8) is further evidence that the information generated by the project is both relevant and highly valued by industry stakeholders.

The PRG rated the value of the project to the macadamia industry highly – on average scoring it 8.9 out of 10. The group members commented that the information produced by the benchmarking project is an important / essential tool for industry, and that the reports are referred to frequently, and also that the data collection covers a good time span.

Process appropriateness

Strong industry engagement has been critical to the success of the benchmarking study. High levels of participation were achieved through effective, sustained collaboration with growers and a wide range of industry stakeholders. Strict adherence to confidentiality and privacy policies has built credibility and trust among industry over many years.

The team has used many strategies to make participation in the project easy and worthwhile. For example, historical contact information on each participating business is maintained to ensure continuity and minimise client disturbance. The content and format for both farm and industry benchmark reports is guided by client input and feedback. All reasonable requests for information from industry stakeholders are satisfied through provision of customised ad-hoc reports and data.

The team has engaged widely with industry and stakeholders to provide information that is both relevant for the intended audience and consistent with latest research findings. Close collaboration and coordination with other RD&E service providers and projects has been key to delivering timely, consistent messages and information to industry. For example, coordination with industry adoption, innovation and communication projects has been beneficial for ensuring consistency of messages and for coordinating their delivery. Inclusion of leading researchers in Benchmark Group activities to promote two-way exchange of information and observations has further strengthened linkages and opportunities for extending and coordinating outputs.

In the project's mid-term review, the PRG commented that:

- the project is fully engaged with industry, and so is gaining very high industry participation rates
- The reports and case study videos produced are excellent - high quality data, complex and professional, while easy to use
- Reports are frequently referred to in industry discussions and used for directing research

Efficiency

The project team regularly reviews and seeks to continuously improve the efficiency of its data collection, management and reporting procedures. Some examples of improvements include:

- The format and content of the final industry report has been significantly refined as a result of extensive industry consultation and feedback
- Consignment data is now sourced in blocks from processors to minimise disruption and workload
- Development of an electronic data collection form (including optional e-signature) has simplified provision of data for those participants who prefer to avoid a paper-based system
- From 2016 onwards, the team has trialled production of customised, consolidated farm reports for large businesses
- Following mid-term review PRG feedback requesting more production cost data, collection processes were reviewed and refined, resulting in a substantial increase in cost datasets sourced in the final year of the project (Table 2).
- Closer partnerships with all major processors has shortened the data analysis and reporting cycle, allowing interim reports to be discontinued in favour of earlier final reports
- Discussions with the Australian Macadamia Handlers Association (AMHA) are ongoing, to seek to simplify data consent procedures and processes
- Changes to timing of Benchmark Group meetings, enabling discussion of seasonal results much closer to the end of each production season, have been universally welcomed by participants

In feedback from the mid-term review the PRG commented that:

- The project continued to improve (Benchmark) Group meeting format and frequency, and therefore value.
- Project team always look to value-add, beyond required outputs.

Recommendations

Over the last decade a variety of factors have significantly influenced seasonal productivity and quality including weather, pests and diseases. High production variability has been observed in this and previous benchmark studies, both between seasons and between farms in any given season. Access to a large pool of data spanning many seasons is required to provide statistical confidence in sample averages and accurately report on seasonal and regional trends. Continued collection of yield, quality, planting and cost data will support these objectives.

Collection of seasonal empirical data was successfully trialed during this project and has proven useful for identifying causes of seasonal and regional variation. Continued linkage with seasonal grower observations of limiting factors is recommended to provide further insight into the relative impact of seasonal conditions, on both farm and whole-industry productivity and quality metrics. The availability of longer-term seasonal observation data will facilitate more detailed analysis of the factors influencing productivity and quality as well as allowing more reliable assessment of the relative industry impact of seasonal conditions such as weather, pests and disease.

It may also be useful to examine management practices that can mitigate these effects in more detail. Examples include irrigation (including supplementary), soil amelioration and soil health, drainage and erosion control and canopy management. Access to data at finer level (i.e. local or farm), such as temperature and rainfall may be beneficial for this type of study. Some of this is being considered in conjunction with other RD&E projects (e.g. MC15004).

Survey feedback from this project suggested that regional Benchmark Group meetings were highly valued by clients and stakeholders. Participants in some regions, such as Bundaberg and Gympie, recommended raising the profile of these group activities to encourage wider participation. Consideration of this is recommended to determine potential for increasing both participant numbers within specific groups as well as possible new groups (e.g. young farms in Bundaberg, new farms in coastal Northern NSW).

In response to PRG feedback from the mid-term project review, collection of production cost data was expanded to provide more confidence in seasonal and regional averages. The volume of cost data collected by the end of this project should be maintained to counter ongoing high variability in production costs between seasons and farms. High confidence in cost trend data is important for provision of reliable information to investors and other stakeholders. Demand for this information is expected to remain high due to ongoing industry expansion.

Refereed scientific publications

None to report.

References

2009 – 2017 Macadamia industry interim report

https://publications.qld.gov.au/dataset/macadamia-industry-benchmark-report/resource/b0b5605f-6f04-49e0-a1c6-c6b6fc97aa9a

2009 – 2017 Macadamia industry report

https://publications.qld.gov.au/dataset/macadamia-industry-benchmark-report/resource/a783d63e-cc40-4988-9d0d-c5642a563ae2

Intellectual property, commercialisation and confidentiality

No project IP, project outputs, commercialisation or confidentiality issues to report.

Acknowledgements

This report has been produced as part of the "Benchmarking the macadamia industry 2015–2018" project (MC15005). This is a joint initiative of the Department of Agriculture and Fisheries, the University of Southern Queensland and the New South Wales Department of Primary Industries, with support from the Australian Macadamia Society.

This project has been funded by Hort Innovation, using the macadamia research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture. The Queensland Government has also co-funded the project through the Department of Agriculture and Fisheries.

The team wishes to acknowledge and thank all of the farm owners, farm managers, processors and consultants who provided data and participated in project activities. We particularly thank Benchmark Group participants for investing their time and being willing to share their expertise and experience with others.

We also wish to thank the following people who participated in and supported the project:

Processors

- Megan Boote, Suncoast Gold
- Craig Brice, PGM
- Ross Burgess, Andrew Pearce and Kelly Wiles, Macadamias Direct
- Grady Danaher, Pacific Farms
- Wayne Gersbach, Nutworks
- Liz Hudson, Waliz Nuts
- Kevin Quinlan, MPC
- William Pretorius, Swiss Gourmet (Australia)
- Chris Waring, MWT Foods
  Kerry Wheeler, Stahmann Farms
- Peter Zummo, CL Macs

RD&E collaborators

- Femi Akinsanmi, University of Queensland
- Ruth Huwer, NSW DPI
- Craig Maddox, NSW DPI

Benchmark Group farm hosts

- Henri Bader
- Phil Bevan
- Chris Cook
- Angela and Daniel Jackson
- Aimee and James Thomas
- Bob Willemse

Case study participants

- Scott Allcott
- Megan Boote
- Les Gain
- Peter Fraser
- Tim Salmon

Project Reference Group

- Adam Briggs
- Lindsay Bryen
- Chris Searle
- Andrew Starkey
- Kim Wilson

Appendices

Appendix A — 2018 data collection form

Macadamia benchmarking data collection form 2018 season

This form is provided as part of the "*Benchmarking the macadamia industry 2015-2018*" project (MC15005)
Please return your completed form by e-mail (macman@daf.qld.gov.au), fax (07 5453 5901), or post (Benchmarking team, PO Box 5083 SCMC Nambour Q 4560).
For assistance, please contact the team on 07 5381 1300.

Email completed form

1. Farm business details			
Owner name			
Owner contact details	Office: Mobile:	Email:	
Is the farm managed on behalf of the owner?	Yes ◯	No ◯	
Manager name (if applicable)			
Manager contact details	Office: Mobile:	Email:	
Postal address (for correspondence)			
Suburb / postcode			
Farm / business name			
Farm address			
Locality / postcode			
Is this farm irrigated?	Full ◯	Partial/supplementary ◯	Not irrigated ◯

2. Consignment details (please choose only one of the two options below)

OPTION 1 – Nominate processor(s) you supplied in 2018 and we'll source your data			OPTION 2 – Enter your summary 2018 factory results by processor			
Agrimac Macadamias	☐		Processor name			
CL Macs	☐		Total tonnes NIS @ 10% MC			
Macadamias Direct	☐		Consigned moisture content %			
Macaz	☐		Premium kernel recovery %			
MPC	☐		Commercial kernel recovery %			
MWT Foods	☐	OR	Reject kernel recovery %			
Nambucca Macnuts	☐		Whole kernel (if known) %			
Nutworks	☐		Insect damage %			
Pacific Farms	☐		Mould %			
Pacific Gold Macadamias (CNA)	☐		Discoloured %			
Stahmann Farms	☐		Internal discolouration %			
Suncoast Gold Macadamias	☐		Immature %			
Swiss Gourmet (Australia)	☐		Germinated %			
Waliz	☐					
Other	☐					

3. Consent to collect data (the project team cannot collect your data without your consent)

I hearby provide my consent for the Department of Agriculture and Fisheries to collect, use and disclose information in accordance with the project's privacy policy shown at the end of this data collection form.

Name:		
Signature:		Date:

Please turn over….

4. Your farm observations from the 2018 season
These observations are valuable for identifying seasonal, regional or emerging issues of importance to growers.

For the following three questions please identify up to **three** major factors limiting production on your farm by writing the numbers **1** (most significant) to **3** (less significant) in the boxes shown. If there were no limiting factors, please just tick "None".

Which **general orchard conditions** had the most significant impact on this farm's production in **2018**?
(Rank 1 to 3 or tick none)

☐ Dry weather ☐ Wet weather ☐ Storm/hail ☐ Soil or tree health ☐ Diseases
☐ Tree or limb removal ☐ Pests ☐ None ☐ Other ______________________

Which **pests** had the most significant impact on this farm's production in **2018**?
(Rank 1 to 3 or tick none)

☐ Fruit spotting bug ☐ Macadamia seed weevil *(previously known as Sigastus weevil)* ☐ Rats ☐ Birds ☐ Macadamia nut borer
☐ Flower caterpillar ☐ Lace bug ☐ None ☐ Other ______________________

Which **diseases** had the most significant impact on this farm's production in **2018**?
(Rank 1 to 3 or tick none)

☐ Phytophthora ☐ Flower disease(s) ☐ Husk spot ☐ Husk rot ☐ AVG
☐ Branch/tree dieback ☐ None ☐ Other ______________________

5. Planting details for this farm (used to calculate total and bearing hectares for productivity reporting)

Please complete the section below if any of your plantings have changed since last year or if you have not previously participated in benchmarking. Otherwise tick the box at right to indicate your plantings have not changed since last year.

☐ Use last year's planting data

Enter new or updated planting details if required

Year planted	Number of trees	Varieties (List individual varieties or just enter "mixed")	Row spacing (m)	Tree spacing (m)

Please turn over....

6a. Costs of production for the 2017/18 financial year (Please note section 6a-c is optional)	
Expenditure category	**Total annual cost**
Administration Includes accounting, admin salaries, insurance, office equipment/stationery, telephone, fax, post.	
Consultants Includes pest scouts, leaf/soil monitors and those who provide orchard management advice.	
Contractors Includes contract dehusking/sorting, harvesting, pruning and spraying.	
Crop nutrition Includes all fertiliser and nutrition-related expenses. Excludes labour.	
Crop protection Includes fungicides, inseticides, rodenticides, weedicides, stickers, wetters etc. Excludes labour.	
Employment costs Includes permanent and casual wages for all farm business activities, OH&S, superannuation, worker's comp. and training. Excludes farm manager salary or farm management fees.	
Freight Includes both inward (e.g. machinery delivery) and outward (e.g. nuts to processor). Excludes labour.	
Fuel and oil Includes diesel, petrol and oil for all equipment used as part of the farm business.	
Government charges Includes rates, vehicle registrations, land tax and other related government charges.	
Hire Includes all farm or shed machinery used by the farm business.	
Irrigation Includes water usage, water rates and R&M of the irrigation system. Excludes labour (see employment costs).	
Leases Includes farm and shed machinery leases.	
Management Includes salaries, fees and other expenses related to provision of farm management (e.g. farm manager).	
Repairs and Maintenance – Improvements Includes dams, farm buildings, fences, roads and other improvements. Excludes labour (see employment costs).	
Repairs and maintenance – plant Includes vehicles, orchard and shed machinery, tools and other equipment. Excludes labour (see employment costs).	
Utilities Includes all expenses associated with use of gas and electricity by the farm business	

6b. Unpaid labour for the 2017/18 season (e.g. owner/operators whose time is not included in employment costs above)	
How many hours of unpaid labour per week were typically performed on this farm during 2017/18? (Please add hours for all unpaid workers)	

6c. Your expenditure priorities for 2017/18

This information is valuable for tracking average expenditure and separating this from activities such as canopy management or tree replacement, which may significantly impact farm costs in specific seasons.

How did total production costs in **2017/18** compare with typical expenditure on this farm in previous seasons?

☐ Above average ☐ Average ☐ Below average

What were your <u>top 3</u> orchard management activties that had a significant impact on your production costs in 2017/18? **(Please rank 1 to 3, with 1 being the highest cost)**

☐ Tree removal ☐ Tree planting ☐ Canopy management ☐ Drainage work

☐ Mulching/composting ☐ Other (please detail) ____________________

What is your preference when acquiring farm machinery? ☐ Purchase/finance OR ☐ Leasing

Thank you for your participation

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7. Privacy policy (this governs how we collect and use any data you provide)

The Queensland Government has in place a privacy scheme to ensure that public service agencies respect personal information. The Department of Agriculture and Fisheries (DAF) has been conducting best practice and benchmarking work within the Australian macadamia industry since 1998. As part of the current project (MC15005) the team and its collaborating partners need to collect information annually.

Collected information includes

- Your personal contact details in order to validate and cross reference the data you provide and to contact you in relation to the project.
- Consignments including tonnage, kernel recoveries and reject analyses;
- Plantings including tree numbers, ages, varieties and spacings;
- Costs of production (optional);
- Farm management practices (optional); and
- Survey responses evaluating products and services provided by the project (optional).

How your information is managed

We value the information you provide and we manage it in accordance with the Information Privacy Act 2009 (Qld). For more information about how we safeguard your privacy see http://www.qld.gov.au/law/your-rights/privacy-and-right-to-information/privacy-rights.

Your information is stored securely in computer systems that can only be accessed by authorised project staff. Paper data collection forms are filed securely. Your personal or confidential information will not be published or shared with any third party, other than the project partners listed below, without your prior written consent.

Your information will be used to

- analyse and anonymously compare annual productivity of farms;
- develop confidential farm benchmark reports;
- develop and publish industry benchmark reports and economic analyses; and
- identify industry trends to inform crop forecasting, research projects and strategic planning.

These activities are designed to better inform you as macadamia growers and the Australian macadamia industry as a whole. Your individual farm data will not be published nor identified in any reports other your own confidential farm benchmark report. All reports and information published is based only on average data that does not permit identification of individual farm results.

Your information may be shared with project team members within the following partner organisations

- New South Wales Department of Primary Industries; and
- University of Southern Queensland.

Information that we have collected from you may be shared with these project partners so that they can assist with data analysis. Any collected data that we share with a project partner for analysis is first de-identified to safeguard your privacy and confidentiality. Your contact details may also be shared with these project partners to allow them to contact you to collect or verify your data for the purposes of this project only. We protect your personal and confidential information through collaborative agreements with each of these project partners.

How long your information will be used

We will use your information for the duration of the MC15005 project unless you advise us that you no longer wish to participate, in which case we will delete your details from our database.

To access, change or remove your information

You may access or correct your information at any time by contacting the Macadamia Benchmarking team at:

Department of Agriculture and Fisheries
PO Box 5083 SCMC
Nambour Q 4560
Ph: 07 5381 1300
Email: macman@daf.qld.gov.au

The "Benchmarking the macadamia industry 2015-2018" project (MC15005) is a joint initiative of the Department of Agriculture and Fisheries, The University of Southern Queensland and NSW Department of Primary Industries, with support from the Australian Macadamia Society. The project has been funded by Horticulture Innovation Australia Limited using the macadamia levy and funds from the Australian Government.
The Queensland Government has also co-funded the project through the Department of Agriculture and Fisheries.

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Appendix B — Links to online case study videos

- Maximising orchard productivity through orchard floor management: https://www.youtube.com/watch?v=sZRw1x2oW4E&feature=youtu.be

- Investing in orchard productivity: https://www.youtube.com/watch?v=p4OnxgMYTRA&feature=youtu.be

- A holistic approach to orchard productivity: https://www.youtube.com/watch?v=uaGV1yTCaOo&feature=youtu.be

- Tree height reduction to maintain productivity: https://www.youtube.com/watch?v=K0_cP__8GTc&feature=youtu.be

- Improving yield through supplementary irrigation: https://www.youtube.com/watch?v=DMMy2pNXdJA&feature=youtu.be

- Macadamia seed weevil: monitoring and control: https://www.youtube.com/watch?v=4QcO8oLh9hw&feature=youtu.be

Appendix C — Evaluation survey form

Macadamia benchmarking project evaluation 2018

1. How useful did you find your personalised farm reports?

Please evaluate each aspect of the reports:

	Very useful	Useful	Not useful	Haven't yet read
Results from the most recent season	○	○	○	○
Results summarising all seasons	○	○	○	○

2. How useful did you find the industry benchmark reports?

Please evaluate each aspect of the reports:

	Very useful	Useful	Not useful	Haven't yet read
Results for all farms	○	○	○	○
Top performing farms	○	○	○	○
Seasonal results	○	○	○	○
Results by tree age	○	○	○	○
Results by farm size	○	○	○	○
Costs of production	○	○	○	○

3. How could benchmark reports be improved?

4. How useful did you find the Benchmark Group meetings?

Very useful	Useful	Not useful	Haven't yet read
○	○	○	○

1

5. How could the Benchmark Group meetings be improved?

6. How useful did you find the video case studies?

Very useful	Useful	Not useful	Haven't yet read
◯	◯	◯	◯

7. Has the benchmarking project increased your awareness of how your farm has been performing?

Please evaluate each aspect of the project:

	Very much	Somewhat	Not at all	Haven't yet read / watched / attended
Farm reports	◯	◯	◯	◯
Industry reports	◯	◯	◯	◯
Video case studies	◯	◯	◯	◯
Benchmarking group meetings	◯	◯	◯	◯

8. Has the benchmarking project increased your awareness of the factors affecting your farm's performance?

Please evaluate each aspect of the project below:

	Very much	Somewhat	Not at all	Haven't yet read / watched / attended
Farm reports	◯	◯	◯	◯
Industry reports	◯	◯	◯	◯
Video case studies	◯	◯	◯	◯
Benchmarking group meetings	◯	◯	◯	◯

2

9. Has the benchmarking project increased your awareness of the economics of your farm's production ?

Please evaluate each aspect of the project below:

	Very much	Somewhat	Not at all	Haven't yet read / watched / participated
Farm reports	○	○	○	○
Industry reports	○	○	○	○
Video case studies	○	○	○	○
Benchmarking group meetings	○	○	○	○
Cost of production participation	○	○	○	○

10. Have you made changes, or do you intend to make changes, to your business as a result of participating in the benchmarking project?

○ Yes (please provide some detail below where possible)

○ No

○ Unsure

Comment

11. Do you have any other comments or suggestions in relation to current or future benchmarking work?

12. Thank you for taking the time to participate in our survey.

☆ ☆ ☆ ☆ ☆

3

Appendix D — Benchmark project findings

Scope and coverage

Table 1 shows the number of bearing farms participating in benchmarking in each major production region. It also shows average farm size and tree age for farms within each of those regions. In 2018 more than half of all participating farms were from Northern Rivers of NSW (NRNSW). Farms in the NRNSW region were, on average, older than those in other regions. Central Queensland (CQ) farms had the highest median planted hectares, making up almost a half of the sample's total planted area, and contributing over half of the sample's total NIS.

The total planted hectares can vary substantially between farms, particularly in some regions. Median rather than average planted hectares per farm is shown in the table as this is more characteristic of typical farm size in these instances.

2018 regional breakdown											
Region	Bearing farms	% of sample by number of farms	Mature cost of production farms	Costs per hectare	Costs per tonne of saleable kernel	Average tree age	Total planted hectares	Median planted hectares per farm	% of sample by planted hectare	Total NIS tonnes	% of sample by NIS tonnes
Central Queensland (CQ)	51	19%	22	$9884	$9728	14	5328	58.8	51%	17,582	56%
South East Queensland (SEQ)	52	19%	10	$8385	$6841	24	1454	13.1	14%	4862	15%
Northern Rivers of NSW (NRNSW)	143	53%	38	$7290	$9447	24	3303	17.1	31%	7765	25%
Mid North Coast of NSW (MNNSW)	26	9%	12	$8098	$10,348	20	402	7.6	4%	1150	4%
All regions	272		82	$8238	$9337	18	10,487	18.7		31,359	

Table 1: Regional distribution of farms in the 2018 benchmark sample

Since 2013 some participating businesses have also submitted data relating to costs of production. Cost data collected from farms between 2013 and 2018 totals 349 farm-years. A total of 85 bearing farms submitted cost data in 2018, representing more than 3790 planted hectares or approximately 37% of total production captured in the benchmark sample in that year. Table 2 summarises the number of farms contributing data to the general benchmarking program and also the number participating in the cost of production program.

Participating farms by season											
Seasons	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009-2018
Yield and quality											
Mature farms	144	153	163	202	218	224	237	245	263	264	**2113**
Bearing farms	178	184	192	243	262	267	271	271	274	272	**2414**
All farms	192	195	207	252	265	268	271	273	278	278	**2479**
Cost of production											
Mature farms	–	–	–	–	36	37	33	48	64	82	**300**
Bearing farms	–	–	–	–	47	47	40	54	71	85	**344**
All farms	–	–	–	–	47	47	40	54	74	87	**349**

Table 2: Number of farms participating in benchmarking and number participating in cost of production 2009-2018

What you need to know about the data

Please consider the following points when interpreting results in this report:

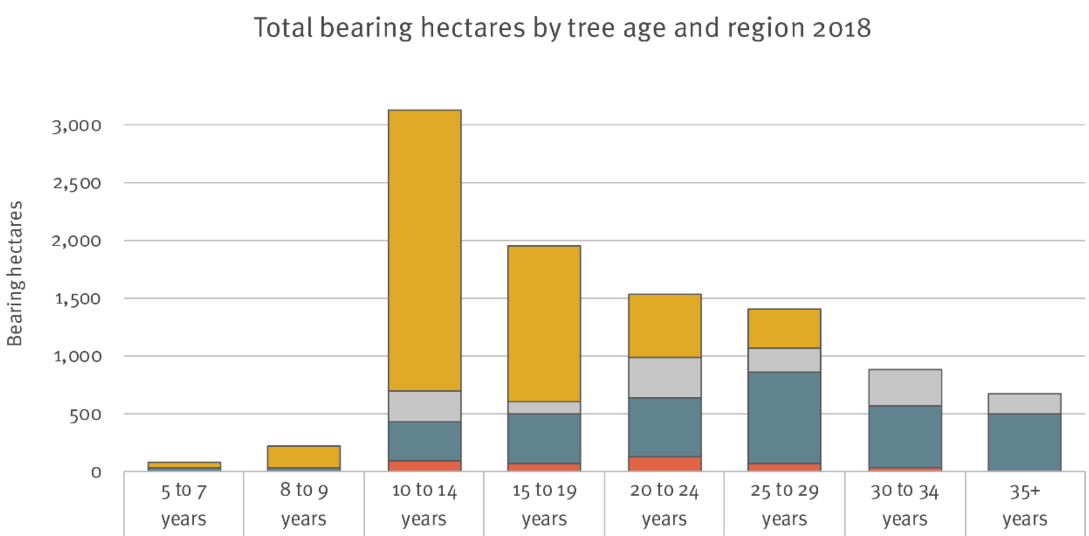
- Averages presented for any given season are based on data from a minimum of ten farms. This minimum is applied to safeguard the confidentiality of individual farm data.
- Average farm performance over multiple seasons is derived only from farms that have provided data for a minimum of four seasons. This is to minimise the impact of seasonal variability on long-term averages.
- All weights presented are based on the industry-standard moisture content of 10% for nut-in-shell and 1.5% for kernel.
- Plantings less than five years of age are generally excluded from estimates of bearing hectares. This is important for consistency across the benchmark sample.
- The sum of reject kernel category values presented equates to the total reject kernel recovery percentage, rather than totalling 100%. This standard is applied across the benchmark study to ensure uniformity.
- While we try to use well recognised terms to describe kernel recovery and reject analysis categories, processors may sometimes use different terminology to describe similar reject categories.
- Unless otherwise stated, all averages presented are unweighted. This means that all farms in the sample exert an equal influence on the average regardless of their size.
- The term farm-year is used to describe data for an individual farm for a given year. Unless otherwise specified, averages that span multiple seasons are derived from all available seasons.
- Cost data collected includes all cash costs incurred in the preceding financial year (2012/13 to 2017/18). Other costs such as capital expenditure, depreciation and taxation are excluded. From 2017 onwards unpaid labour hours have also been recorded. The value of this labour has been imputed at a nominal rate of $30 per hour to derive a more complete picture of orchard expenditure, particularly on owner-operated farms.
- Unless otherwise stated all farm costs per hectare are based on total planted hectares. This may include non-bearing hectares for some farms as most businesses do not separate costs by tree age within their accounting systems.
- Heads of expenditure shown in this report are derived from a standard chart of accounts developed in conjunction with accountants and financial advisers as part of the previous levy funded project *On-farm economic analysis in the Australian macadamia industry* (MC03023). This chart of accounts is used to ensure consistent interpretation of costs across multiple farm businesses.
- Some averages may be based on subsets of the available data. Atypical or non-representative data may be excluded from some analyses to avoid adversely skewing averages. Where this has occurred it will generally be indicated in results (e.g. mature farms only).

Plantings

Figure 1 shows a breakdown of bearing hectares by region and tree age within the 2018 benchmark sample. Plantings less than five years of age are not considered bearing and are therefore excluded. Some farms, particularly in the Central Queensland (CQ) region, harvest nuts from four year old trees but these are usually small volumes. As individual tree ages vary between plantings on many farms, tree age categories shown in the chart are based on a weighted average tree age for each farm.

Farms with an average tree age between 10 and 14 years comprised the largest number of bearing hectares in the 2018 benchmark sample. This corresponds with trees planted between 2005 and 2009. Most of the farms in this age group are located in CQ, as are those in the 15-19 years age group.

Farms in the South East Queensland (SEQ) region are spread across multiple age groups from 10 years through to more than 35 years. Farms in the Northern Rivers of NSW (NRNSW) region have the widest diversity of average ages, from 8-9 years through to more than 35 years of age. Farms in the Mid North Coast of NSW (MNNSW) region are spread relatively evenly from ages 10 through to 34.

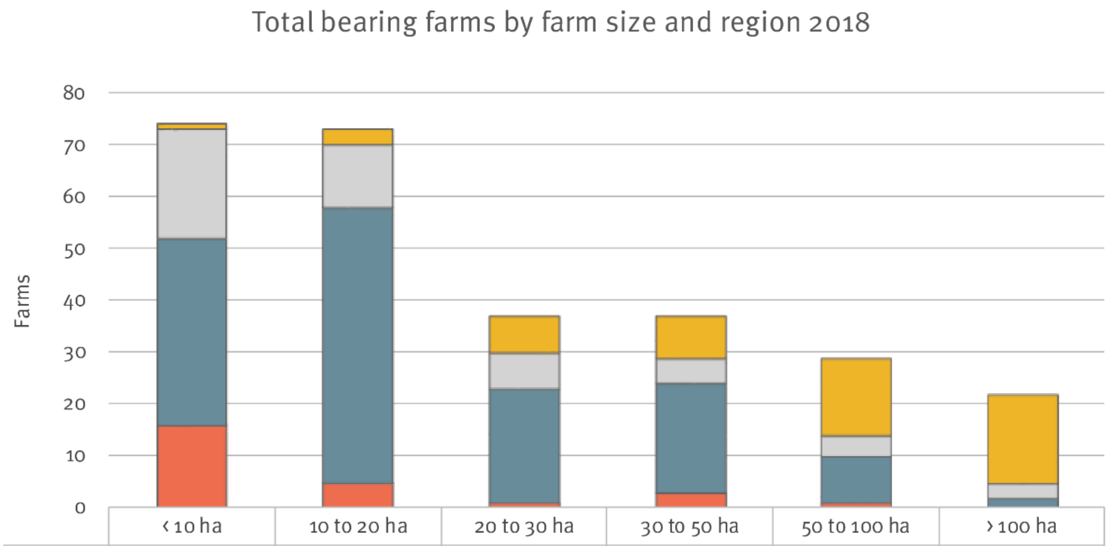


	5 to 7 years	8 to 9 years	10 to 14 years	15 to 19 years	20 to 24 years	25 to 29 years	30 to 34 years	35+ years
CQ	50	184	2,439	1,352	538	337	0	0
SEQ	0	0	264	105	359	215	316	171
NRNSW	29	33	331	431	508	788	536	502
MNNSW	0	0	96	64	126	71	30	0

Figure 1: Total bearing hectares of benchmarking farms as of 2018, displayed by tree age and region

Figure 2 shows a breakdown of farms in the 2018 benchmark sample according to their size. The chart shows the number of farms within each major production region for size categories ranging from less than 10 hectares to more than 100 hectares.

Most farms had between 10 and 20 hectares (73 farms) or less than 10 hectares of bearing trees (74 farms). The majority of these farms are located in the MNNSW, NRNSW and SEQ regions. By comparison, the majority of larger farms (> 50 hectares) were located in the CQ region.



	< 10 ha	10 to 20 ha	20 to 30 ha	30 to 50 ha	50 to 100 ha	> 100 ha
CQ	1	3	7	8	15	17
SEQ	21	12	7	5	4	3
NRNSW	36	53	22	21	9	2
MNNSW	16	5	1	3	1	0

Figure 2 : Number of bearing farms participating in benchmarking by farm size and region

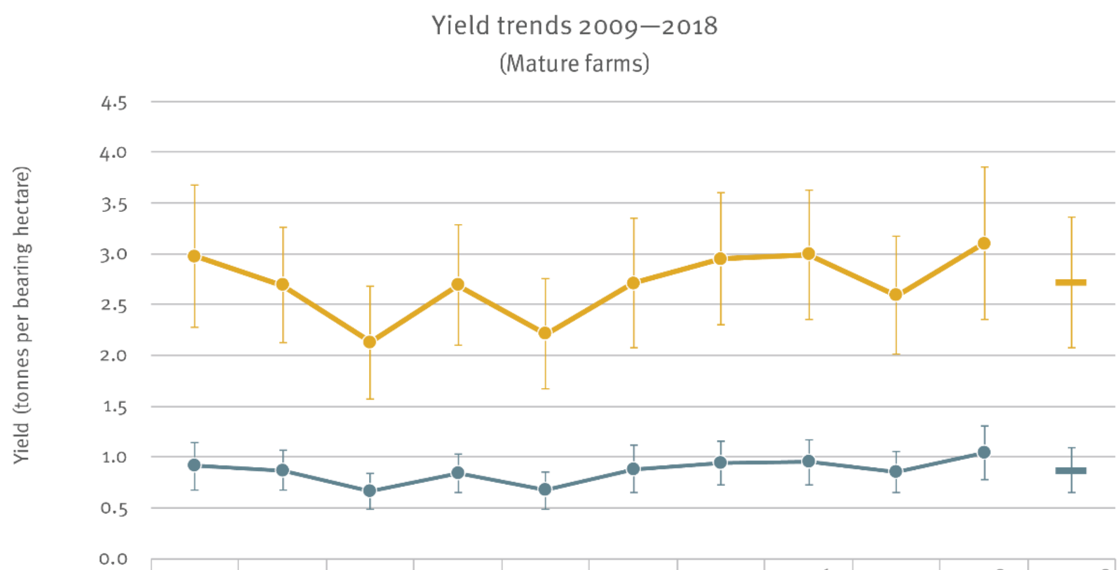
Seasonal trends

This section shows seasonal orchard productivity and quality from 2009 to 2018. This provides insight into long-term trends as well as seasonal variability within the sample. Cost trends are also shown for each year in which cost of production data was collected (2013 to 2018).

Figure 3 shows trends in average nut-in-shell (NIS) and saleable kernel (SK) yield per bearing hectare for mature farms (10+ years old) in the benchmark sample. The vertical error bars show the standard deviation for each season. Larger error bars indicate higher variability between farms in the benchmark sample.

The standard deviation in NIS productivity averaged 1.29 tonnes per bearing hectare from 2009 to 2018, or approximately 47% of average NIS productivity. Standard deviation in SK productivity over this period was 0.45 t/ha, or approximately 52% of average SK production. There has been no substantial change in either NIS or SK production variability since 2009.

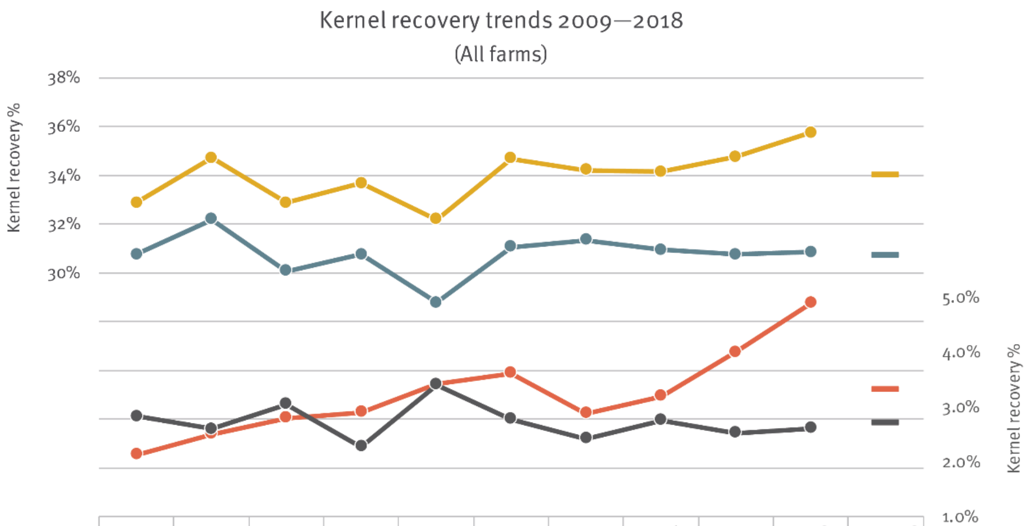
The major factors limiting production, as reported by benchmarking participants in 2017 and 2018, were hot and/or dry weather conditions, rain, hail, flood and storm events, and pests.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
NIS yield	2.97	2.69	2.13	2.69	2.21	2.71	2.95	2.99	2.59	3.10	2.72
NIS Std.dev.	1.40	1.13	1.11	1.19	1.08	1.28	1.31	1.27	1.16	1.50	1.29
SK yield	0.91	0.87	0.66	0.84	0.67	0.88	0.94	0.95	0.85	1.04	0.87
SK Std.dev.	0.46	0.40	0.36	0.38	0.36	0.46	0.44	0.44	0.40	0.53	0.45

Figure 3: Average nut-in-shell and saleable kernel productivity for mature farms 2009-2018

Figure 4 shows trends in average kernel recovery for all farms in the benchmark sample from 2009–2018. The left axis shows trends in premium (or sound) kernel recovery (PKR) and saleable kernel recovery (SKR). SKR is the sum of premium and commercial grades. The right axis shows trends in commercial kernel recovery (CKR) and reject kernel recovery (RKR).

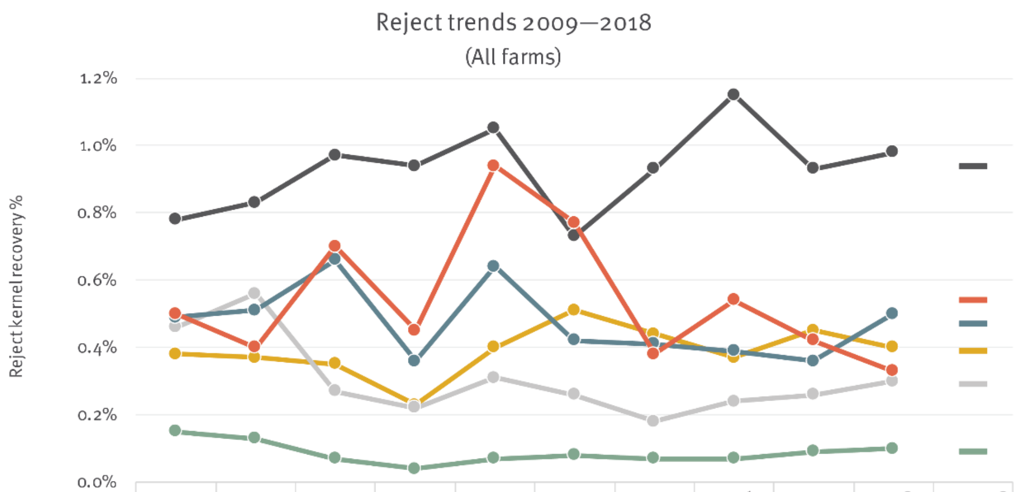


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
Premium KR%	30.76	32.20	30.08	30.76	28.78	31.05	31.34	30.95	30.76	30.85	30.73
Saleable KR%	32.88	34.71	32.88	33.67	32.20	34.67	34.22	34.15	34.76	35.74	34.05
Commercial KR%	2.13	2.51	2.80	2.91	3.42	3.62	2.89	3.20	4.00	4.89	3.32
Reject KR%	2.83	2.60	3.05	2.28	3.41	2.78	2.43	2.76	2.53	2.61	2.72

Figure 4: Average kernel recovery percentages 2009-2018

Analysis of factory reject categories provides insight into the specific causes of post-harvest losses in any season. Figure 5 shows the averages of all major factory reject categories for farms in the benchmark sample from 2009 to 2018. It is important to note that these averages are unweighted, which means each farm in the sample exerts equal influence on the average regardless of its size or level of production.

Insect damage has been the leading cause of factory reject across the benchmark sample in all years except 2014. Factory insect damage rejects were the leading cause of reject in all regions other than Central Queensland (CQ), where brown centres were the major cause of reject.



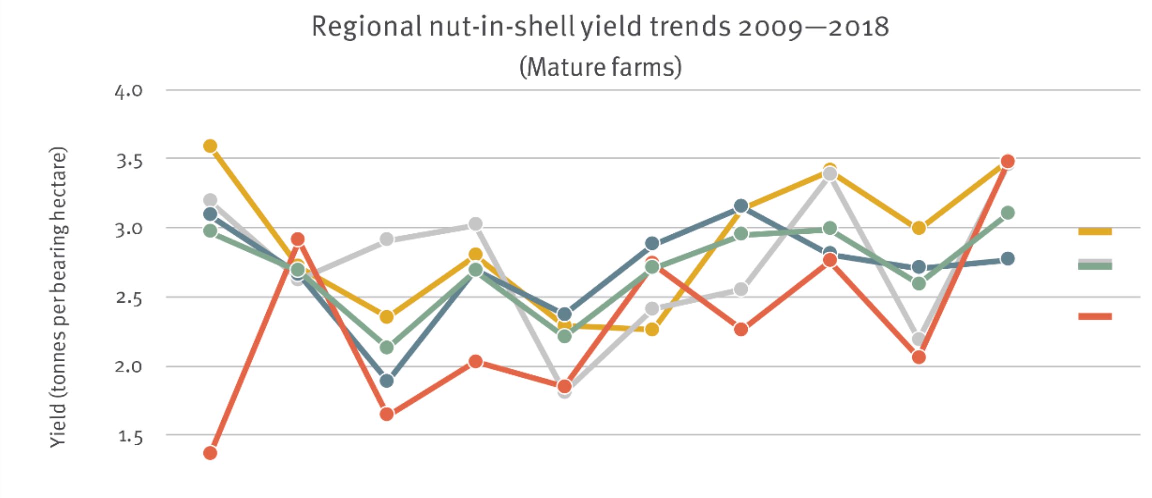
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
Insect	0.78	0.83	0.97	0.94	1.05	0.73	0.93	1.15	0.93	0.98	0.94
Mould	0.38	0.37	0.35	0.23	0.40	0.51	0.44	0.37	0.45	0.40	0.39
Discoloured	0.46	0.56	0.27	0.22	0.31	0.26	0.18	0.24	0.26	0.30	0.29
Brown centres	0.49	0.51	0.66	0.36	0.64	0.42	0.41	0.39	0.36	0.50	0.47
Immature	0.50	0.40	0.70	0.45	0.94	0.77	0.38	0.54	0.42	0.33	0.54
Germinated	0.15	0.13	0.07	0.04	0.07	0.08	0.07	0.07	0.09	0.10	0.09

Figure 5: Average reject kernel percentages for each reject category 2009-2018

Regional trends

Yield and quality results were compared across the four major production regions of Central Queensland (CQ), South East Queensland (SEQ), Northern Rivers of NSW (NRNSW) and the Mid North Coast of NSW (MNNSW). Figure 6 compares average annual nut-in-shell (NIS) yield per bearing hectare for mature farms (10 or more years old) in each of these regions. These averages are unweighted, meaning all farms exert equal influence regardless of their size.

Over the last 10 years the average yield of mature farms in CQ (2.97 t/ha) was significantly higher ($P < 0.05$) than that of any of the other three regions. SEQ and NRNSW ten year averages (2.75 and 2.72 t/ha respectively) were not significantly different to each other ($P > 0.05$). The MNNSW ten year average yield (2.36 t/ha) was significantly lower ($P < 0.01$) than the other three regions.

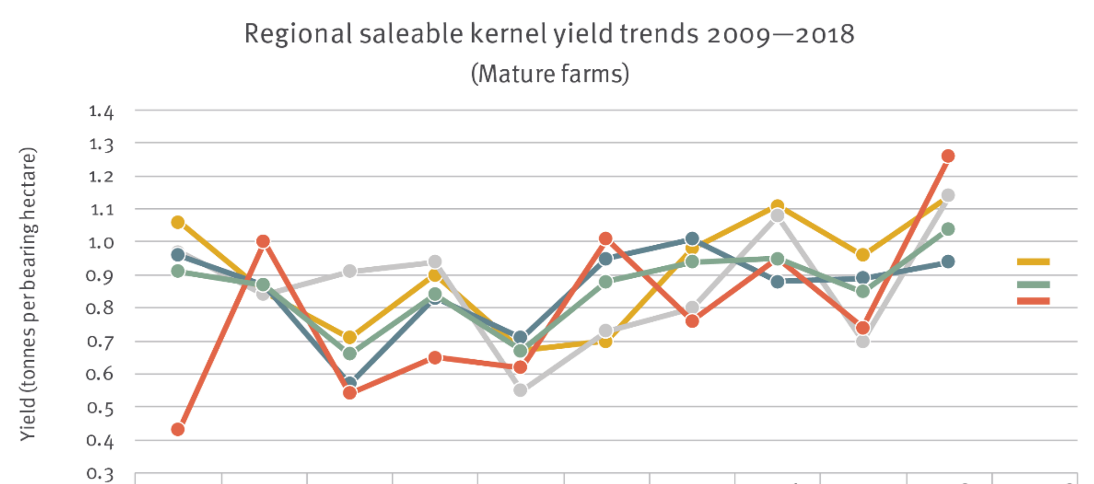


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
CQ	3.59	2.72	2.35	2.80	2.29	2.26	3.14	3.41	2.99	3.48	2.97
SEQ	3.19	2.62	2.91	3.02	1.81	2.41	2.55	3.38	2.19	3.45	2.75
NRNSW	3.09	2.66	1.89	2.70	2.37	2.88	3.15	2.81	2.71	2.77	2.72
MNNSW	1.36	2.91	1.64	2.03	1.85	2.74	2.26	2.76	2.06	3.47	2.36
All regions	2.97	2.69	2.13	2.69	2.21	2.71	2.95	2.99	2.59	3.10	2.72

Figure 6: Average nut-in-shell yields for each region of mature benchmarking farms, from 2009 to 2018

Figure 7 compares average yields of saleable kernel (SK) per bearing hectare from 2009 to 2018 for mature farms in each of the four regions in the benchmark sample. This chart shows a similar general trend to NIS productivity for this period, with some variation in specific regions and seasons due to differences in saleable kernel recovery.

Farms in the CQ region achieved significantly higher average SK productivity (0.94 t/ha) than all other regions between 2009 to 2018 ($P < 0.05$). NRNSW and SEQ SK productivity (both 0.87 t/ha) was not statistically different to MNNSW (0.82 t/ha).

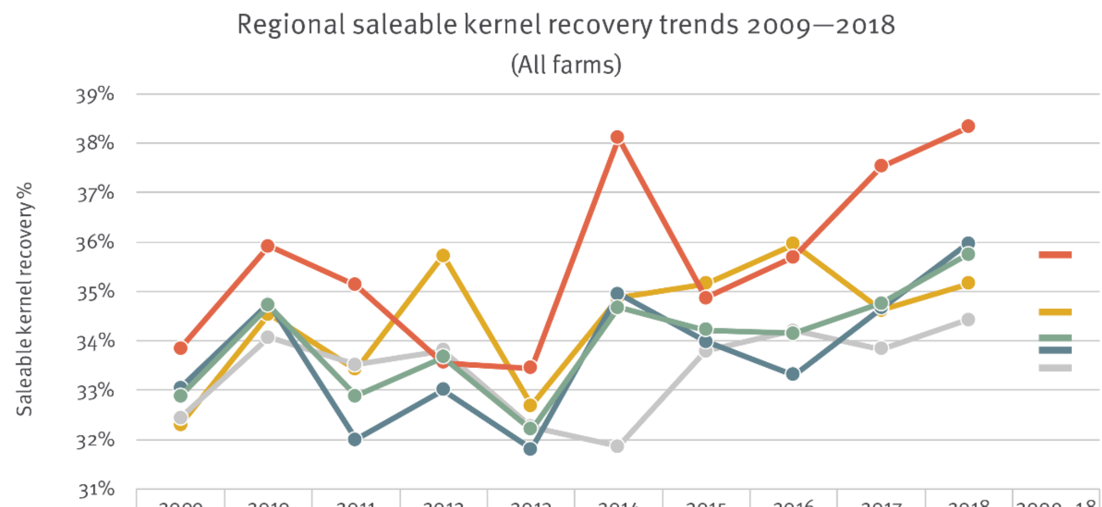


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
CQ	1.06	0.85	0.71	0.90	0.67	0.70	0.98	1.11	0.96	1.14	0.94
SEQ	0.97	0.84	0.91	0.94	0.55	0.73	0.80	1.08	0.70	1.14	0.87
NRNSW	0.96	0.87	0.57	0.83	0.71	0.95	1.01	0.88	0.89	0.94	0.87
MNNSW	0.43	1.00	0.54	0.65	0.62	1.01	0.76	0.95	0.74	1.26	0.82
All regions	0.91	0.87	0.66	0.84	0.67	0.88	0.94	0.95	0.85	1.04	0.87

Figure 7: Average saleable kernel yields for each region of mature benchmarking farms, from 2009 to 2018

Figure 8 compares average regional saleable kernel recovery (SKR) for farms in each major production region from 2009 to 2018. SKR is the sum of premium kernel recovery (PKR) and commercial kernel recovery (CKR).

The MNNSW region and CQ did not have significantly different SKR (P>0.05) but had significantly higher (P<0.01) average SKR (35.75% and 34.57 respectively) compared to all other regions. NRNSW (33.81%) had significantly lower SKR (P<0.01) than CQ (34.57%) and MNNSW but was not significantly different (P>0.05) than SEQ (33.45%). The high average SKR in the MNNSW region and CQ regions are is influenced by the high percentage of "A" series cultivars grown in this region, which tend to have high kernel recoveries.

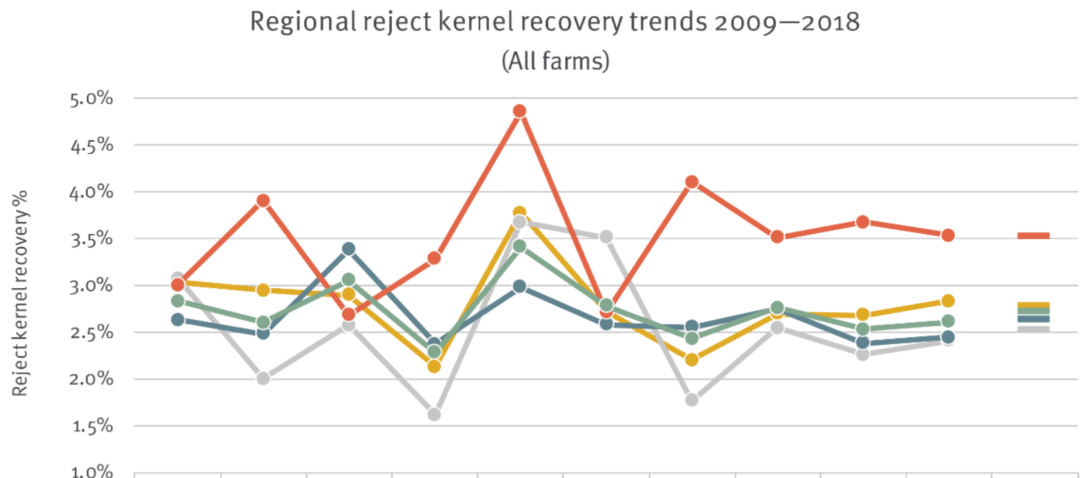


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
CQ	32.30	34.53	33.42	35.72	32.69	34.86	35.16	35.96	34.62	35.16	34.57
SEQ	32.44	34.07	33.52	33.81	32.26	31.86	33.79	34.20	33.83	34.43	33.45
NRNSW	33.04	34.76	32.00	33.00	31.81	34.95	33.98	33.31	34.66	35.97	33.81
MNNSW	33.85	35.91	35.12	33.56	33.45	38.10	34.87	35.69	37.52	38.33	35.75
All regions	32.88	34.71	32.88	33.67	32.20	34.67	34.22	34.15	34.76	35.74	34.05

Figure 8: Average saleable kernel recovery percentages for each region of benchmarking farms, from 2009 to 2018

Figure 9 compares average reject kernel recovery (RKR) for each region from 2009 to 2018.

The MNNSW region had a long-term average RKR (3.52%) that was significantly higher (P<0.01) than the other regions for the 2009 to 2018 period. This was followed by CQ which had significantly higher (P<0.05) average RKR (2.78%) than SEQ (2.53%), but was not significantly different (P>0.05) to NRNSW (2.64%).

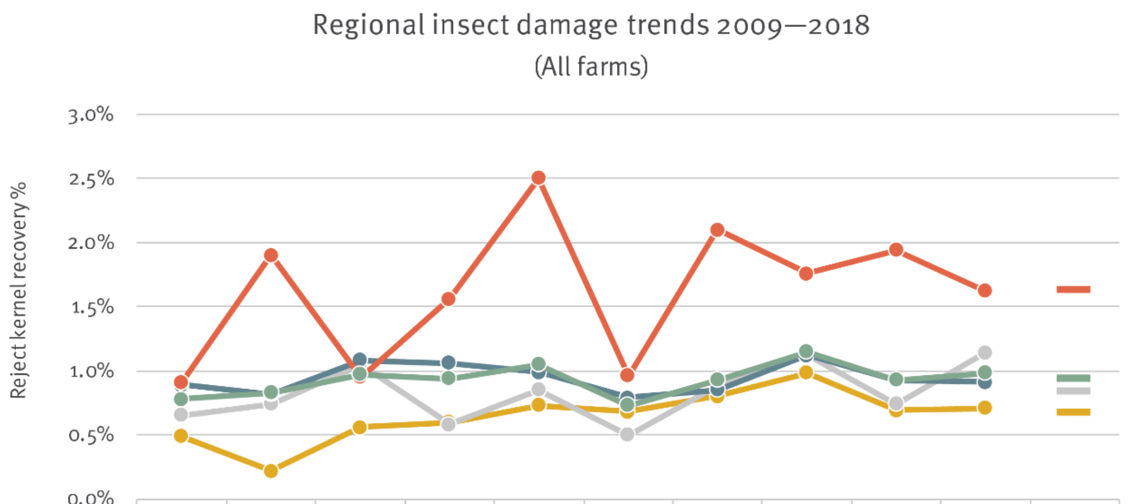


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
CQ	3.03	2.94	2.89	2.13	3.77	2.72	2.20	2.69	2.68	2.83	2.78
SEQ	3.07	2.00	2.57	1.61	3.67	3.51	1.76	2.54	2.26	2.41	2.53
NRNSW	2.63	2.48	3.38	2.37	2.98	2.58	2.55	2.75	2.38	2.44	2.64
MNNSW	3.00	3.90	2.68	3.28	4.85	2.71	4.10	3.51	3.67	3.53	3.52
All regions	2.83	2.60	3.05	2.28	3.41	2.78	2.43	2.76	2.53	2.61	2.72

Figure 9: Average percentage of kernel rejected for each region of benchmarking farms, from 2009 to 2018

Figure 10 shows average factory rejects due to insect damage for participating farms in each of the four major production regions from 2009 to 2018.

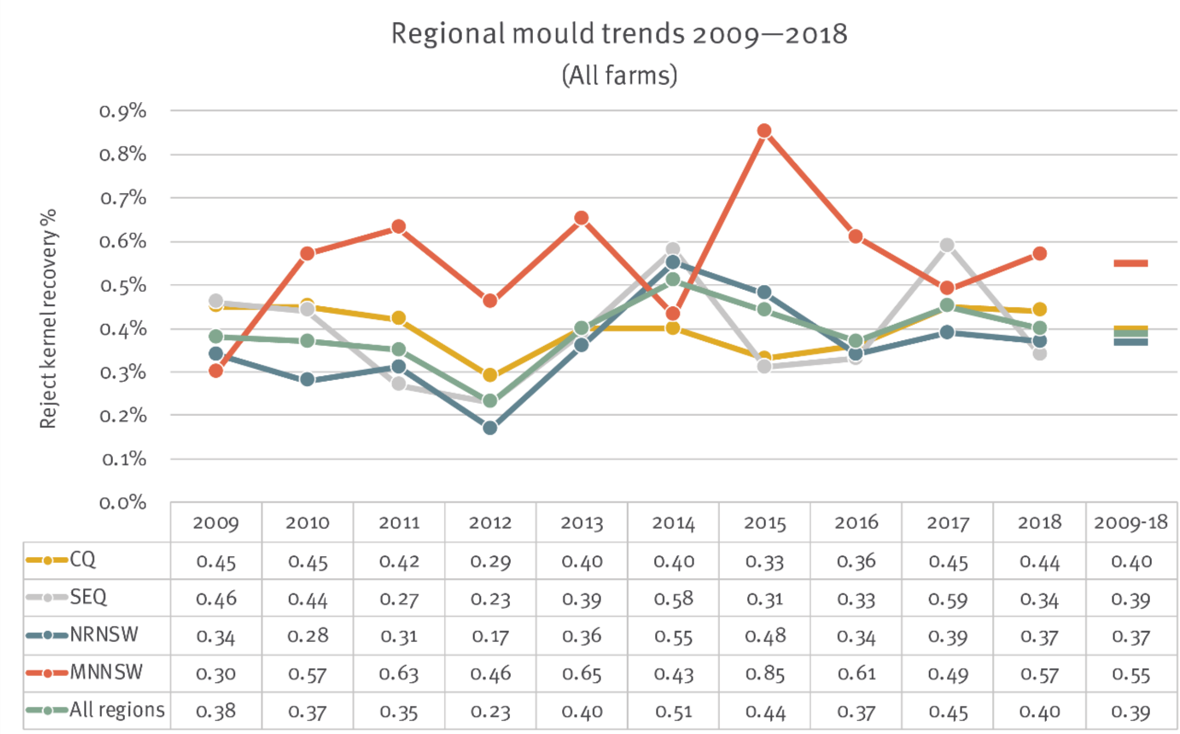
Average insect damage levels were significantly higher (P <0.01) in MNNSW (1.63%) than in all other regions over the 2009-2018 period. NRNSW and SEQ average insect reject levels (0.94% and 0.84% respectively) were statistically similar to each other and significantly higher (P<0.01 and P<0.05 respectively) than CQ (0.68%).



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
CQ	0.49	0.22	0.56	0.60	0.73	0.68	0.80	0.98	0.69	0.71	0.68
SEQ	0.65	0.74	1.05	0.58	0.85	0.50	0.88	1.12	0.74	1.14	0.84
NRNSW	0.89	0.82	1.08	1.06	0.99	0.79	0.85	1.12	0.92	0.91	0.94
MNNSW	0.91	1.90	0.95	1.56	2.50	0.96	2.10	1.76	1.94	1.62	1.63
All regions	0.78	0.83	0.97	0.94	1.05	0.73	0.93	1.15	0.93	0.98	0.94

Figure 10: Average percentage of kernel rejected due to insect damage for each region of benchmarking farms, from 2009 to 2018

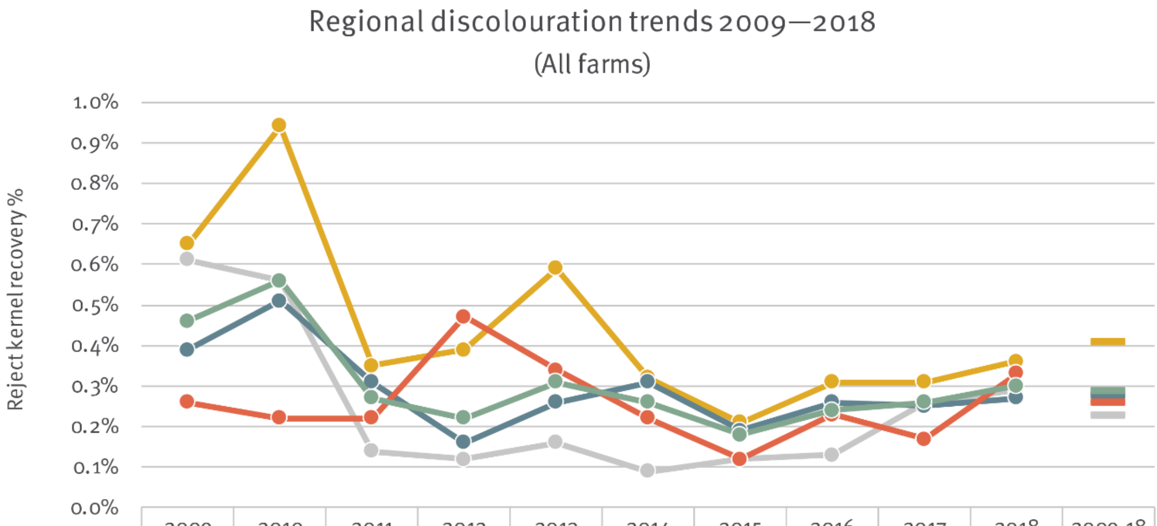
Figure 11 shows average factory rejects due to mould from 2009 to 2018 for each of the four regions in the benchmark sample. MNNSW had a significantly higher (P <0.01) average level of mould rejects (0.55%) than all other regions over the 2009–2018 period. The SEQ average mould rejects over the 2009-2018 period (0.39%) were not significantly different (P>0.05) to CQ and NRNSW (0.40% and 0.37% respectively).



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009-18
CQ	0.45	0.45	0.42	0.29	0.40	0.40	0.33	0.36	0.45	0.44	0.40
SEQ	0.46	0.44	0.27	0.23	0.39	0.58	0.31	0.33	0.59	0.34	0.39
NRNSW	0.34	0.28	0.31	0.17	0.36	0.55	0.48	0.34	0.39	0.37	0.37
MNNSW	0.30	0.57	0.63	0.46	0.65	0.43	0.85	0.61	0.49	0.57	0.55
All regions	0.38	0.37	0.35	0.23	0.40	0.51	0.44	0.37	0.45	0.40	0.39

Figure 11: Average percentage of kernel rejected due to mould for each region of benchmarking farms, from 2009 to 2018

Figure 12 shows factory rejects due to discolouration over the period 2009 to 2018 for each of the four regions in the benchmark sample. SEQ and MNNSW achieved the lowest average discolouration level (0.23% and 0.26% respectively) for this category, each significantly lower than CQ ($P < 0.01$). The SEQ average discolouration level was also significantly lower than that of NRNSW ($P < 0.05$). CQ had the highest average for this reject category ($P < 0.01$).



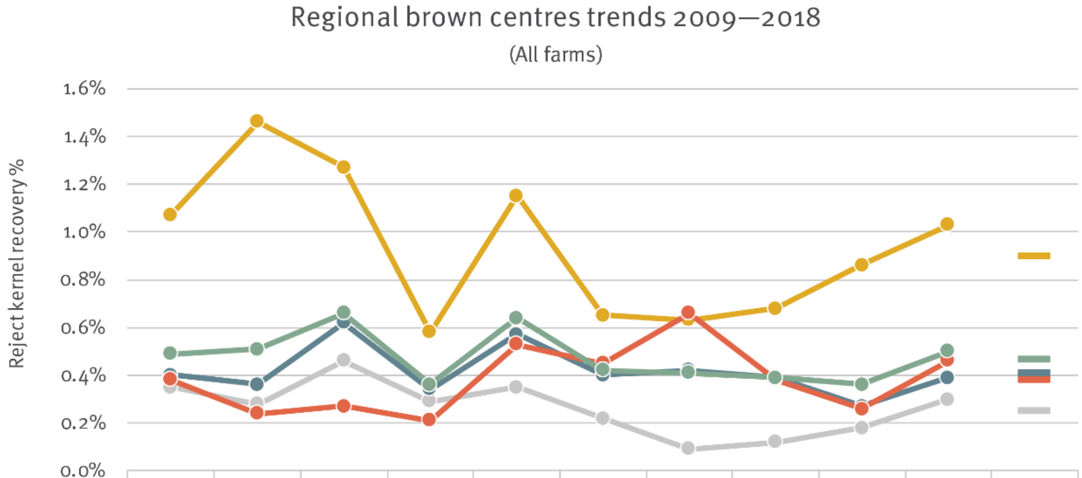
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009-18
CQ	0.65	0.94	0.35	0.39	0.59	0.32	0.21	0.31	0.31	0.36	0.41
SEQ	0.61	0.56	0.14	0.12	0.16	0.09	0.12	0.13	0.26	0.29	0.23
NRNSW	0.39	0.51	0.31	0.16	0.26	0.31	0.19	0.26	0.25	0.27	0.28
MNNSW	0.26	0.22	0.22	0.47	0.34	0.22	0.12	0.23	0.17	0.33	0.26
All regions	0.46	0.56	0.27	0.22	0.31	0.26	0.18	0.24	0.26	0.30	0.29

Figure 12: Average percentage of kernel rejected due to discolouration for each region of benchmarking farms, from 2009 to 2018

Figure 13 shows factory rejects due to brown centres from 2009 to 2018 for each of the four regions in the benchmark sample.

In most seasons, farms in the CQ region have had higher average rejects due to brown centres than those in other regions. The CQ long-term average (0.90%) over the study period shows brown centre reject levels were higher than any other region (P < 0.01). The average of brown centre reject levels for SEQ (0.25%) was lower than any other region (P < 0.01).

Benchmark data has shown that CQ farms are, on average, much larger than farms in the other regions. Grower surveys from the Macadamia Kernel Quality project (MC07008) found that on average brown centres increased with increasing farm size, maximum silo size and nut storage bed depth.

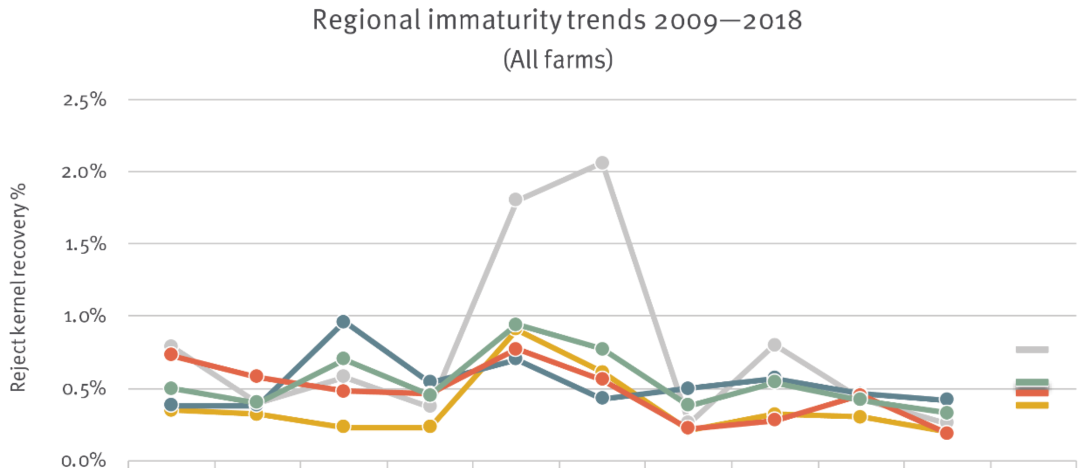


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
CQ	1.07	1.46	1.27	0.58	1.15	0.65	0.63	0.68	0.86	1.03	0.90
SEQ	0.35	0.28	0.46	0.29	0.35	0.22	0.09	0.12	0.18	0.30	0.25
NRNSW	0.40	0.36	0.62	0.34	0.57	0.40	0.42	0.39	0.27	0.39	0.41
MNNSW	0.38	0.24	0.27	0.21	0.53	0.45	0.66	0.38	0.26	0.46	0.38
All regions	0.49	0.51	0.66	0.36	0.64	0.42	0.41	0.39	0.36	0.50	0.47

Figure 13: Average percentage of kernel rejected due to brown centres for each region of benchmarking farms, from 2009 to 2018

Figure 14 shows factory rejects due to immaturity from 2009 to 2018 for each of the four regions in the benchmark sample.

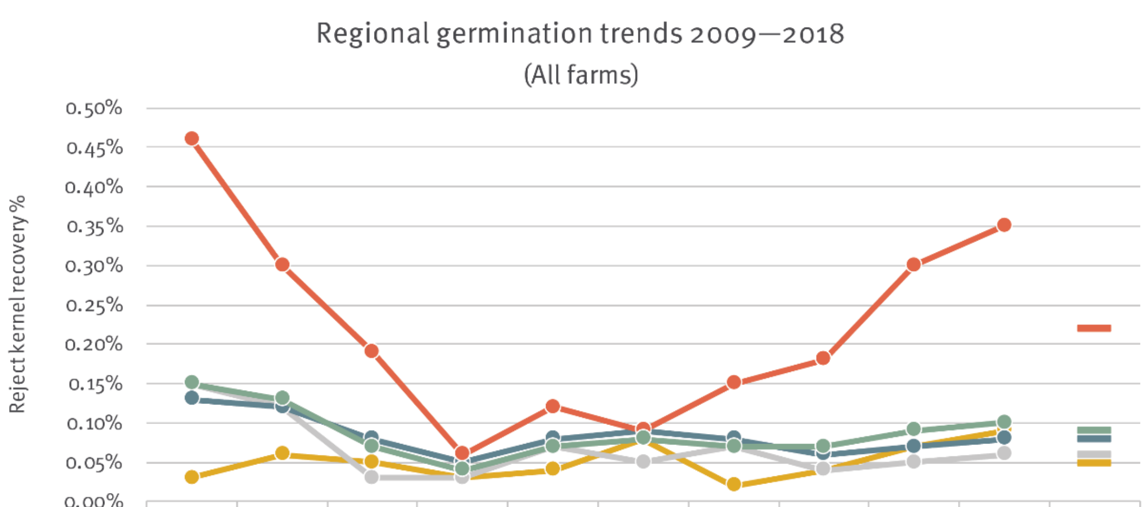
SEQ had the highest levels of immaturity over the 2009–2018 period ($P < 0.01$). Previous high immaturity levels in SEQ in 2013 and 2014 have largely been attributed to very dry conditions leading to moisture stress during nut growth and oil accumulation stages. Prior to 2012 much of the immaturity in SEQ and NSW was attributed to premature nut drop caused by husk spot. Husk spot was not as prevalent during 2012 to 2018 and was not considered a major cause of immaturity in these seasons.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009-18
CQ	0.35	0.32	0.23	0.23	0.91	0.61	0.21	0.32	0.30	0.20	0.38
SEQ	0.79	0.40	0.58	0.37	1.80	2.06	0.26	0.80	0.43	0.26	0.77
NRNSW	0.38	0.38	0.96	0.54	0.70	0.43	0.50	0.57	0.46	0.42	0.53
MNNSW	0.73	0.58	0.48	0.46	0.77	0.56	0.22	0.28	0.45	0.19	0.47
All regions	0.50	0.40	0.70	0.45	0.94	0.77	0.38	0.54	0.42	0.33	0.54

Figure 14: Average percentage of kernel rejected due to immaturity for each region of benchmarking farms, from 2009 to 2018

Figure 15 shows factory rejects due to germination from 2009 to 2018 for each of the four regions in the benchmark sample. Average germination rejects have remained low across most regions since 2012, with average losses due to germination being the least prevalent type of reject across the benchmark sample from 2009 to 2018. MNNSW however had higher average levels of germination than the other regions in most years, with its average over the whole period (0.22%) being significantly higher than other regions (p<0.01).



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
CQ	0.03	0.06	0.05	0.03	0.04	0.08	0.02	0.04	0.07	0.09	0.05
SEQ	0.15	0.12	0.03	0.03	0.07	0.05	0.07	0.04	0.05	0.06	0.06
NRNSW	0.13	0.12	0.08	0.05	0.08	0.09	0.08	0.06	0.07	0.08	0.08
MNNSW	0.46	0.30	0.19	0.06	0.12	0.09	0.15	0.18	0.30	0.35	0.22
All regions	0.15	0.13	0.07	0.04	0.07	0.08	0.07	0.07	0.09	0.10	0.09

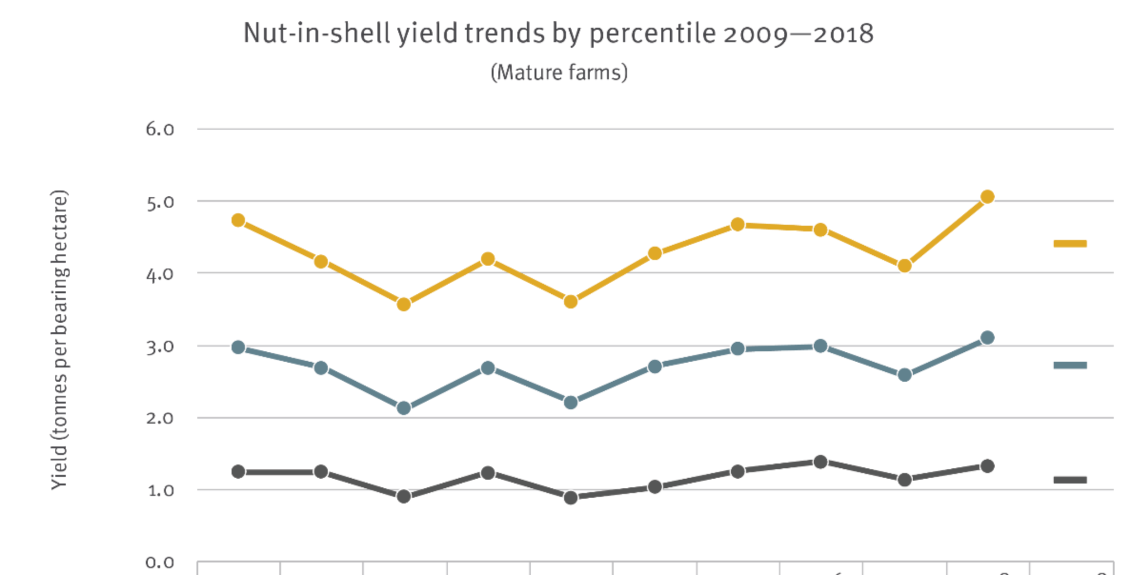
Figure 15: Average percentage of kernel rejected due to germination for each region of benchmarking farms, from 2009 to 2018

Sample variability

In this section yield and quality information is presented as percentiles, i.e. averages for the top 25% and bottom 25% of the benchmark sample are compared with the overall sample average. It is important to note that the farms included in percentile averages are different for each yield or quality attribute. This means for example that the top 25% of farms for nut-in-shell (NIS) production in any given season may not be the same farms as the top 25% for saleable kernel (SK) production. This is quite different to the top performing farms in the following section, which are based on a static group of farms that returned consistently high SK production per bearing hectare over multiple seasons. Percentiles therefore provide insight into sample variability rather than providing indication of long-term performance. This is an important distinction between percentiles and top performing farms.

Substantial variability in both yield and quality was evident within the benchmark sample. Percentiles demonstrate the extent of this variability for various yield and quality attributes. Yield percentiles are based on mature farms to avoid the influence of young farms that are yet to reach full production. Quality percentiles are based on all farms in the benchmark sample.

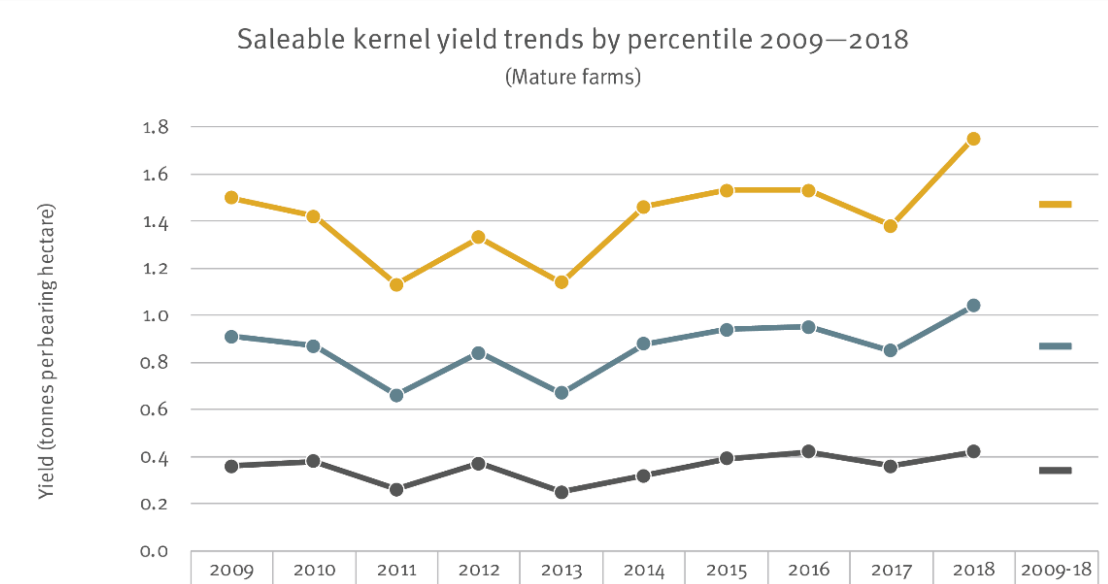
Figure 16 compares the average tonnes of NIS per bearing hectare for the top 25%, bottom 25% and all mature farms in the benchmark sample for each year from 2009 to 2018. In terms of average NIS, over this period the top 25% of farms were almost four times as productive as the bottom 25% of farms.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009-18
Top 25%	4.73	4.17	3.57	4.20	3.61	4.27	4.67	4.61	4.10	5.06	4.41
All mature farms	2.97	2.69	2.13	2.69	2.21	2.71	2.95	2.99	2.59	3.10	2.72
Bottom 25%	1.25	1.25	0.90	1.24	0.89	1.04	1.26	1.39	1.14	1.33	1.14

Figure 16: Nut-in shell average yields with top and bottom quartile yields from 2009 to 2018

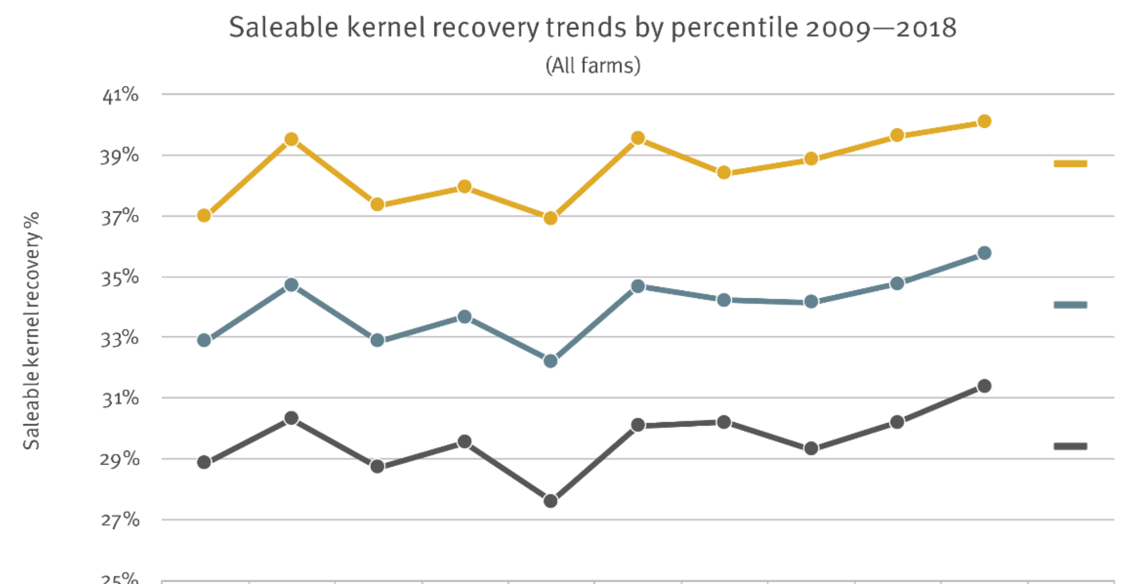
Figure 17 compares the average tonnes of saleable kernel (SK) per bearing hectare for the top 25%, bottom 25% and all farms in the benchmark sample for each year from 2009 to 2018. SK productivity increased across all groups from 2013, with a dip in 2017. Yield increases and decreases were generally more pronounced in the top 25%. The average SK productivity of the top 25% of farms over the entire period 2009-2018 was over four times that of the bottom 25%.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009-18
Top 25%	1.50	1.42	1.13	1.33	1.14	1.46	1.53	1.53	1.38	1.75	1.47
All mature farms	0.91	0.87	0.66	0.84	0.67	0.88	0.94	0.95	0.85	1.04	0.87
Bottom 25%	0.36	0.38	0.26	0.37	0.25	0.32	0.39	0.42	0.36	0.42	0.34

Figure 17: Saleable kernel average yields with top and bottom quartile yields from 2009 to 2018

Figure 18 compares average saleable kernel recovery (SKR) for the top 25%, bottom 25% and all farms in the benchmark sample for each year from 2009 to 2018. SKR is equivalent to the sum of premium kernel recovery (PKR) and commercial kernel recovery (CKR). Over the period 2009-2018, average SKR of the top 25% (38.74%) had a recovery rate nearly one third greater than that of the bottom 25% (29.41%).

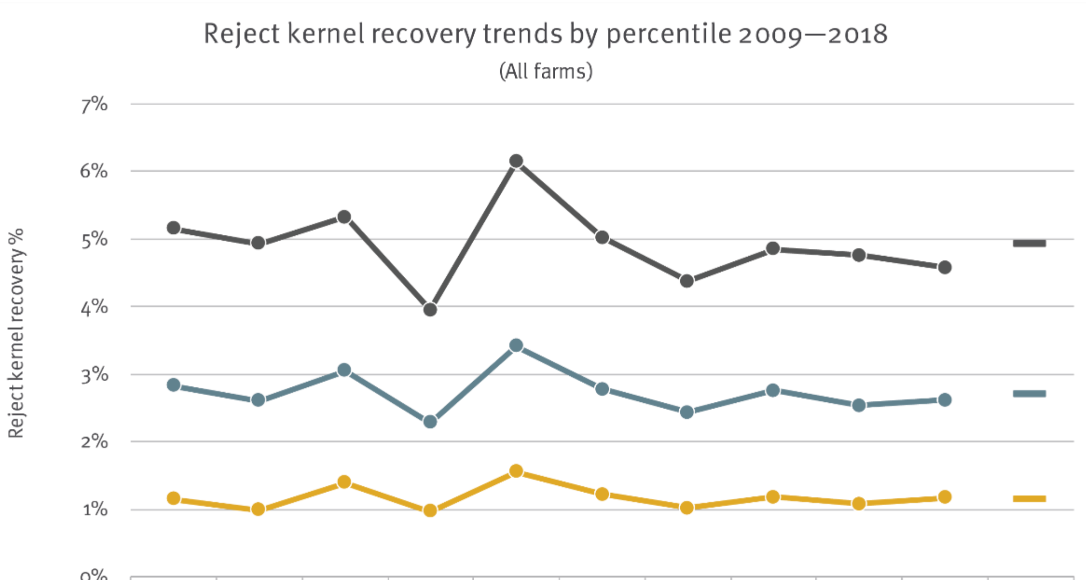


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
Top 25%	36.98	39.50	37.35	37.93	36.90	39.54	38.40	38.86	39.62	40.07	38.74
All farms	32.88	34.71	32.88	33.67	32.20	34.67	34.22	34.15	34.76	35.74	34.05
Bottom 25%	28.85	30.32	28.73	29.54	27.60	30.09	30.21	29.32	30.21	31.38	29.41

Figure 18: Saleable kernel recovery averages with top and bottom quartile averages from 2009 to 2018

Figure 19 compares average reject kernel recovery (RKR) for the top 25%, bottom 25% and all farms in the benchmark sample for each year from 2009 to 2018. RKR and associated reject category percentiles are inverted, as low RKR and individual reject levels represent better quality.

Over the ten seasons, average RKR levels were lowest in 2012 and peaked in 2013 across all percentile groups. Over the whole study period the average RKR of the top 25% of farms was around one fifth of that of the bottom 25% of farms.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
Top 25%	1.15	0.99	1.39	0.97	1.55	1.22	1.02	1.18	1.08	1.17	1.16
All farms	2.83	2.6	3.05	2.28	3.41	2.78	2.43	2.76	2.53	2.61	2.72
Bottom 25%	5.15	4.93	5.32	3.95	6.14	5.02	4.37	4.85	4.76	4.58	4.94

Figure 19: Reject kernel recovery averages with top and bottom quartile averages from 2009 to 2018

High production variability is evident between seasons and farms within the benchmark sample. Figure 20 shows the frequency distribution of average productivity (2009-2018) for 248 mature farms (10+ years old) that have participated in benchmarking for more than four seasons, including 2018. Median SK per bearing hectare for these farms was 0.86 t/ha, with the sample having a standard deviation of 0.45 t/ha.

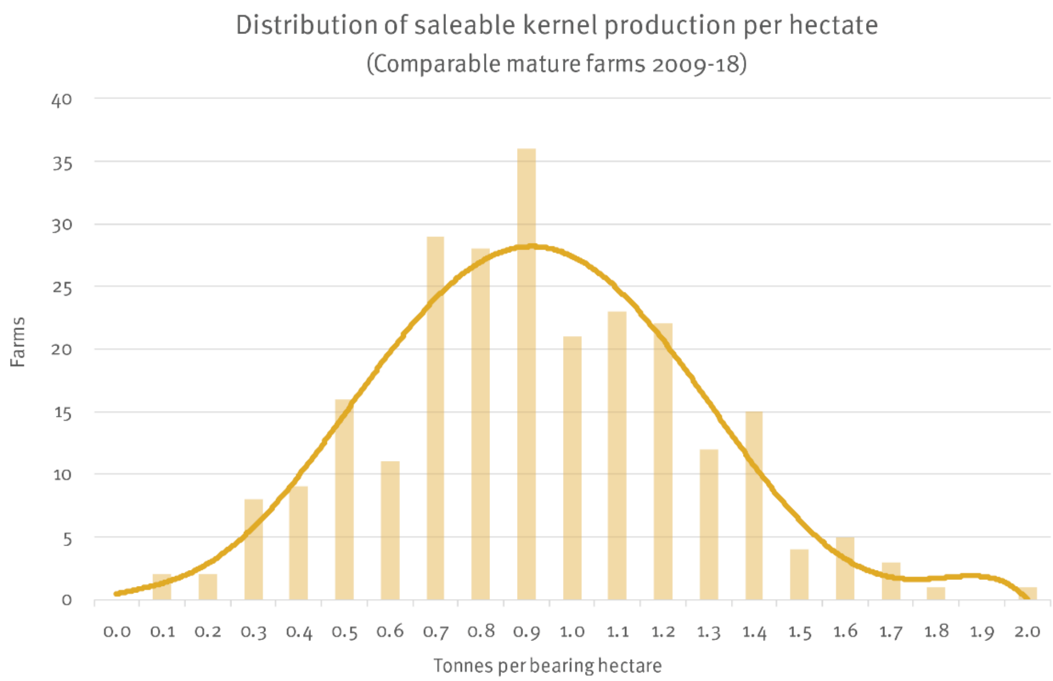


Figure 20: Distribution of saleable kernel per hectare per year of all benchmarking farms over the period 2009-2018

Figure 21 shows the regional frequency distribution of average productivity from 2009-2018 for 248 mature farms (10+ years old) that have participated in benchmarking for more than four seasons. The Central Queensland (CQ) productivity curve is biased to the right, with a higher median productivity (0.93 t/ha) than other regions. CQ also had more uniform productivity compared with other regions. This is reflected by a smaller standard deviation in SK productivity (0.34 t/ha).

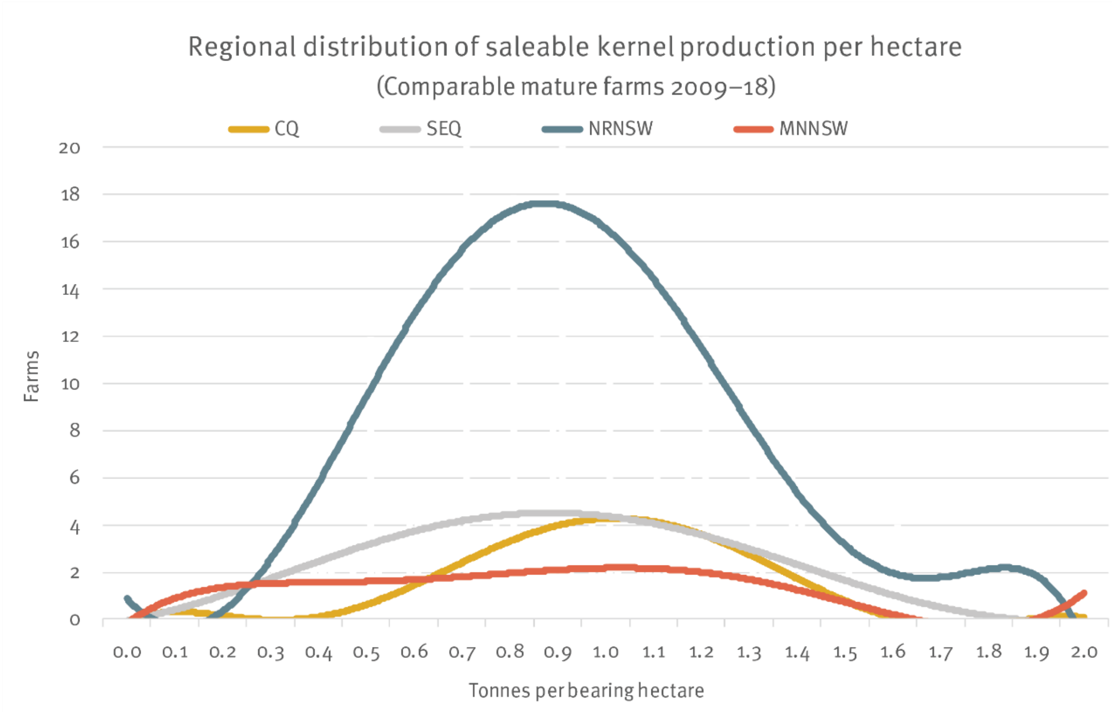
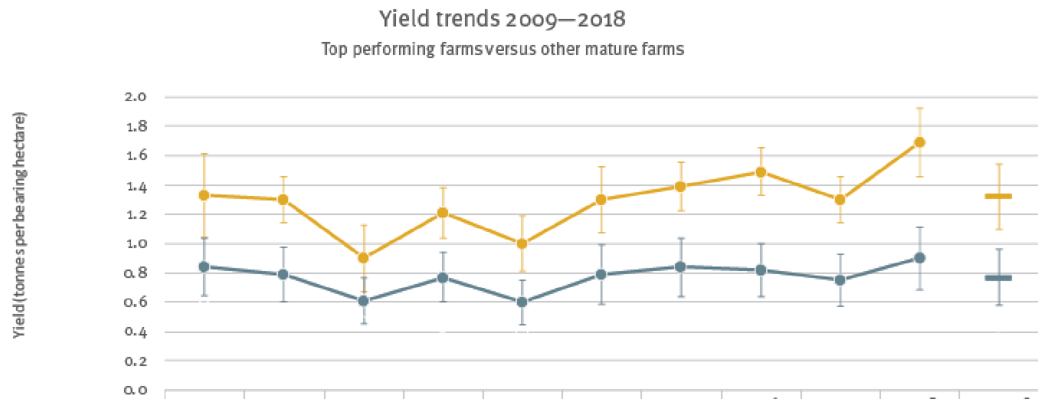


Figure 21: Distribution of saleable kernel per hectare per year for benchmarking farms in each growing region 2009-2018

Top performing farms

The benchmark study has revealed high variability in productivity between farms and also between seasons for individual farms. Analysis of the top performing farms in the sample is included to determine any trends associated with high orchard productivity.

To be regarded as a top performing farm, high orchard productivity must be sustained over a minimum of four seasons, including the most recent production season of 2018. These farms are then ranked according to their average saleable kernel productivity (t/ha) over all seasons for which they have submitted data. Only farms that fall within the top 25% percent of this group are regarded as top performing farms. As inclusion in this group is based on average performance over multiple seasons it is possible that some top performing farms may not have been among the most productive farms in a particular season.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
SK yield (TPF)	1.33	1.30	0.90	1.21	1.00	1.30	1.39	1.49	1.30	1.69	1.32
Std.dev. (TPF)	0.57	0.31	0.46	0.35	0.38	0.45	0.33	0.32	0.31	0.46	0.44
SK yield (Other mature farms)	0.84	0.79	0.61	0.77	0.6	0.79	0.84	0.82	0.75	0.9	0.77
Std.dev. (Other mature farms)	0.39	0.37	0.32	0.34	0.31	0.4	0.4	0.36	0.35	0.43	0.38

Figure 22: Saleable kernel yield for top performing farms and other mature farms over the period 2009-2018

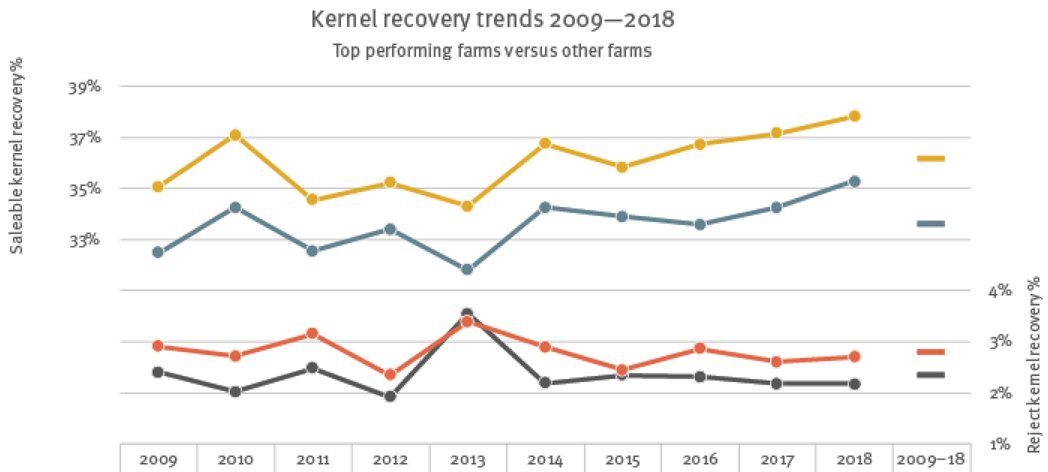
Error! Reference source not found. shows the average saleable kernel (SK) yields per bearing hectare for the top performing farms from 2009 to 2018, and compares these with other mature farms in the benchmark sample. Farms aged less than 10 years are excluded from both groups for consistency. The error bars on the chart represent the standard deviations from these average yields.

It is important to remember that top performing farms must have provided data for at least four years, including 2018, to be considered for inclusion within this group.

This chart confirms that top performing farms, like the broader benchmark sample, experience seasonal yield fluctuations. It also shows that the pattern of this fluctuation is reasonably consistent between the two groups from season to season. The error bars show that even low yields for farms in the top performing farms group rarely overlap with average yields in even the best cropping years for other mature farms in the benchmark sample.

The top performing farms averaged 1.32 tonnes of SK per bearing hectare over the ten years from 2009 to 2018, compared with 0.77 tonnes for other farms in the benchmark sample with an average tree age of 10 years or more. This result shows that the top performing farms' long-term average for SK yield was 71% greater than the average for all other mature farms.

compares average kernel recovery trends from 2009 to 2018 for the top performing farms with other farms in the benchmark sample. Between 2009 and 2018, top performing farms achieved lower average reject kernel recovery (RKR) than the benchmark average in all years, apart from 2012.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–18
SKR% (TPF)	35.06	37.09	34.55	35.23	34.31	36.75	35.82	36.73	37.14	37.83	36.16
SKR% (Other farms)	32.48	34.26	32.56	33.40	31.81	34.26	33.89	33.59	34.26	35.28	33.63
RKR% (TPF)	2.40	2.02	2.48	1.92	3.54	2.19	2.34	2.31	2.18	2.18	2.36
RKR% (Other farms)	2.91	2.71	3.15	2.34	3.39	2.90	2.45	2.86	2.60	2.70	2.79

Figure 23: Saleable and reject kernel recoveries for top performing farms and other farms over the period 2009-2018.

The top performing farms (based on average yield per hectare) consistently achieved a higher average saleable kernel recovery (SKR) than other farms in the benchmark sample across the ten seasons. The top performing farms averaged 36.16% SKR over the past ten years, compared to 33.63% for other farms. This is a difference of 2.53% in SKR. The difference between groups in SKR varied from 1.83% in 2012 to 3.14% in 2016. These SKR differences mean that the top performing farms also achieved a higher price per kilogram of nut-in-shell (NIS) each year than the average for all other farms in the benchmark sample.

Figure 24 shows the average percentage of rejects by reject category for the top performing farms compared with all other farms in the benchmark sample from 2009 to 2018. These averages are unweighted, which means that each farm in the data sample exerts equal influence on the average regardless of size or amount of production.

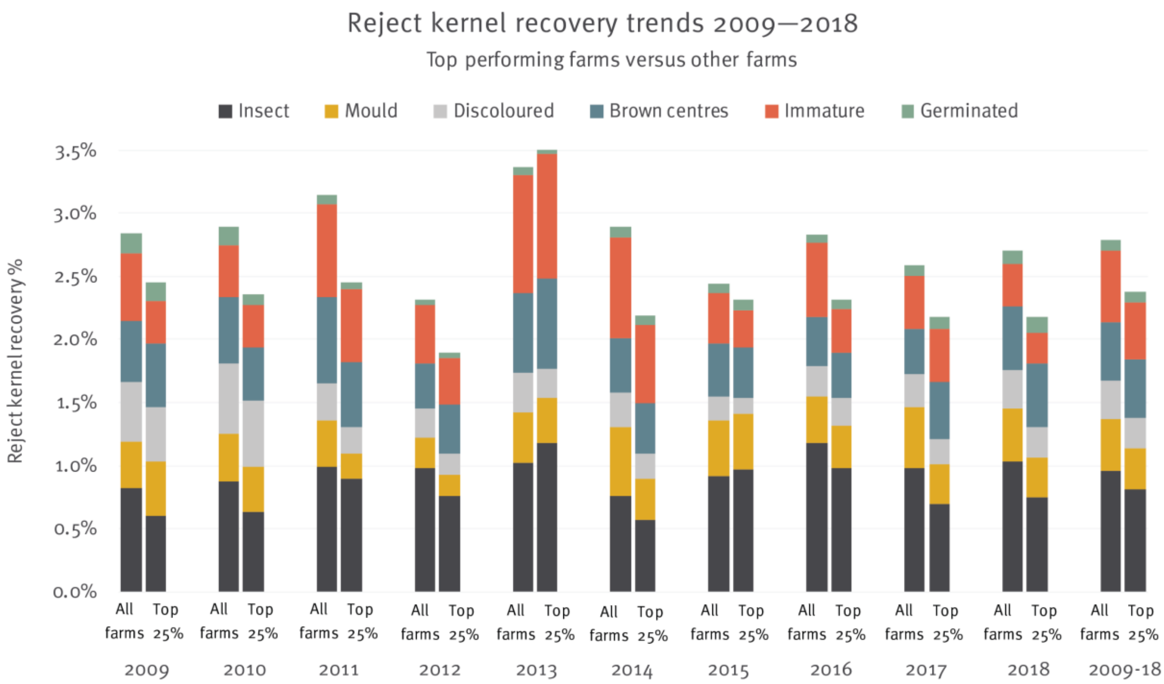


Figure 24: Reject kernel recovery in each reject category 2009-2018, for top performing farms and all other farms.

The top performing farms' long-term average (2009–2018) reject kernel recovery is significantly lower (P<0.01) than that of all other farms. Insect damage was the dominant reject category for most seasons from 2009 to 2018 for all farms. Over this whole period top performing farms had significantly lower rejects due to insect damage, mould, discolouration and immaturity than other farms (for all P < 0.01). The only categories of reject that did not differ significantly between the two groups were brown centres and germination (P>0.05).

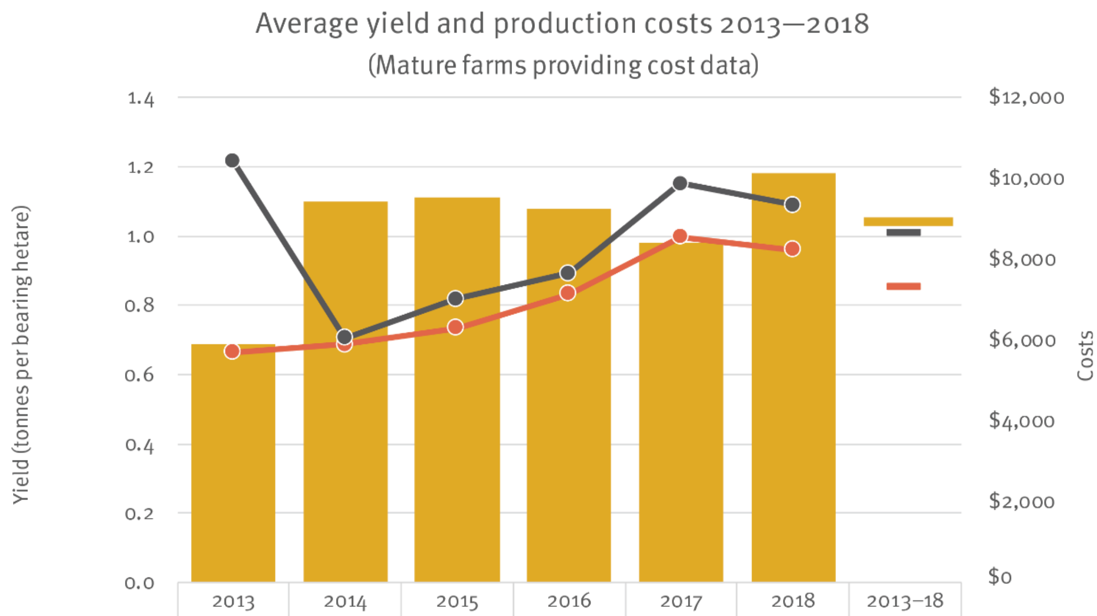
Cost of production

Figure 25 shows saleable kernel (SK) productivity (t/ha) and average production costs (per hectare and per tonne of SK) for mature farms (10+ years only) that provided cost data between 2013 and 2018. As collection of imputed labour data only commenced in 2017, the seasonal averages shown exclude imputed labour.

Average costs per hectare have increased since 2013 by 45%. The rises in costs per hectare may partially be related to previous high NIS prices, allowing businesses to reinvest in their orchards.

Lower average productivity in 2013 was a strong driver of the higher costs per tonne of SK in that year. The higher costs per tonne of SK in 2017 resulted from a combination of higher expenditure per hectare and a decline in orchard productivity.

There is a significant correlation between year and increased costs per tonne of NIS ($P < 0.01$) and increased costs per hectare ($P<0.01$). There is no significant correlation per tonne of SK and year ($P>0.05$).



	2013	2014	2015	2016	2017	2018	2013–18
SK yield	0.69	1.10	1.11	1.08	0.98	1.18	1.04
Costs per hectare	$5,695	$5,887	$6,287	$7,141	$8,552	$8,238	$7,320
Costs per tonne SK	$10,436	$6,053	$7,013	$7,652	$9,862	$9,337	$8,651

Figure 25: Saleable kernel yield and cost of production (per hectare and per tonne) for mature farms

Figure 26 shows the regional comparison of total expenditure for mature farms over 6 years (2013-2018). Northern Rivers NSW (NRNSW) had the lowest costs per tonne of SK at $7905. This is 25% lower than Mid North Coast NSW (MNNSW), which had the highest average at $10,555 per tonne of SK.

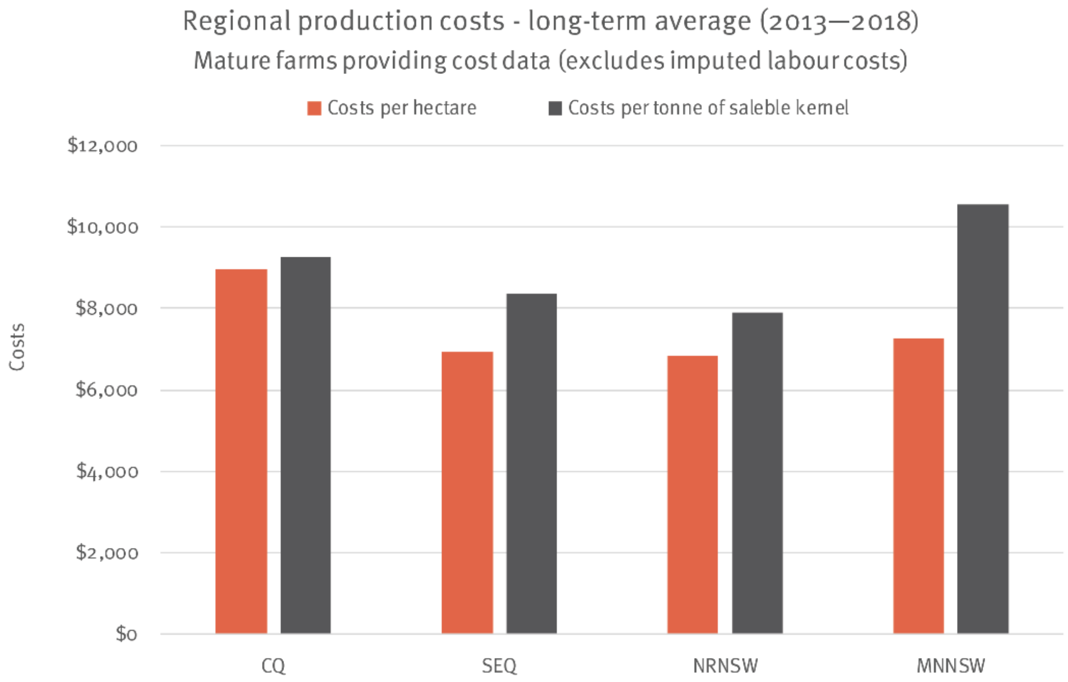
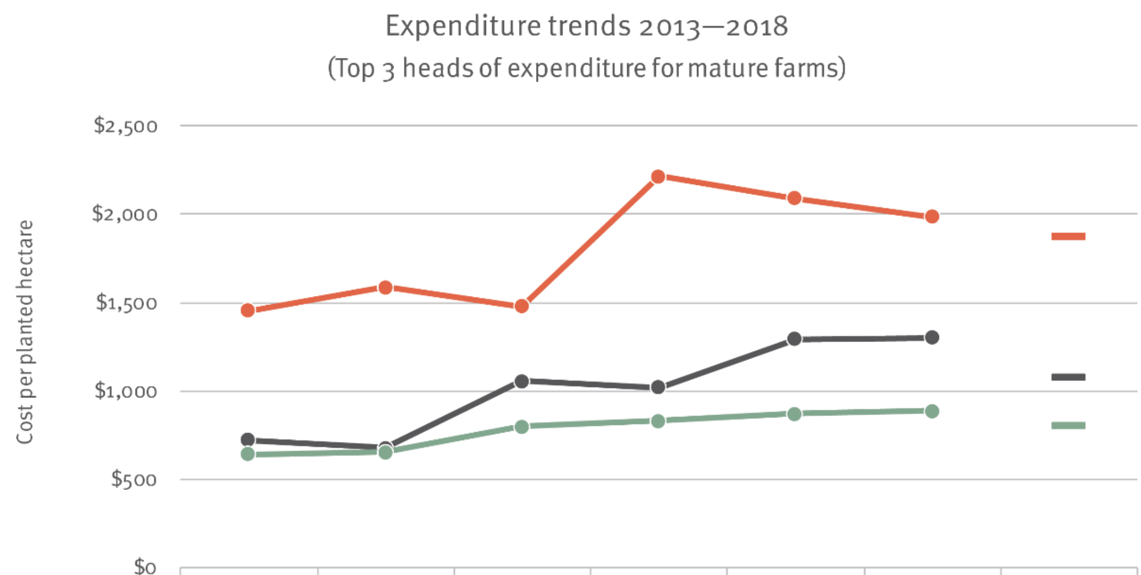


Figure 26 : Top heads of expenditure per hectare and per tonne of saleable kernel for each benchmarking region.

Figure 27 shows the top three heads of expenditure (per planted hectare) for mature farms from 2013 to 2018 – employment, crop nutrition, and repairs and maintenance (R&M) plant. Other heads of expenditure included crop protection, contractors, administration, leases, fuel and oil, R&M improvements, management, government charges, utilities, hire, freight, consultants and irrigation. Employment accounted for the largest proportion of total costs (26% excluding imputed labour). This is consistent with the previous *On-farm Economic Analysis* study from 2003-2006, with employment costs accounting for 24% of total costs at that time. This expenditure includes all costs associated with employment including permanent and casual wages, superannuation, training and expenses incurred as part of occupational health and safety and worker's compensation. It does not include unpaid labour costs, which were not collected prior to 2017.

Analysis of expenditure averages for mature farms between 2017 and 2018 shows that employment costs account for approximately 37% of total costs when unpaid labour is included. This figure falls to 32% for managed farms and rises to 43% for owner-operated farms. Crop protection was the next highest average cost (excluding imputed labour) from 2013 to 2018 (7%) followed by repairs and contractors (6%).

In each season there are significant differences between farms in both total costs and the breakdown of those costs. This variation is related to individual farm characteristics, periodic farm management activities and the stage of development within the orchard.



	2013	2014	2015	2016	2017	2018	2013–18
Employment	$1,456	$1,588	$1,478	$2,216	$2,092	$1,985	$1,876
Crop nutrition	$722	$678	$1,057	$1,022	$1,295	$1,302	$1,082
R&M plant	$642	$653	$797	$831	$870	$888	$807

Figure 27: Employment, crop nutrition and R&M plant expenditure of mature farms 2013-2018

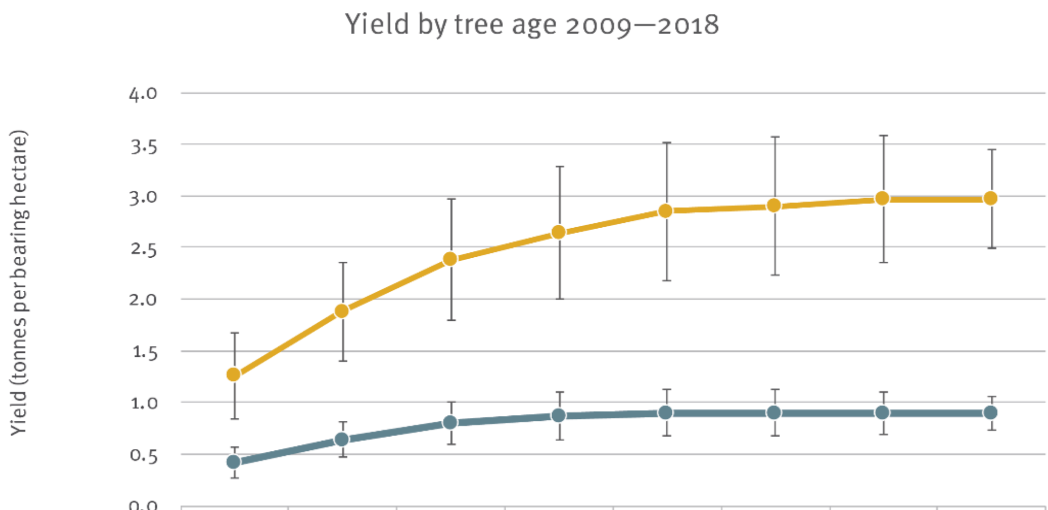
Tree age effects

Yield and quality were plotted by tree age to identify age-related trends in orchard performance. It is important to note that all age-related analyses are based on weighted average tree age, as very few farms record harvest results by individual block or tree age group. Some farms also have plantings of various tree ages and so weighted average tree age is calculated from planting data recorded for each farm. Tree age categories are then used to identify and compare data from farms of similar ages.

Tree ages may vary substantially both within and between production regions. Planting densities also vary between farms in various age categories and this may also impact on yields per hectare, particularly during the early bearing years before trees grow together within rows.

Figure 28 shows average yields of nut-in-shell (NIS) and saleable kernel (SK) per bearing hectare for all years from 2009 to 2018 for farms from various tree age categories. Results are presented only where sufficient data exists to maintain individual farm confidentiality (i.e. more than 10 data points).

The average NIS and SK yield both increased significantly with tree age up to the 15-19 years category ($P<0.01$). After this point, greater than 19 years there is no significant correlation between NIS yield and tree age ($P>0.05$) or SK yield and tree age ($P>0.05$).



	5 to 7 years	8 to 9 years	10 to 14 years	15 to 19 years	20 to 24 years	25 to 29 years	30 to 34 years	35+ years
NIS yield (2009-18)	1.26	1.88	2.38	2.64	2.85	2.90	2.97	2.97
NIS Std.dev (2009-18)	0.84	0.95	1.17	1.29	1.34	1.34	1.22	0.95
SK yield (2009-18)	0.42	0.64	0.80	0.87	0.90	0.90	0.89	0.89
SK Std.dev (2009-18)	0.30	0.34	0.41	0.46	0.46	0.45	0.41	0.33

Figure 28: Average yield of nut-in-shell and saleable kernel across tree age groups 2009-2018.

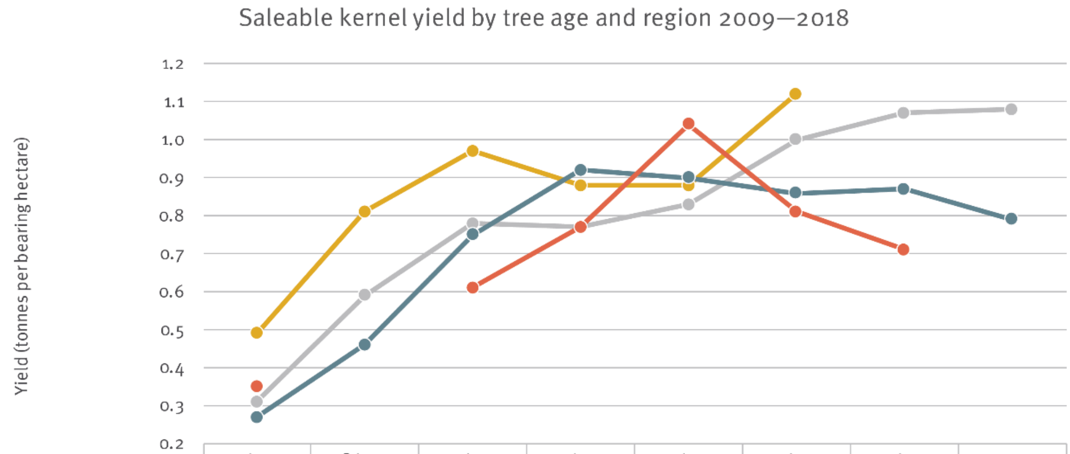
Figure 29 shows the average yield of SK per bearing hectare by tree age category for 2009 to 2018 across the major production regions. As insufficient data was available for individual tree age categories in some regions, it was not possible to plot beyond 25-29 years within the Central Queensland (CQ) region, or to plot 8 to 9 years and over 34 years on the Mid North Coast of NSW (MNNSW).

CQ farms with an average tree age 14 years or younger had a higher average yield of SK per hectare than farms of the same age in the other regions ($P < 0.05$). This indicates that while there is a significant positive correlation ($P<0.01$) between tree age and yields across all age groups, relationships are complex and other regional or management factors can influence the early performance of orchards.

For NRNSW there is a significant negative correlation ($P < 0.05$) between tree age and yield (SK and NIS per bearing hectare) among farms 35 years and over, indicating that in this region yields are declining at this age.

In SEQ there is a significant positive correlation ($P<0.01$) between tree age and SK yield per hectare across all age groups.

In MNNSW SK yields appeared to peak in the 20 to 24 years group, and while statistically this group was no different to this region's 25 to 29 year old trees ($P>0.05$), it did yield significantly higher than all other tree age categories reported for this region ($P<0.05$).



	5 to 7 years	8 to 9 years	10 to 14 years	15 to 19 years	20 to 24 years	25 to 29 years	30 to 34 years	35+ years
CQ SK yield (2009-18)	0.49	0.81	0.97	0.88	0.88	1.12		
CQ SK std.dev (2009-18)	0.25	0.31	0.34	0.35	0.29	0.26		
SEQ SK yield (2009-18)	0.31	0.59	0.78	0.77	0.83	1.00	1.07	1.08
SEQ SK std.dev (2009-18)	0.21	0.29	0.45	0.51	0.51	0.44	0.53	0.43
NRNSW SK yield (2009-18)	0.27	0.46	0.75	0.92	0.90	0.86	0.87	0.79
NRNSW SK std.dev (2009-18)	0.22	0.31	0.41	0.45	0.43	0.42	0.33	0.21
MNNSW SK yield (2009-18)	0.35		0.61	0.77	1.04	0.81	0.71	
MNNSW SK std.dev (2009-18)	0.59		0.39	0.51	0.64	0.71	0.50	

Figure 29: Saleable kernel productivity by tree age and region 2009-2018

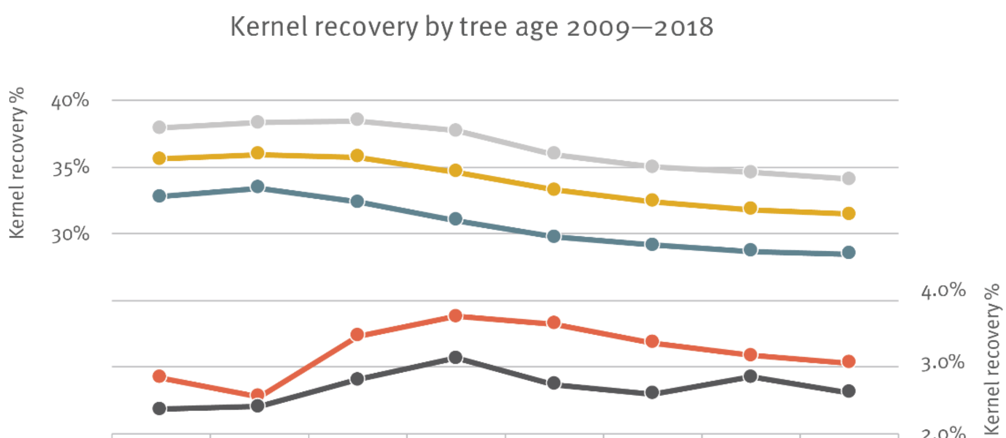
Figure 30 shows the averages from 2009 to 2018 of kernel recoveries by tree age category, including total kernel recovery (TKR), saleable kernel recovery (SKR), premium kernel recovery (PKR), commercial kernel recovery (CKR) and reject kernel recovery (RKR). TKR is the sum of premium, commercial and reject kernel recovery. Saleable kernel recovery is the sum of premium kernel recovery and commercial kernel recovery.

Farms in the younger tree age categories (5 to 7, 8 to 9 and 10 to 14 years) achieved significantly higher (P<0.01) average PKR and SKR than farms in the older age categories (15 years and older). There is a significant negative correlation (P<0.01) between tree age and PKR, SKR and TKR indicating that on average they decrease with tree age.

There is no significant correlation (P>0.05) between tree age and CKR indicating that on average CKR is not associated with tree age. However, trees in the middle age groups of 10 to 14 and 15 to 19 years had significantly higher CKR than the 5 to 7 (P<0.05 and P<0.01 respectively) and 8 to 9 age groups (P<0.01 and P<0.01 respectively). The 15 to 19 year age groups also had significantly higher CKR than the 25 to 29 and the 30 to 34 age group (P<0.05 and P<0.01 respectively). There is no significant difference (P>0.05) between the 35 years and older age group and the younger age groups less than 15 years of age. This indicates that the middle age groups on average tend to have higher levels of CKR.

Farms under 15 years of age do not have significantly different (P>0.05) TKR but have significantly higher (P<0.01) TKR than trees 15 years and older. Trees under 15 years of age have an average of TKR of 38.34% compared to farms 15 years and older which achieved an average TKR of 36.05%. TKR is significantly negatively correlated (P<0.01) with tree age indicating that on average TKR declines with tree age. Varietal selection is one of the major factors influencing kernel recovery. Many macadamia varieties planted on younger farms have higher potential kernel recoveries than many of the varieties planted on older farms.

Farms aged 15-19 years of age had significantly higher average RKR than all other tree age categories up to 30 years of age (P<0.01). RKR is significantly negatively correlated (P<0.01) with tree ages 15 years and older and significantly positively correlated (P<0.01) with farm size, indicating that on average older farms have lower RKR and larger farms have higher RKR.



	5 to 7 years	8 to 9 years	10 to 14 years	15 to 19 years	20 to 24 years	25 to 29 years	30 to 34 years	35+ years
Total KR%	37.92	38.31	38.48	37.70	35.95	34.99	34.59	34.06
Saleable KR%	35.57	35.92	35.74	34.64	33.26	32.43	31.79	31.48
Premium KR%	32.79	33.41	32.38	31.02	29.73	29.16	28.70	28.49
Commercial KR%	2.78	2.52	3.36	3.63	3.53	3.27	3.09	2.99
Reject KR%	2.34	2.38	2.75	3.05	2.69	2.56	2.79	2.58

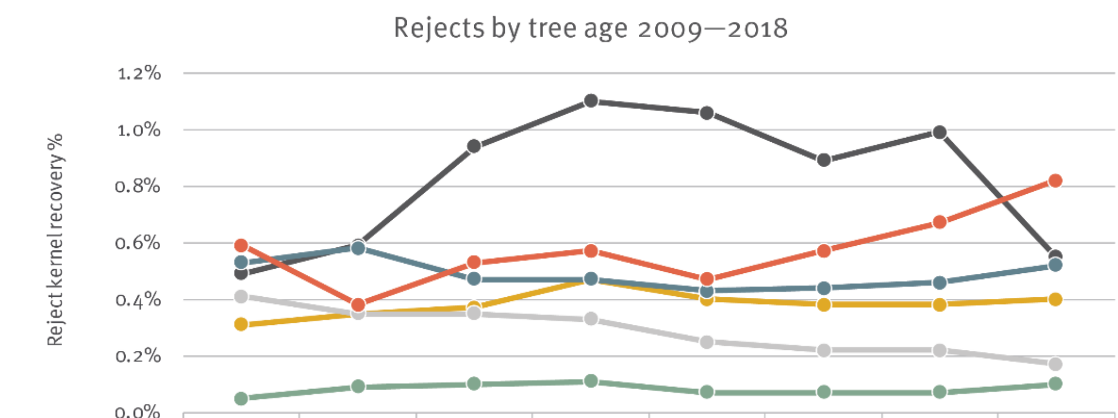
Figure 30: Average total kernel recovery percent, and its component percentages of saleable, premium, commercial and reject kernel recoveries, by tree age categories 2009-2018.

Figure 31 shows a breakdown of factory rejects by category from 2009 to 2018 for farms of various average tree ages.

Insect damage was the major reject category for farms with an average tree age of between 8 and 34 years. Average insect damage levels were highest among farms aged 15 to 19 years, although analysis of rejects by farm size revealed that most small farms fall within this age group, which may be a contributing factor to these high levels of damage. See the *Productivity and Quality by Farm Size* section within this report for more information.

Average immaturity levels were highest among farms aged over 35 years old. Some of this immaturity may be related to premature nut drop associated with husk spot damage. It is important however to note that in some seasons there have also been significant levels of immaturity in farms in this age group resulting from weather related moisture stress, such as farms in the SEQ region in 2013 and 2014.

Immaturity, brown centres and insect damage were the major reject categories amongst farms with an average tree age less than 8 years. Farms younger than 8 years had the highest average rejects due to discolouration. These differences could also be related to the fact that most farms in the benchmark sample with an average tree age less than 8 years are also larger farms and mostly located in the CQ region.



	5 to 7 years	8 to 9 years	10 to 14 years	15 to 19 years	20 to 24 years	25 to 29 years	30 to 34 years	35+ years
Insect	0.49	0.59	0.94	1.10	1.06	0.89	0.99	0.55
Mould	0.31	0.35	0.37	0.47	0.40	0.38	0.38	0.40
Discolouration	0.41	0.35	0.35	0.33	0.25	0.22	0.22	0.17
Brown centres	0.53	0.58	0.47	0.47	0.43	0.44	0.46	0.52
Immaturity	0.59	0.38	0.53	0.57	0.47	0.57	0.67	0.82
Germination	0.05	0.09	0.10	0.11	0.07	0.07	0.07	0.10

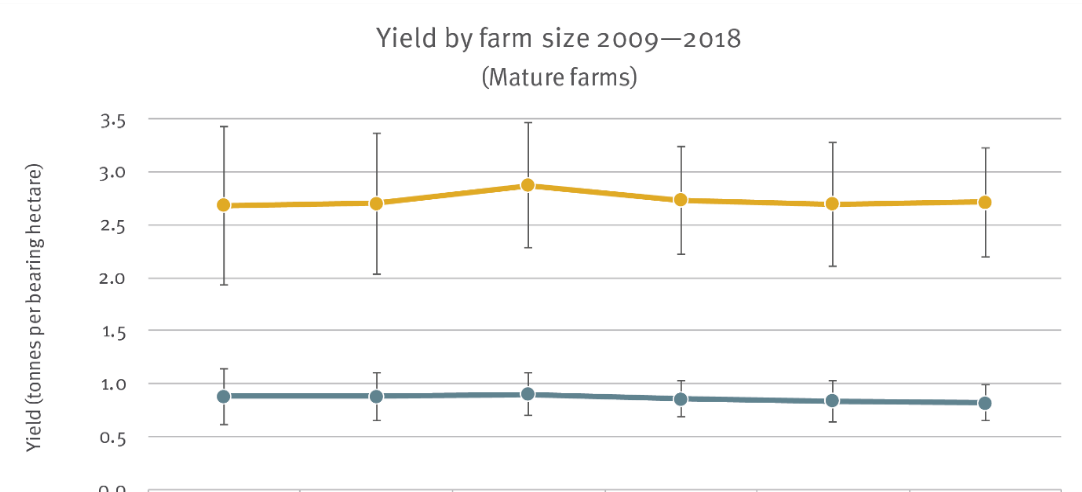
Figure 31: Reject kernel recovery by reject category and tree age 2009-2018.

Farm size effects

Analysis of yield and quality trends reveal some differences in kernel recovery related to farm size. It should be noted that certain farm sizes are more prevalent in particular regions. Larger farms within the benchmark sample also tend to be younger than smaller farms. Care must be taken when interpreting these results as regional or tree age factors may be involved.

Figure 32 shows average yield of nut-in-shell (NIS) and saleable kernel (SK) per bearing hectare, for different farm size categories for all years from 2009 to 2018. These averages are based on mature farms in the benchmark sample (i.e. farms with an average tree age of 10 or more years).

Farms between 20 and 30 hectares had significantly higher NIS yield (P <0.05) than farms less than 10 hectares. However the actual tonnage differences were not large. There is no significant difference in NIS yield for other farms sizes (P>0.05). There was no significant difference in saleable kernel across different farm sizes or correlation between farm size and NIS or SK yield (P>0.05). Farms less than 10 hectares had the highest standard deviation in both SK and NIS yield, 0.52t/ha and 1.49 t/ha respectively.



	< 10 ha	10 to 20 ha	20 to 30 ha	30 to 50 ha	50 to 100 ha	> 100 ha
NIS yield	2.68	2.70	2.87	2.73	2.69	2.71
NIS std.dev	1.49	1.33	1.18	1.01	1.17	1.02
SK yield	0.88	0.88	0.90	0.86	0.84	0.82
SK std.dev	0.52	0.46	0.40	0.34	0.39	0.34

Figure 32: Nut-in-shell per bearing hectare and saleable kernel per bearing hectare by size of farm 2009-2018

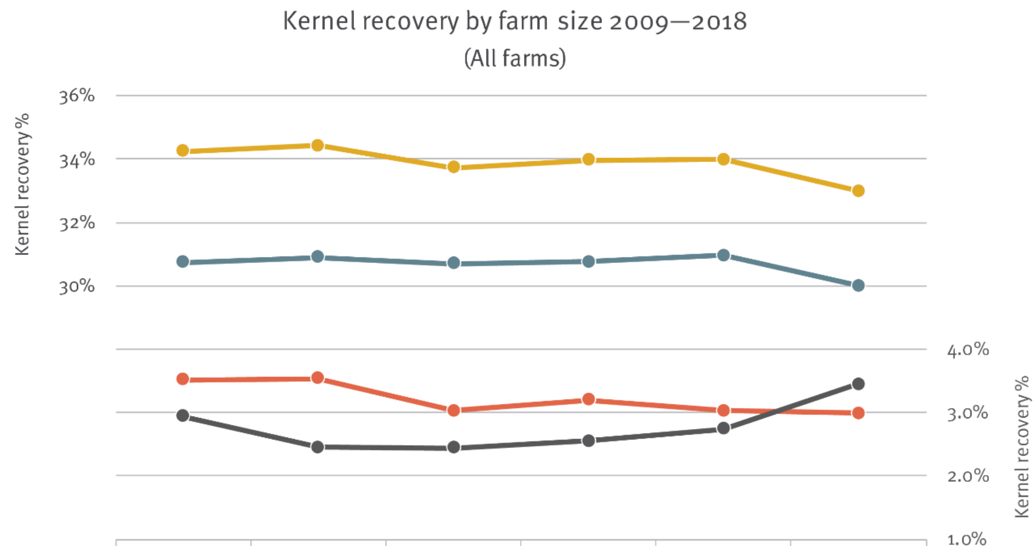
Figure 33 shows average commercial kernel recovery (CKR), saleable kernel recovery (SKR), premium kernel recovery (PKR), and reject kernel recovery (RKR) for all years from 2009 to 2018 for different farm size categories in the benchmark sample. These kernel recovery trends are based on all farms in the benchmark sample.

Farms less than 10 hectares had significantly lower (P<0.01) PKR than farms 10 to 20 hectares and farms 50 to 100 hectares in size. Farms greater than 100 hectares had significantly lower (P<0.05) PKR than farms 50 to 100 hectares but were not significantly different (P>0.05) to other farm sizes. There is no significant correlation (P>0.05) between farm size and PKR indicating that on average farm size is not associated with PKR.

Farms less than 10 hectares have significantly less (P<0.01) SKR than farms 10 to 20 hectares, but were not significantly different to all other farms sizes (P>0.05). SKR is not significantly correlated (P>0.05) with farm size indicating that on average farm size is not associated with SKR.

Farms greater than 100 hectares have significantly lower (P<0.01) CKR that farms less than 10 hectares and farms 10 to 20 hectares, but are not significantly different to any other farm sizes (P>0.05). CKR is significantly negatively correlated with farm size (P<0.01), indicating that on average as farm size increases CKR tends to decrease.

Farms greater than 100 hectares have significantly higher (P<0.01) average RKR than all other farm sizes. RKR is significantly positively correlated (P<0.01) with farm size indicating that on average RKR increases with farm size.



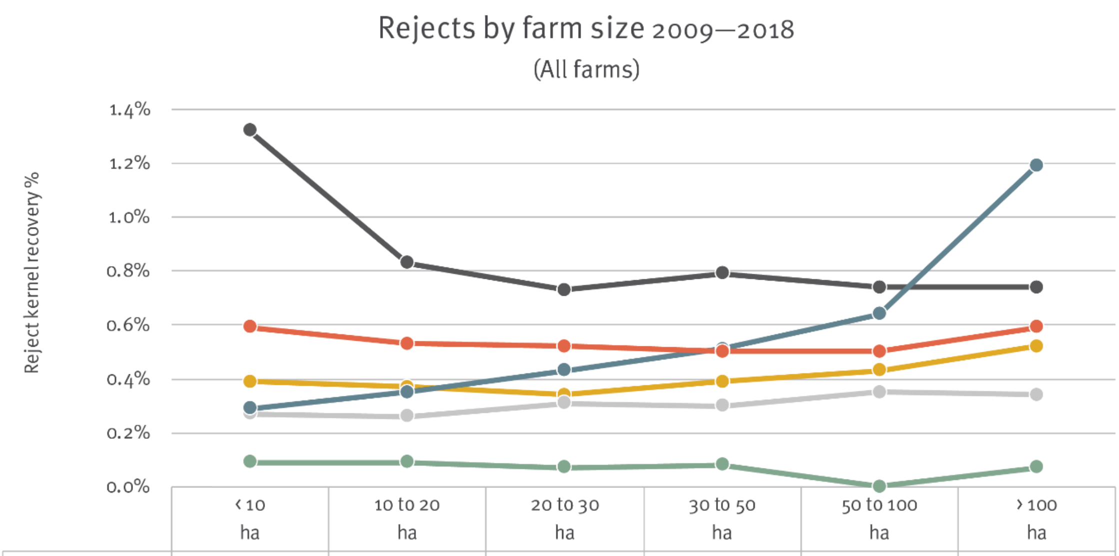
	< 10 ha	10 to 20 ha	20 to 30 ha	30 to 50 ha	50 to 100 ha	> 100 ha
Saleable KR%	34.25	34.43	33.73	33.97	33.98	32.99
Premium KR%	30.74	30.89	30.70	30.76	30.95	30.00
Commercial KR%	3.52	3.54	3.03	3.20	3.03	2.99
Reject KR%	2.94	2.45	2.44	2.55	2.74	3.45

Figure 33 : Average percentage of kernel classified as either premium, commercial or reject, and average percentage saleable kernel, by farm size category 2009-2018.

Figure 34 shows the average reject percentage and breakdown for the different farm size categories in the benchmark sample for all years from 2009 to 2018. These averages are again based on all farms in the benchmark sample.

Rejects due to brown centres are correlated with increasing farm size ($P < 0.01$). Farms less than 10 hectares had significantly lower ($P < 0.01$) average brown centres than all other farm size categories with average rejects of 0.29% compared with 1.19% for farms greater than 100 hectares.

Rejects due to insect damage were inversely correlated with smaller farm size ($P <0.01$), and significantly higher ($P <0.01$) on farms less than 10 hectares than all other farm sizes. Farms less than 10 hectares had average insect damage rejects of 1.32% compared with other farm size categories that ranged from 0.73% to 0.83%. Immaturity, discolouration and germination rejects did not vary as much with farm size as insect damage and brown centres.



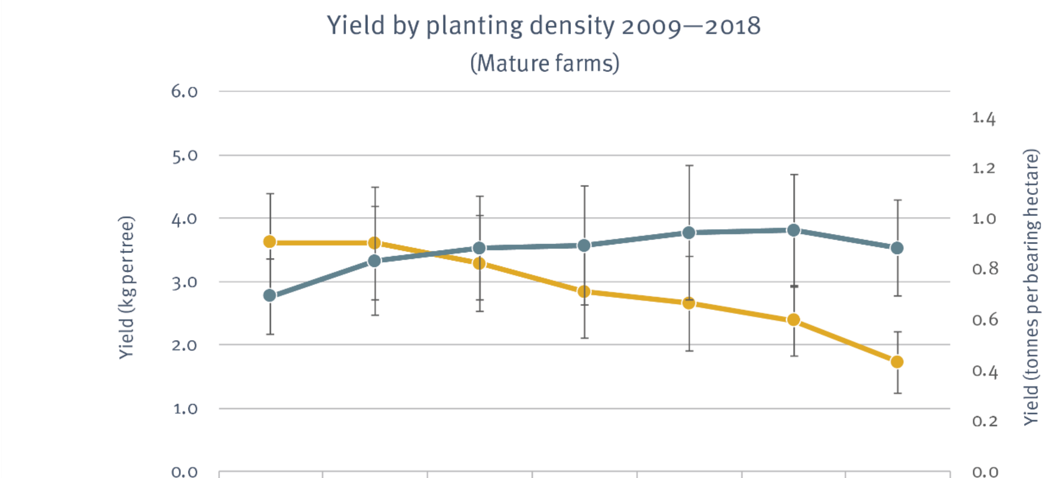
	‹ 10 ha	10 to 20 ha	20 to 30 ha	30 to 50 ha	50 to 100 ha	› 100 ha
Insect	1.32%	0.83%	0.73%	0.79%	0.74%	0.74%
Mould	0.39%	0.37%	0.34%	0.39%	0.43%	0.52%
Discolouration	0.27%	0.26%	0.31%	0.30%	0.35%	0.34%
Brown centres	0.29%	0.35%	0.43%	0.51%	0.64%	1.19%
Immaturity	0.59%	0.53%	0.52%	0.50%	0.50%	0.59%
Germination	0.09%	0.09%	0.07%	0.08%	0.00%	0.07%

Figure 34: Percentage reject from each reject category by farm size, averaged over 2009-2018.

Planting density effects

Figure 35 shows average saleable kernel (SK) productivity in tonnes per bearing hectare and kilograms per tree for mature farms at a range of planting densities. Weighted average planting density is calculated for each farm from tree spacing information provided. The weighted average planting density for mature farms in the benchmark sample is 327 trees per hectare.

SK productivity per tree declines markedly in a significant correlation with increasing planting density, particularly at planting densities above 250 trees per hectare (P <0.01). Higher planting densities are significantly correlated with higher overall yield per hectare (P <0.01)



	100-200 trees/ha	201-250 trees/ha	251-300 trees/ha	301-350 trees/ha	351-400 trees/ha	401-450 trees/ha	>450 trees/ha
SK yield (Kg/Tree)	3.61	3.60	3.28	2.84	2.65	2.38	1.72
SK SD (Kg/Tree)	1.54	1.78	1.51	1.49	1.49	1.11	0.98
SK yield (T/Ha)	0.69	0.83	0.88	0.89	0.94	0.95	0.88
SK SD (T/Ha)	0.30	0.43	0.41	0.47	0.53	0.44	0.38

Figure 35: Saleable kernel (SK) productivity in tonnes per hectare and kilograms per tree for mature farms at a range of planting densities, averaged over 2009-2018

Observations on production limitations

As part of the 2017 and 2018 data collection process, all benchmark participants were asked to rank the major limiting factors affecting production on their farm, according to their observation from that year. In 2018 the data collection process was refined and modifications to the benchmarking database enabled the analysis of limitations in conjunction with other data collected.

In 2018 major factors reported by participants as most limiting to production included storm/hail, pests, and hot/dry weather (Figure 36). Approximately 12% of respondents indicated that their farms had were no major limiting factors during the 2018 season.

Storm or hail damage was reported mainly in the NRNSW region, where nearly half of farms in the benchmark sample are located. Mature farms that reported storm or hail as the major limitation to production in 2018 averaged 2.16 tonnes of NIS per bearing hectare compared to the benchmark average of 3.10 tonnes of NIS per bearing hectare. Hot/dry weather was reported mostly in the CQ region, and soil or tree health was the most common limiting factor in the MNNSW region. In SEQ the greatest number of responses showed that there was no major limitation in 2018. Mature farms in all regions that had no major factors limiting production in 2018 averaged 4.22 tonnes of NIS per bearing hectare, which was more than one tonne per hectare higher than the benchmark sample average for mature farms (3.10T/Ha).

Smaller numbers of farms reported other factors as most limiting to production, including heavy pruning, mistletoe and lack of light due to tall or crowded canopies.

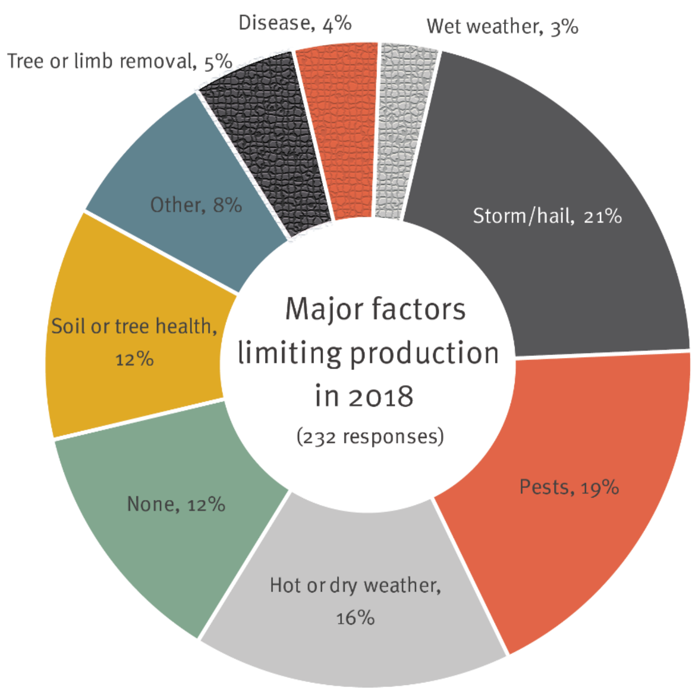


Figure 36: Major factors limiting production in 2018

A total of 196 benchmark farms ranked their pest limitations for the 2018 season (Figure 37).

Fruitspotting bug was most commonly ranked first as the major pest limiting production (37%). In NRNSW however the most significant pest reported was macadamia seed weevil (formerly known as *Sigastus* weevil). Mature NRNSW farms that nominated macadamia seed weevil as the major limiting pest in 2018 averaged 2.4 tonnes of NIS per bearing hectare, compared to an average of 2.77 for all mature benchmarked farms in this region. In MNNSW rats were the most significant pest (18%).

Ten percent of farms said they had no major pest limitations. Lace bug was the main limitation for a small proportion of farms (3%). The “Other” category (5%) included birds, nut borer, flower caterpillar, *Leptocoris*, feral pigs and kernel grub.

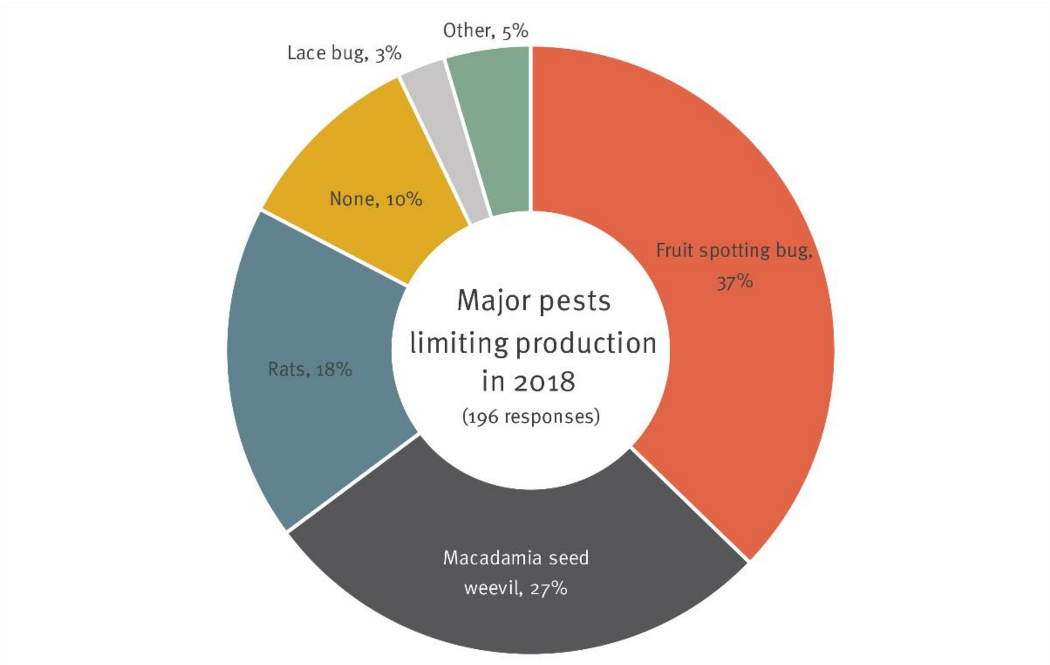


Figure 37: Figure 4: Major pests limiting production in 2018

A total of 182 farms ranked their disease limitations (Figure 38). The disease most limiting across all regions was Phytophthora (26%). In CQ however husk spot was reported as the most limiting disease by over half of the participating farms. Over all regions husk spot was the second most common limiting disease (25%).

One quarter of farms (25%) said they had no major disease limitation this year. Flower diseases were commonly reported as limiting (14%), followed by dieback (8%).

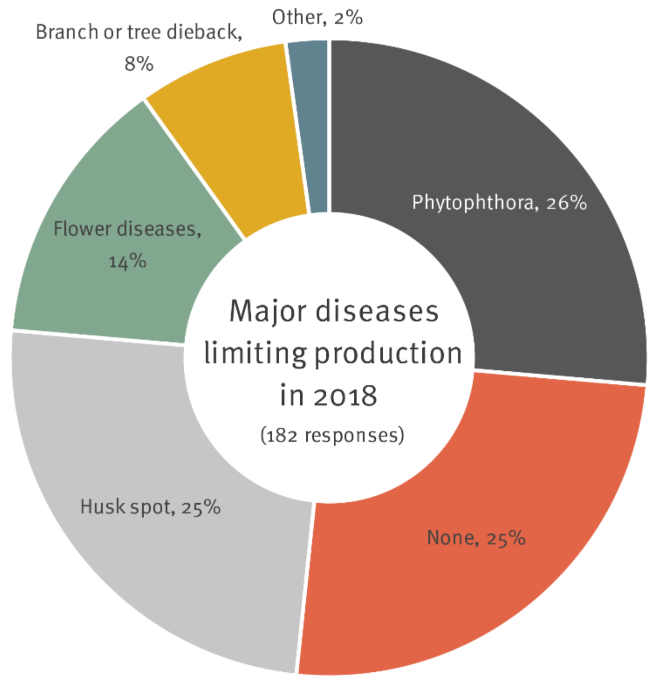


Figure 38: Major diseases limiting production in 2018

Appendix E — Sample farm benchmark report

Department of Agriculture and Fisheries

Benchmarking the macadamia industry 2015 - 2018
Project MC15005

Final farm benchmark report
2017 production season

Sample Farm

Acknowledgements

This report has been produced as part of the *"Benchmarking the macadamia industry 2015-2018"* project (MC15005). This is a joint initiative of the Department of Agriculture and Fisheries, the University of Southern Queensland and NSW Department of Primary Industries with support from the Australian Macadamia Society.

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

The Queensland Government has also co-funded the project through the Department of Agriculture and Fisheries.

Disclaimer

Results presented in this report are based on data provided by industry participants. Figures presented are based on summary statistics using underlying data that is not included in this report.

The project partners associated with the MC15005 project and this report include the Department of Agriculture and Fisheries, Hort Innovation, University of Southern Queensland, and New South Wales Department of Primary Industries. While every care has been taken to ensure the validity of information collected and analyses produced, none of these project partners, nor any persons acting on their behalf, make any promise, representation, warranty or undertaking in relation to the appropriateness of findings in this report and expressly disclaim all warranties (to the extent permitted by law) about the accuracy, completeness, or currency of information in this report.

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About the benchmarking project

Yield, quality and planting information has been collected annually from macadamia farms throughout Australia since 2009. These data are provided either directly by growers or by processors on their behalf.

Each season all benchmarking participants receive personalised reports that confidentially compare their farm's performance with the average performance of similar farms based on a range of criteria including region, locality, farm size, management structure, irrigation status and tree age. These reports also highlight individual and average farm performance trends over multiple seasons.

Scope and coverage

A total of 275 farms covering 10,040 hectares participated in benchmarking during the 2017 season. Yield and quality information was sourced from 272 of these farms, which produced 26,073 tonnes of nut-in-shell at 10% moisture content. This represents 56.7% of the industry's production. This proportion is based on the AMS estimate of 46,000 tonnes published in December 2017.

This report on the 2017 season is based on available data collected up to March 23, 2018. The regional breakdown of farms in the sample is shown in Table 1 below.

What you need to know about the data

Please consider the following points when interpreting results in your report:

- Averages are based on data from a minimum of ten farms to safeguard the confidentiality of individual farm data. Average farm performance over multiple seasons is derived only from farms with data for a minimum of four seasons, to minimise the impact of seasonal variability on long-term averages.
- All weights presented are based on the industry standard moisture content of 10% for nut-in-shell and 1.5% for kernel.
- Plantings less than five years of age are generally excluded from estimates of bearing hectares for consistency across the benchmark sample.
- The sum of reject category values relates to the total reject kernel recovery percentage, rather than totalling 100%. This standard is applied across the benchmark study to ensure uniformity.
- Unless otherwise stated, all averages presented are unweighted. This means that all farms in the sample exert equal influence on the average regardless of their size.
- The term farm-year is used to describe data for an individual farm for a given year. Yield and quality data comprises 2140 farm years from 2009 to 2017. Cost data comprises 262 farm years from 2012/13 to 2016/17. Unless otherwise specified, averages that span multiple seasons are derived from all available seasons.

2017 regional breakdown

Region	Bearing farms	% of sample by number of farms	Average tree age	Total planted hectares	% of sample by planted hectare	Median planted hectares per farm	% of sample by NIS tonnes
Central Queensland (CQ)	51	19%	14	4,959	49%	59.1	53%
South East Queensland (SEQ)	51	19%	23	1,419	14%	12	12%
Northern Rivers of NSW (NRNSW)	144	53%	24	3,245	32%	16.5	31%
Mid North Coast of NSW (MNNSW)	26	9%	19	417	4%	9	3%
All regions	272		18	10,040			

Table 1: Regional breakdown of farms in the 2017 benchmark sample

- Unless otherwise stated, all farm costs per hectare are based on total planted hectares. This may include non-bearing hectares for some farms as most businesses do not separate costs by tree age within their accounting systems.
- Unless otherwise stated, costs per tonne of saleable kernel for a given season are calculated by relating that season's production (e.g. 2017) to costs in the preceding financial year (2016/17).
- Heads of expenditure presented in this report are derived from a standard chart of accounts developed in conjunction with Rutherfords Accountants and Financial Advisers as part of the previous levy funded project "On-farm economic analysis in the Australian macadamia industry" (MC03023). This chart of accounts is used to ensure consistent interpretation of costs across multiple farm businesses.

What's included in this report?

This report summarises yield and quality results for your farm for the 2017 production season and costs of production for the 2016/17 financial year. It also compares your farm's performance with the averages of other farms in the benchmarking pool. If you have participated in previous seasons then trends over those seasons are also shown. Results are presented in the following sections:

Results for the benchmark sample

This section presents summary results for all farms in the benchmark sample for the 2017 season, as well as comparisons to previous seasons. It also includes 2017 season observations from benchmark participants and growers who attended the Benchmark Group meetings.

Results for your farm

This section details your farm performance for the 2017 season. Your farm's yield and quality results and costs are compared and ranked against the averages of other farms in the benchmark sample. This includes farms in your locality and region, farms of a similar size and similar age. It also shows trends in your farm's performance over all seasons in which you have participated in benchmarking. These data provide useful insight into seasonal and long-term productivity, quality and expenditure on your farm.

Results for the benchmark sample

Figure 1 shows overall summary results for the 2017 benchmark sample, as well as corresponding long-term averages for all seasons from 2009 to 2017, shown in brackets. Average yield figures are based on mature farms (10+ years old) only. Averages for farm size, tree age and quality are based on all farms in the benchmark sample.

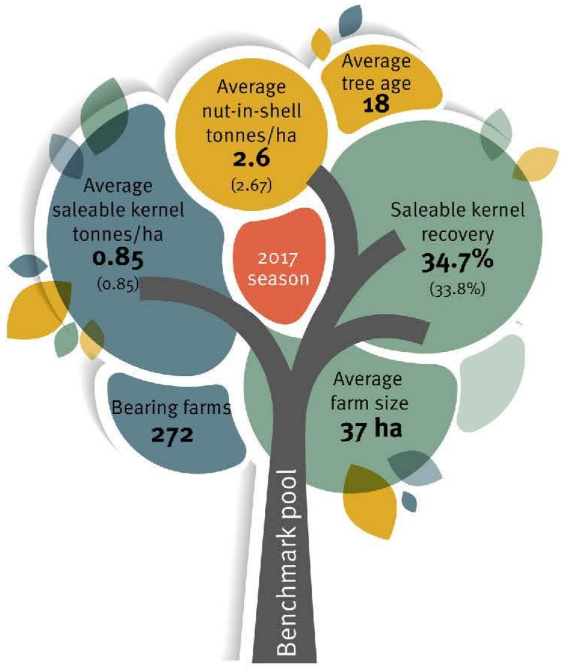

Figure 1: Summary of results from the 2017 benchmark sample (with long-term averages in brackets).

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Table 2 below shows the differences in average yield and quality between the 2016 and 2017 seasons for mature farms (10+ years old) in the benchmark sample. Younger farms have been excluded to ensure a representative analysis of farm performance. Favourable seasonal changes are shown in gold and unfavourable changes are shown in red.

In 2017 average saleable kernel yield per hectare decreased in Central Queensland (CQ), South East Queensland (SEQ) and the Mid North Coast of NSW (MNNSW) compared with 2016. The Northern Rivers of NSW (NRNSW) achieved a slight increase in average kernel yield in 2017 compared to the 2016 season.

Average saleable kernel recovery decreased in CQ and SEQ and increased in NRNSW and MNNSW in 2017. Average reject kernel recovery decreased in CQ, SEQ and NRNSW and increased in MNNSW. Saleable kernel recovery is defined as the sum of premium and commercial kernel recovery.

Insect damage caused the highest percentage of factory reject kernel in all regions. The major factor limiting production in 2017 for SEQ, NRNSW and MNNSW was hot dry weather and lack of water. Growers from CQ nominated pests as the major factor limiting production in 2017.

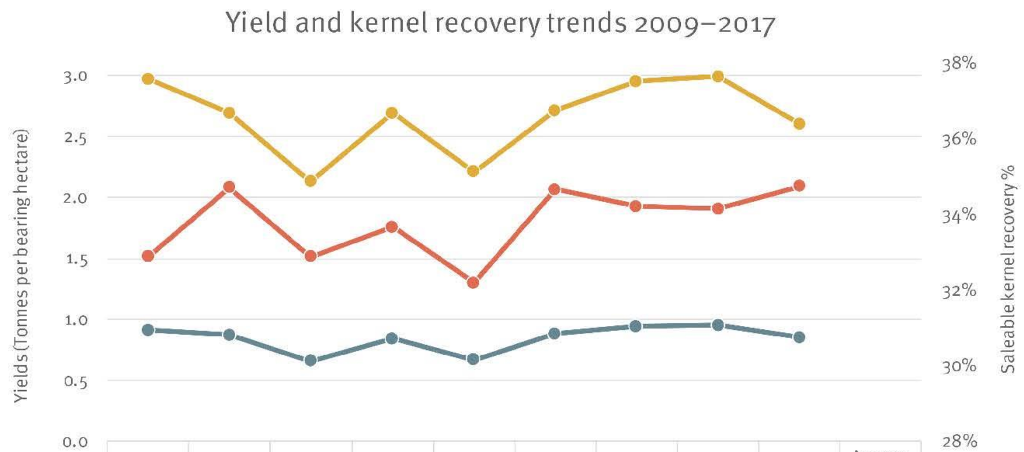
<table>
<tr><th colspan="6">2016 vs 2017 comparison of mature farms</th></tr>
<tr><th></th><th>Saleable kernel per hectare</th><th>Saleable kernel recovery %</th><th>Reject kernel recovery %</th><th>Leading cause of reject KR% in 2017</th><th>Major factor limiting production in 2017</th></tr>
<tr><td>CQ</td><td>Decrease 14%</td><td>Decrease 0.3%</td><td>Decrease 0.4%</td><td rowspan="4">Insect damage</td><td>Pests</td></tr>
<tr><td>SEQ</td><td>Decrease 36%</td><td>Decrease 0.2%</td><td>Decrease 0.1%</td><td rowspan="3">Hot dry weather/ lack of water</td></tr>
<tr><td>NRNSW</td><td>Increase 5%</td><td>Increase 1.4%</td><td>Decrease 0.4%</td></tr>
<tr><td>MNNSW</td><td>Decrease 21%</td><td>Increase 1.7%</td><td>Increase 0.3%</td></tr>
</table>

Table 2: Comparison of mature farm performance between the 2016 and 2017 seasons

Figure 2 shows trends in the average nut-in-shell (NIS) and saleable kernel (SK) yield per bearing hectare for mature farms in the benchmark sample from 2009–2017. Average saleable kernel recovery (SKR) for all farms in the sample is also shown.

Productivity decreased in 2017 following three successive seasons of increases from 2013–2016. The major factors limiting production reported by participants were weather related, including hot dry conditions as well as rain, hail, flood and storm events.

Average SKR for farms in the 2017 sample was higher than the long term average from 2009–2017. This increase in 2017 partially offset the reduction in NIS yield and resulted in a SK yield (0.85 t/ha) that was consistent with the long term average.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average 2009-17
NIS yield	2.97	2.69	2.13	2.69	2.21	2.71	2.95	2.99	2.60	2.67
SK yield	0.91	0.87	0.66	0.84	0.67	0.88	0.94	0.95	0.85	0.85
SKR %	32.9%	34.7%	32.9%	33.7%	32.2%	34.7%	34.2%	34.2%	34.8%	33.8%

Figure 2: Average yield and kernel recovery trends for 2009 to 2017

As part of the data collection process, all benchmark participants were asked to nominate the major factors affecting production on their farm in 2017, as well as the most significant pests and diseases. These issues were also discussed and similar feedback sought during benchmark group meetings in each of the major production regions from August to November 2017. At these meetings participants had the opportunity to discuss these and other aspects of their farm management such as nutrition and canopy management.

Responses were received from 242 farms in the benchmark sample and benchmark groups. In some cases respondents nominated multiple limiting factors so the following charts show the proportion of each limiting factor relative to the total number of responses received.

Figure 3 shows the major factors nominated by benchmarking participants as limiting production in the 2017 season. The most common factors reported were weather related (59%). These included hot dry conditions and lack of water through to storms, hail, floods and wet weather. Growers in some areas reported a combination of both extended dry periods followed by storms or wet weather events.

The next most commonly reported limiting factor was pests (16%), followed by impacts associated with tree or limb removal (5%), nutrition or poor soil health (4%), tree height or crowding (2%), old orchard (2%) and disease (3%). The "Other" category (6%) included erosion, biennial bearing, labour or machinery issues, organic methods and management. Approximately 4% of respondents indicated there were no factors limiting production on their orchard in 2017.

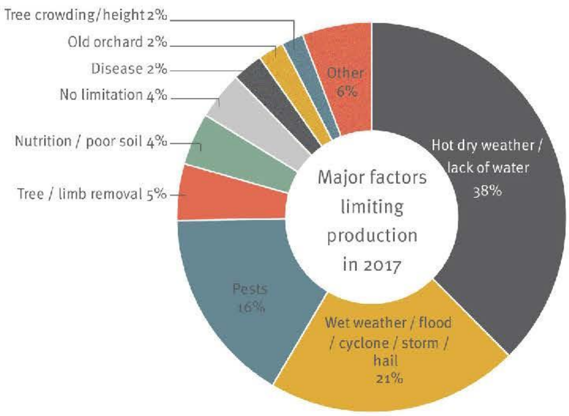


Figure 3: Major factors limiting production in 2017

Participants were also asked to nominate the major pests and diseases affecting production on their farms. A total of 193 benchmark farms were limited by pests in the 2017 season. A summary of these responses is shown in Figure 4.

Fruitspotting bug was identified as the major pest affecting production in 2017 (43%), followed by Sigastus weevil (33%), lace bug (7%), rats (7%), cockatoos (3%) and flower caterpillar (1%). The "Other" category (6%) included nut borer, feral pigs and mistletoe.

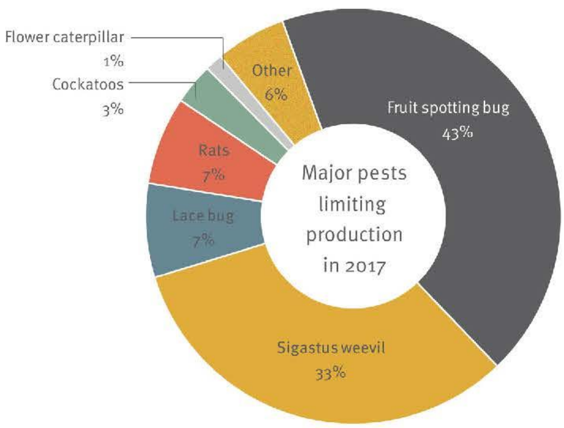


Figure 4: Major pests limiting production in 2017

A total of 135 benchmarking farms were limited by one or more diseases in the 2017 season. A summary of these responses is shown in Figure 5.

The disease most commonly reported by participants was *Phytophthora* (50%) followed by flower diseases (27%) and husk spot (17%). Responses relating to flower diseases included *Botrytis* flower blight, dry flower and unspecified flower disease. The "Other" category (6%) included husk rot, unspecified fungi, Abnormal Vertical Growth (AVG), dieback and *Dothiorella*.

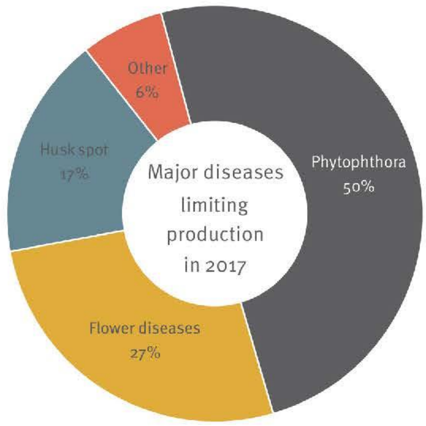


Figure 5: Major diseases limiting production in 2017

An APVMA permit has now been issued for foliar and trunk application of Phosphorous acid for the management of Phytophthora in macadamias. Always check the currency and conditions of the permit before application.

A video on how to manage Phytophthora in macadamias is now available on macSmart and the Queensland Agriculture YouTube channel.

Visit http://www.youtube.com/watch?v=zgAn1T9U7xs

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Results for your farm for 2017

Figure 6 provides a summary of your yield and quality for the 2017 season. You can compare your 2017 results against all farms in the benchmark sample as well as other farms in your locality and region, and other farms of a similar size, age and management system.

Yield and quality summary for 2017

Farm: Sample Farm Owner / Manager: Sample Grower

Your yield results compared with the averages of bearing farms in the survey	Total farms	Bearing farms	Planted hectares	Bearing hectares	NIS yield (t / bearing ha)	Moisture content %	Whole kernel %	Saleable kernel (t / bearing ha)	Total kernel (t / bearing ha)
Your farm	1	1	30	30	4.2	16		1.31	1.39
All farms in the benchmark pool	276	273	36.88	36.13	2.559	15.5	39.81	0.84	0.89
SEQ region	52	52	27.86	27.63	2.202	12.79	41.96	0.71	0.75
Glasshouse Mountains locality (4510 to 4520)	21	21	24.36	23.89	2.603	13.44	44.09	0.86	0.91
Similar bearing tree age (15 to 19 years)	53	53	36.15	35.4	2.904	15.77	41.59	0.99	1.07
Similar farm size (30 to 50 ha.)	37	37	37.83	37.42	2.656	14.31	40.4	0.85	0.91
All owner operated farms	202	201	25.01	24.49	2.463	15.95	39.93	0.81	0.86
All non-irrigated farms	196	195	23	22.42	2.563	16.89	39.74	0.84	0.9

Your quality results compared with the averages of bearing farms in the survey	Kernel recoveries			Reject kernel analysis %					
	Premium KR%	Commercial KR%	Reject KR%	Insect damage %	Mould %	Discoloured %	Brown centres %	Immature %	Germinated %
Your farm	31	2.5	1.9	0.4	0.1	0.2	0.7	0.5	0
All farms in the benchmark pool	30.78	3.97	2.53	0.93	0.45	0.26	0.37	0.42	0.09
SEQ region	31.82	2.08	2.24	0.72	0.58	0.26	0.19	0.43	0.05
Glasshouse Mountains locality (4510 to 4520)	33.42	2.3	1.82	0.52	0.36	0.26	0.23	0.39	0.06
Similar bearing tree age (15 to 19 years)	31.7	4.46	2.95	1.04	0.49	0.27	0.52	0.49	0.12
Similar farm size (30 to 50 ha.)	30.59	3.86	2.35	0.76	0.38	0.26	0.34	0.51	0.09
All owner operated farms	30.93	3.81	2.41	0.95	0.43	0.24	0.25	0.46	0.08
All non-irrigated farms	30.45	4.42	2.53	1.02	0.43	0.25	0.26	0.46	0.1

Figure 6: Summary and comparison of yield and quality results

Figure 7 shows how your farm production of saleable kernel (shown as a red bar) compared with other farms in the benchmark sample. These include farms within your locality, region and state. Your farm is also compared with farms of similar size, average tree age, management style and use of irrigation.

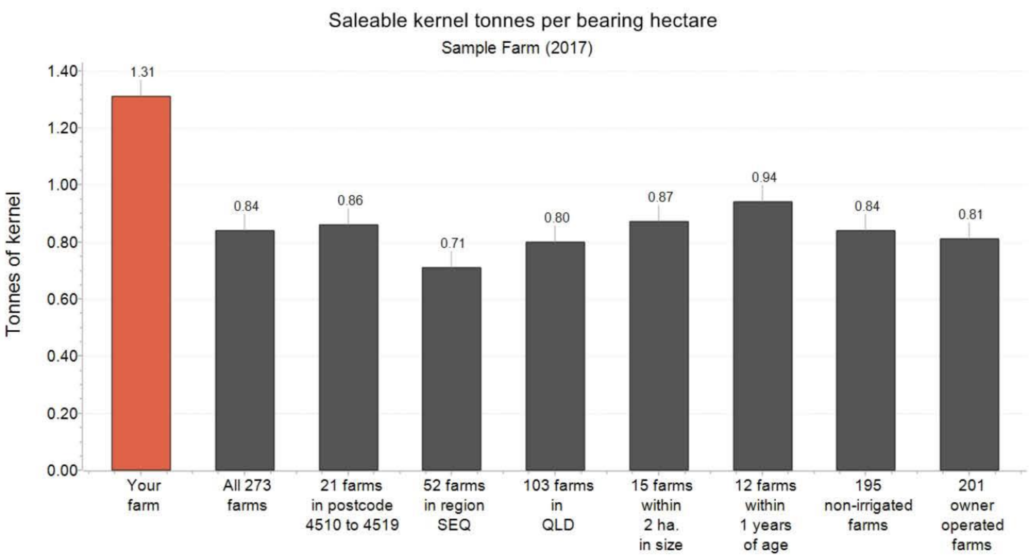

Figure 7: Saleable tonnes per bearing hectare for the 2017 season

Figure 8 ranks your farm's production of saleable kernel against all other farms in the benchmark sample. The green shaded areas to the left and right of the chart show the top and bottom 25% of farms in the sample and the area in the middle shows the middle 50%. Your farm is shown highlighted in red. Your saleable kernel per bearing hectare result and your rank in relation to other farms is shown in the sub-title on the chart.

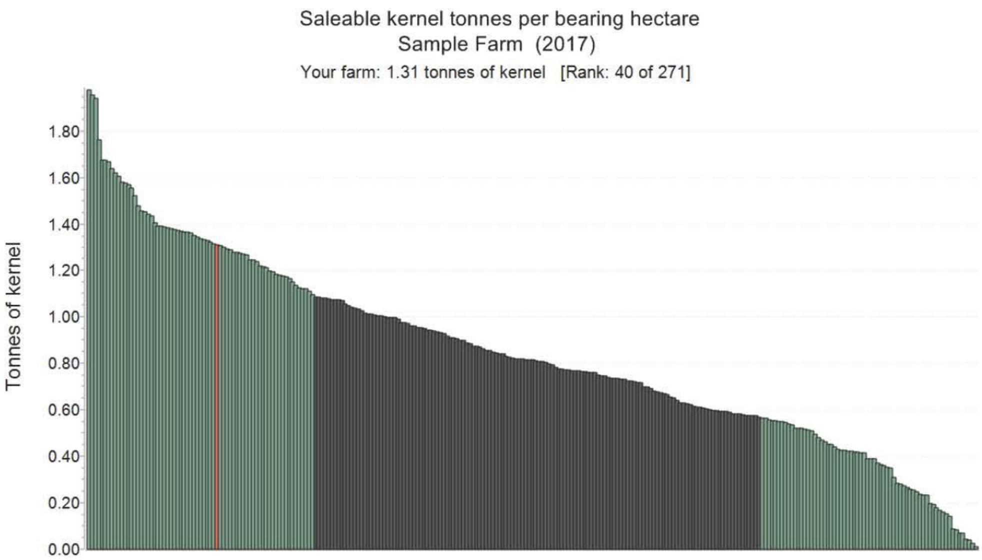

Figure 8: Saleable kernel tonnes per bearing hectare ranking for the 2017 season

Figure 9 shows your farm's ranking for saleable kernel recovery within the benchmark sample for the 2017 season. Your farm is shown as a red bar. The green shaded areas to the left and right of the chart show the top and bottom 25% of farms in the sample and the grey area shows the middle 50% of farms. Saleable kernel recovery is defined as the sum of premium and commercial kernel recovery.

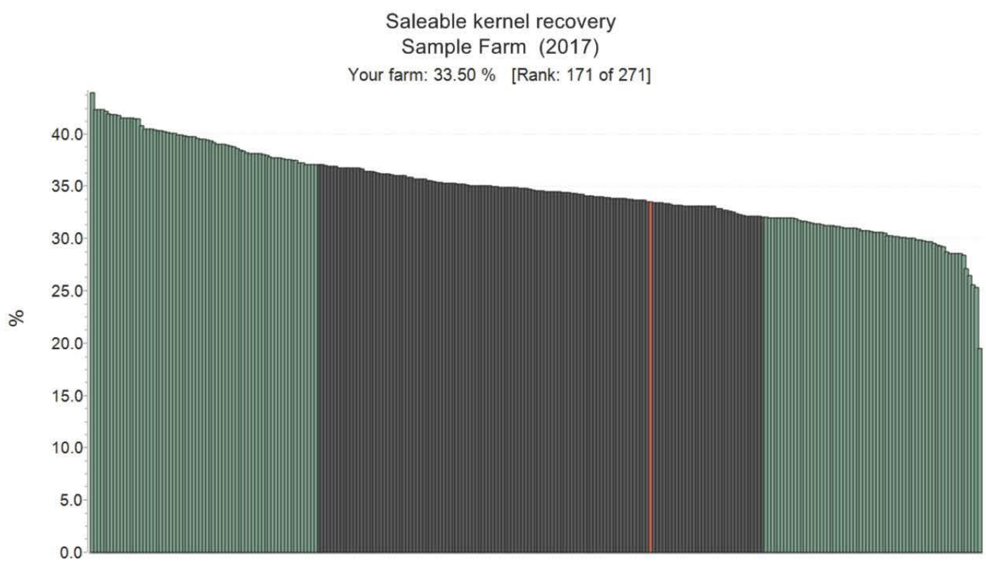

Figure 9: Saleable kernel recovery % ranking for the 2017 season

Figure 10 shows your farm's ranking (shown as a red bar) for reject kernel recovery within the benchmark sample for the 2017 season. The green shaded areas to the left and right of the chart show the top and bottom 25% of farms in the sample and the grey area shows the middle 50% of farms. As low reject levels are desirable the rank order of this chart is the opposite of saleable kernel recovery with lowest to highest reject kernel recovery displayed from left to right.

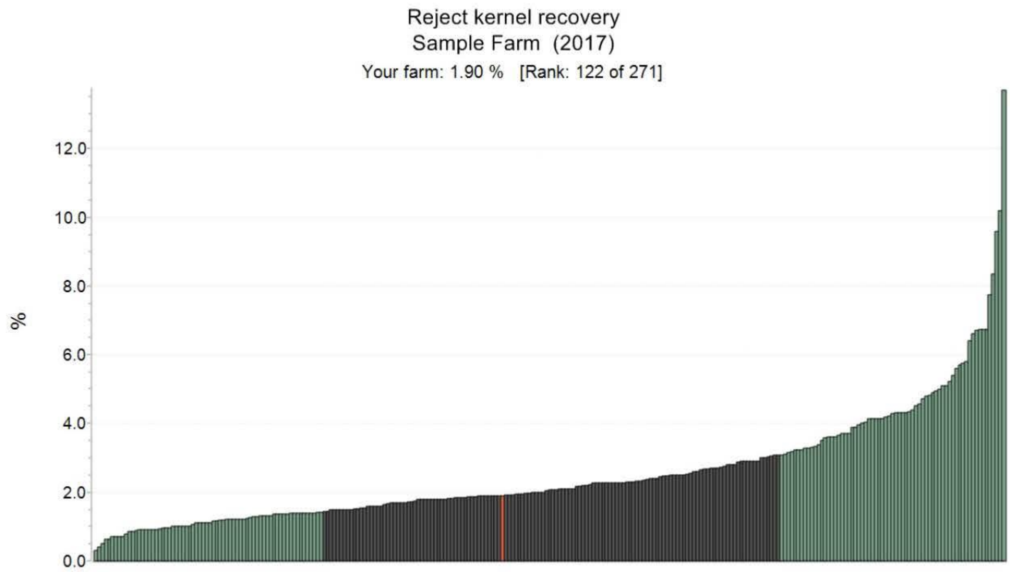

Figure 10: Reject kernel recovery % ranking for the 2017 season

Figure 11 compares your farm's 2017 reject analysis results with other farms in the benchmark sample. These results are based on standard consignment reject categories applied to all participating farms. These include insect damage, mould, discolouration, brown centres (internal discolouration), immaturity (shrivelled kernel) and germination (discoloured crest). Each reject category is represented by a different colour on the chart. The relative size of each colour section on the bars reflects the proportion of total reject that relates to each reject category.

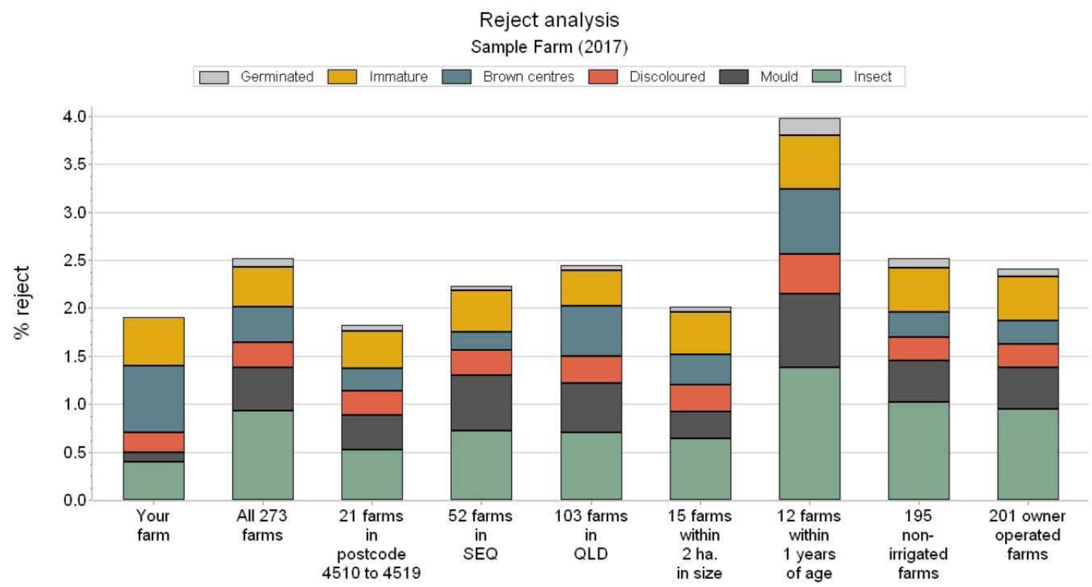

Figure 11: Reject analysis of major reject categories for the 2017 season

Figure 12 compares your farm's total costs per planted hectare (shown as a red bar) with other farms in the benchmark sample who supplied cost of production data for the 2016/17 financial year.

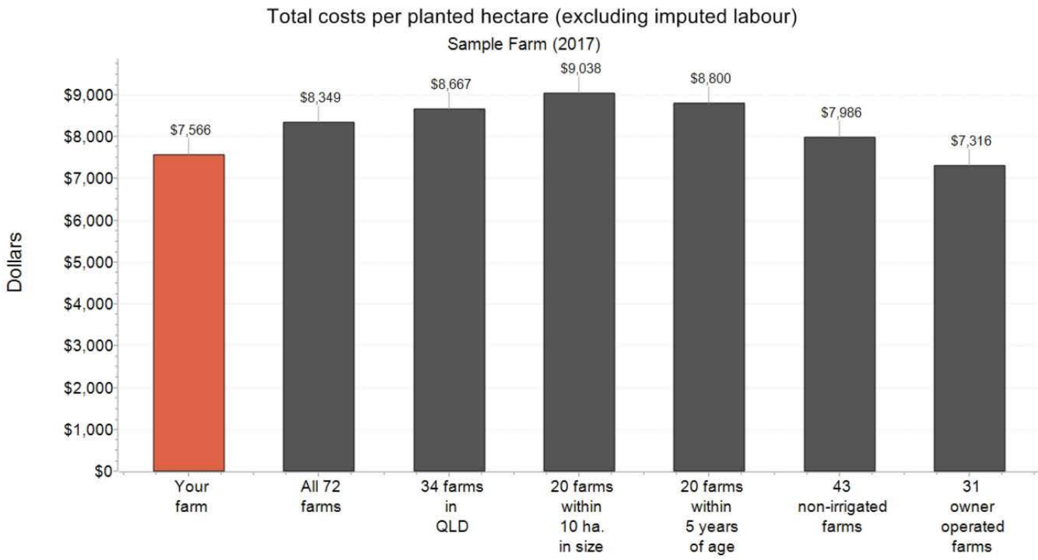

Figure 12: Total costs per planted hectare comparison for 2017

Figure 13 compares your farm's costs per tonne of saleable kernel (shown as a red bar) with other farms in the benchmark sample who supplied cost of production data for the 2016/17 financial year.

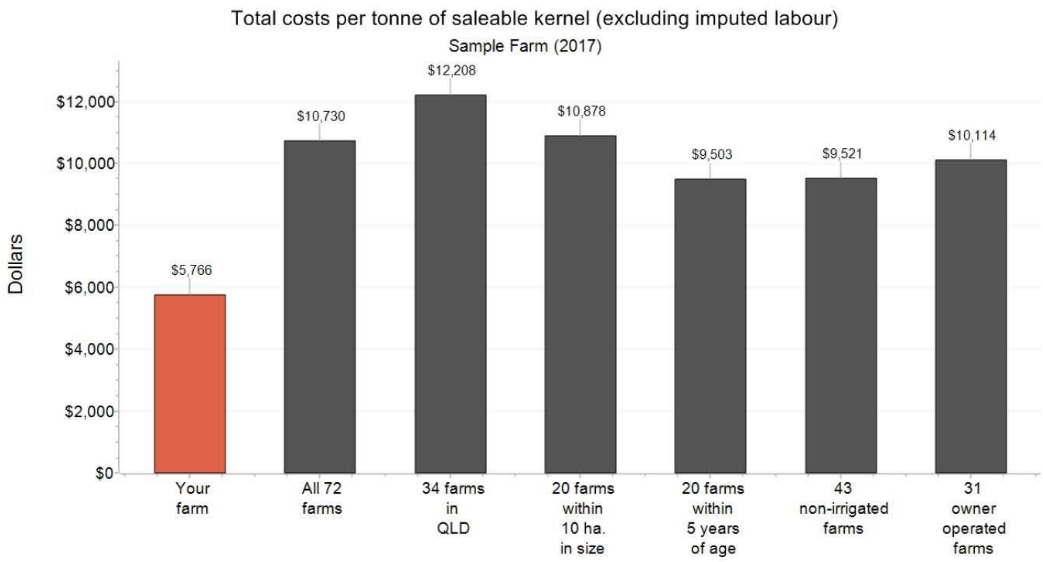

Figure 13: Total costs per tonne of saleable kernel comparison for 2017

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Figure 14 below shows your farm's ranking in 2017 for costs per planted hectare within the sample of farms that provided cost data. Your farm is shown as a red bar. The green shaded areas to the left and right of the chart show the top and bottom 25% of farms in the sample and the grey area shows the middle 50% of farms.

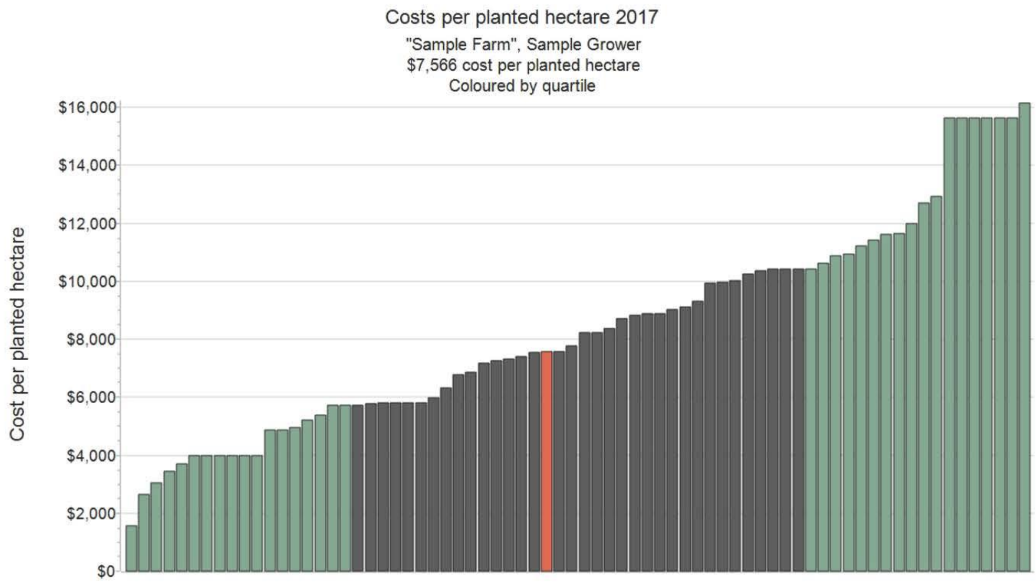

Figure 14: Costs per planted hectare ranking for 2017

While Figure 14 relates your costs to planted area, Figure 15 below shows your expenditure in relation to your production. Your farm's ranking is based on your costs per tonne of saleable kernel compared with other farms that provided cost data for the 2016-17 financial year. Your farm is shown as a red bar.

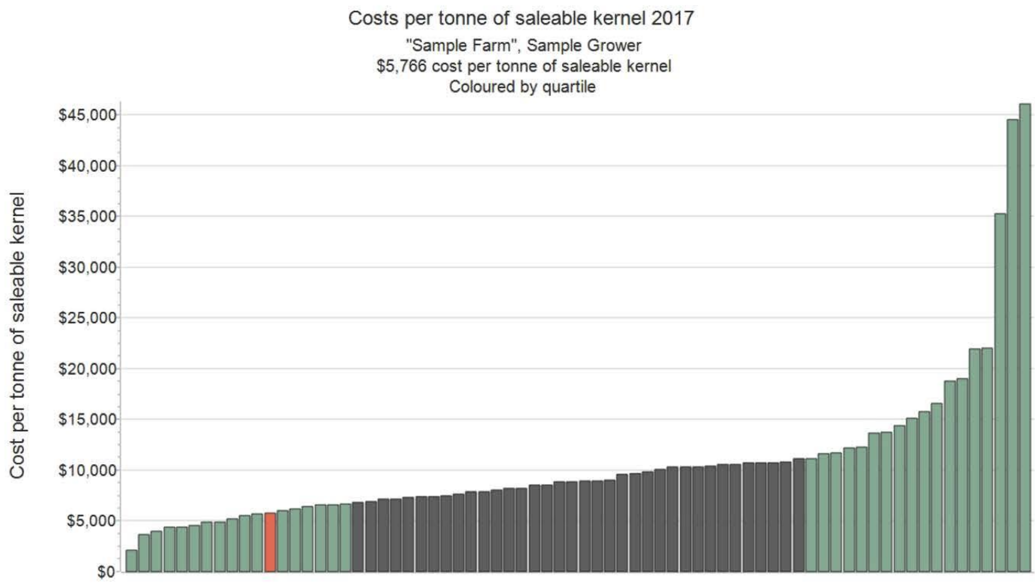

Figure 15: Costs per tonne of saleable kernel ranking for the 2016-2017 financial year

Results for your farm for all seasons

This section shows average productivity and quality for all seasons in which farms have participated in benchmarking. Your farm's average performance is ranked both within your region (Figure 16) and across the benchmark sample (Figure 17). This provides insight into long-term farm productivity. Please note that only farms that have participated in benchmarking for four or more seasons are included in this section.

Figure 16 shows average annual saleable kernel productivity by region for all participating farms for 2009 to 2017. If you have participated in benchmarking for at least four years your farm will be shown as a red bar.

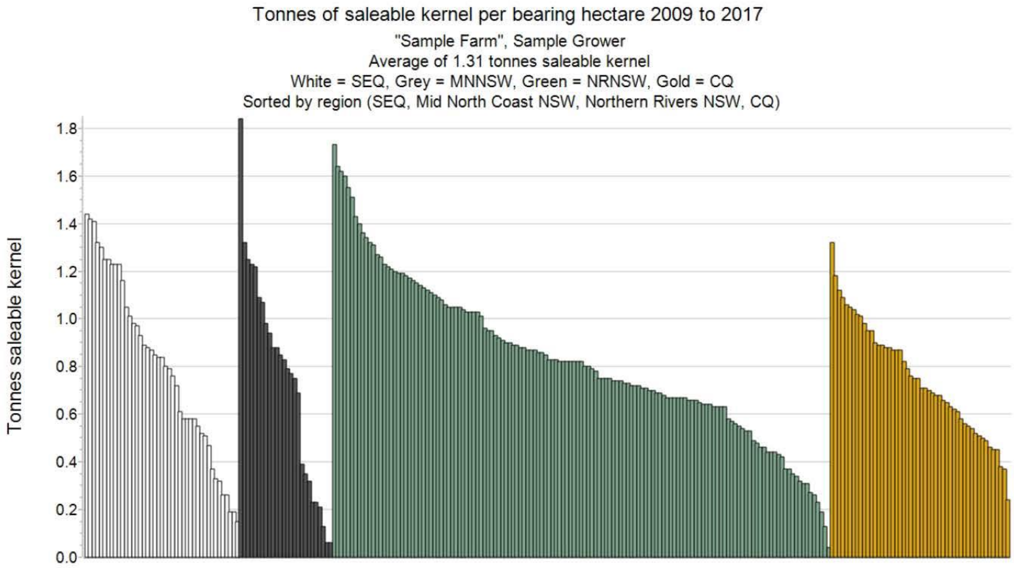

Figure 16: Average saleable kernel per bearing hectare for 2009 to 2017, grouped by region

Figure 17 shows average annual saleable kernel productivity for all participating farms for 2009 to 2017. If you have participated in benchmarking for at least four years your farm's rank will be shown as a red bar.

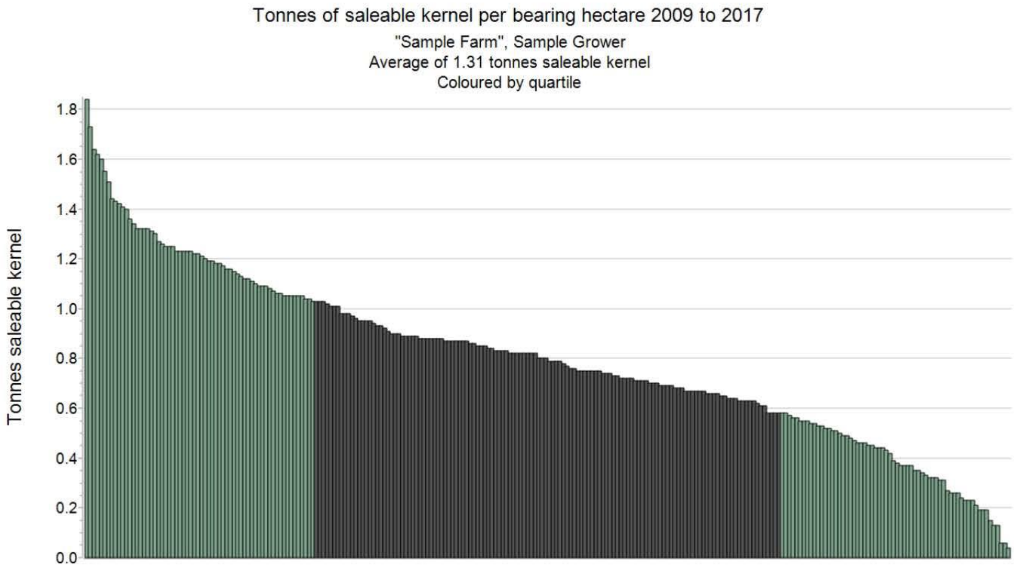

Figure 17: Average saleable kernel per bearing hectare for 2009 to 2017

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Figure 18 chart shows your farm's average total costs per planted hectare for all seasons in which you have supplied cost data (shown as a red bar). This is compared with the averages of other farms in the benchmark sample who supplied cost of production data. These include farms within your locality, region and state. Your farm is also compared with farms of similar orchard size, average tree age, management style and use of irrigation.

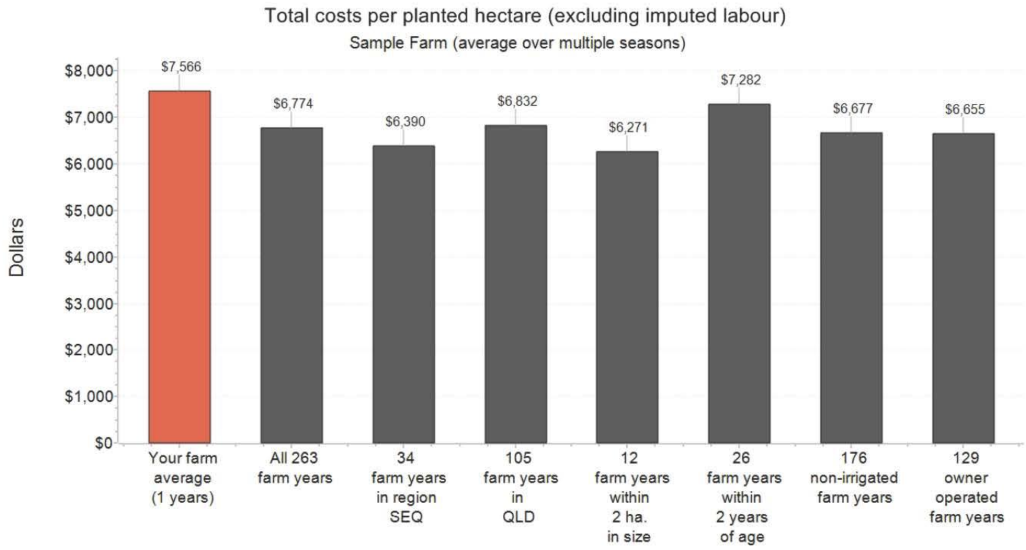

Figure 18: Comparison of total average costs per planted hectare over multiple seasons

Figure 19 below shows average farm production costs for the five years from 2012/13 to 2016/17 inclusive. The chart ranks only the most significant heads of expenditure rather than all costs. The industry averages are based on a total of 266 farm years, or an average of 53 farms per year. Your farm's average expenditure is also shown for all years in which you submitted data (red bars).

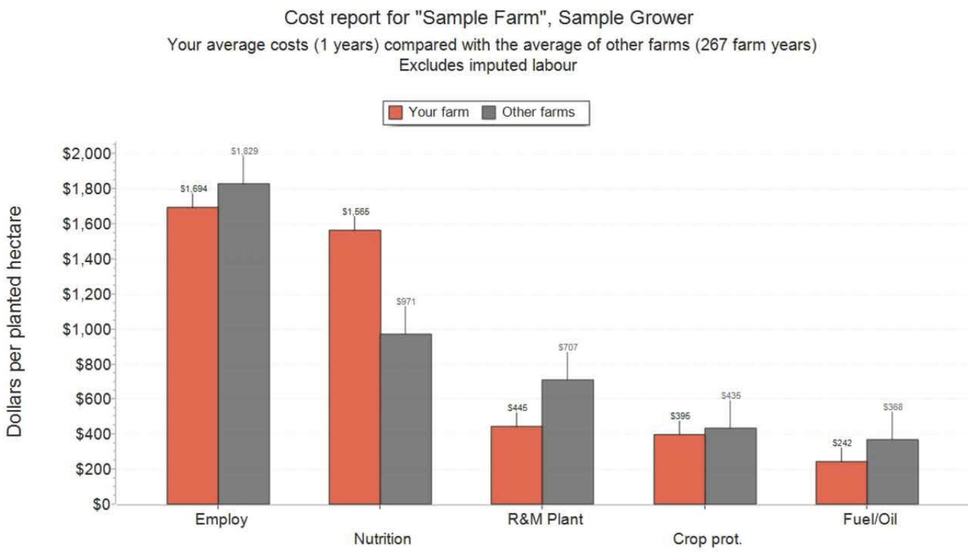

Figure 19: Heads of expenditure costs averaged over multiple financial years

This section shows annual yield and quality trends over multiple seasons. This provides insight into farm performance and variability from season to season. Yield trends include both nut-in-shell and saleable kernel per bearing hectare. Saleable kernel recovery, reject kernel recovery and rejects by category are also provided.

Figure 20 shows your farm's annual productivity (nut-in-shell and saleable kernel per bearing hectare) and kernel recovery (saleable and reject) for all seasons in which you have participated in benchmarking.

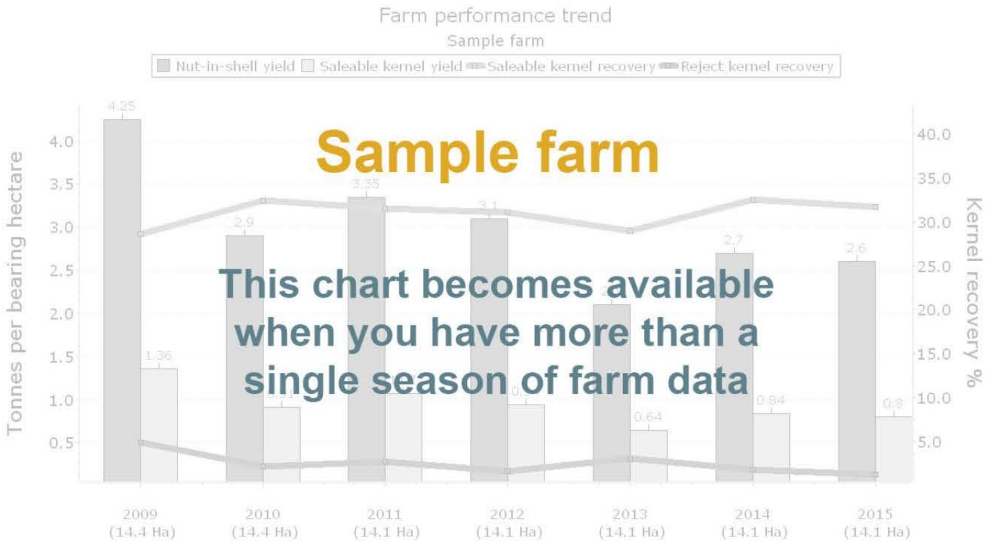

Figure 20: Your farm's annual productivity and kernel recovery over multiple seasons

Figure 21 shows your farm's annual productivity (nut-in-shell and saleable kernel per bearing hectare) and a breakdown of rejects by category for all seasons in which you have participated in benchmarking.

Figure 21: Your farm's annual productivity and percentage reject by category over multiple seasons

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Figure 22 below shows your farm's annual productivity (nut-in-shell and saleable kernel per bearing hectare) and your farm's costs per planted hectare for all seasons in which you have supplied data.

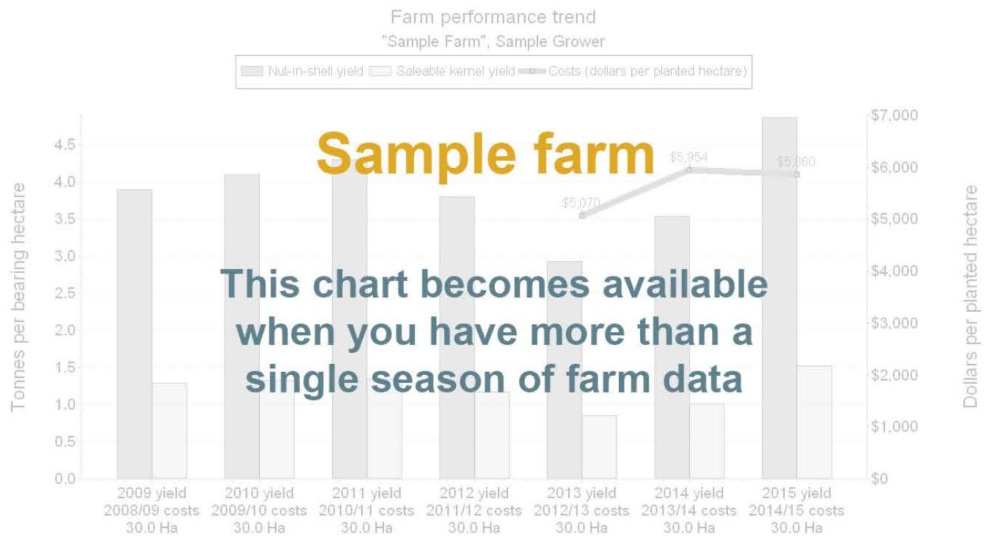

Figure 22: Your farm's annual productivity and costs per planted hectare over multiple seasons

Figure 23 shows average annual productivity and kernel recovery trends for all farms in your region. By comparing with Figure 20 you can see how your farm compares with the average of all participating farms in your region.

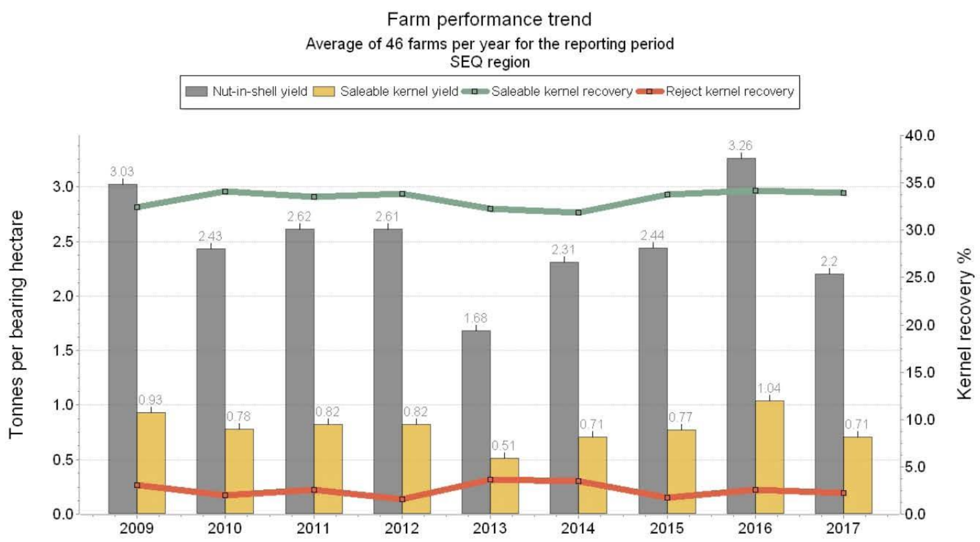

Figure 23: Annual farm performance trends for all farms within your region

15

Figure 24 shows average annual productivity and kernel recovery trends for all farms participating in benchmarking. By comparing with Figure 20 you can see how your farm compares with the average of all farms in the benchmark sample.

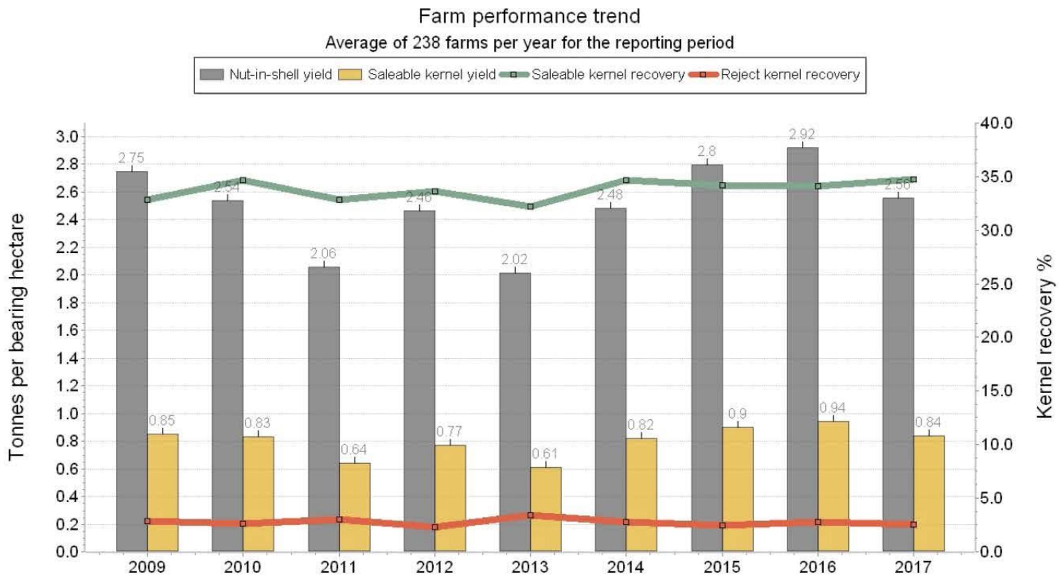

Figure 24: Annual farm performance trends for all farms within the benchmark sample

Figure 25 shows average annual trends in productivity per bearing hectare and costs per planted hectare for all farms participating in benchmarking. Note that production results are based on an average of 238 farms per year and cost of production results are based on a smaller sub-sample average of 52 farms per year. By comparing with Figure 22 you can see how your farm compares with the average of all participating farms in the benchmark sample.

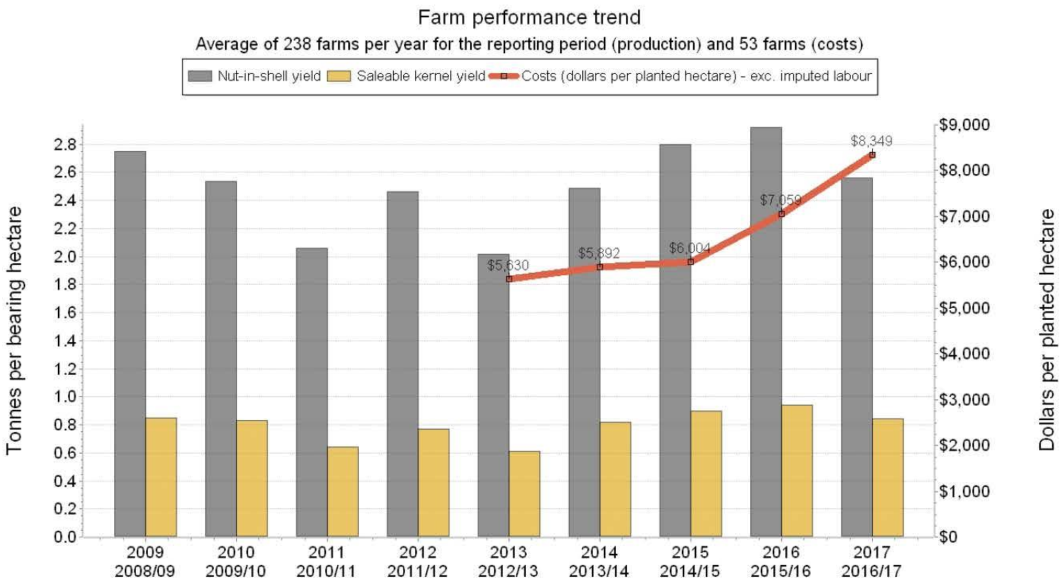

Figure 25: Annual farm performance trends for all farms within the benchmark sample

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Summary of data submitted for benchmarking (2017 season)

Grower and farm details

Grower name Mr Sample Grower
Company Sample Farm
Grower address 10 Macadamia Lane ELIMBAH QLD 4516
Contact e-mail macman@daf.qld.gov.au

Farm ID 332 Irrigated ✖ Partial / supplementary only —
Farm name Sample Farm
Farm address 10 Macadamia Lane ELIMBAH QLD 4516

Consignment details for this farm

NIS tonnes	126	**Insect %**	0.4
Consigned MC %	16	**Mould %**	0.1
Premium KR %	31	**Discoloured %**	0.2
Commercial KR %	2.5	**Brown centres %**	0.7
Reject KR %	1.9	**Immature %**	0.5
Whole kernel %		**Germinated %**	0

Planted areas as applied to the current season

Total hectares 30
Bearing hectares 30 *

* Note that trees must be aged 5 years or older to be considered bearing

Planting details recorded for this farm (Please update or add information as required)

Planted	Trees	Spacing	Variety	Hectares	Your notes
2000	9360	8 x 4 m	Mixed	30	
Totals	**9360**			**30**	

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